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Influence of Teachers' ICT Self-Efficacy on ICT Integration in Geography Instruction in Selected Kenyan National and Extra County Secondary Schools

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Abstract: *This study examined the effects of teachers' self-efficacy towards technology on ICT integration in geography instruction in selected Kenyan National and Extra County secondary schools. Using cross-sectional descriptive research design grounded in the Technology Acceptance Model (TAM), the research involved 190 geography teachers from 106 schools in Kenya's North Rift region. Data were collected through structured questionnaires and semi-structured interviews. Quantitative data were analyzed using descriptive statistics and multiple linear regressions, while qualitative data underwent thematic analysis. The findings demonstrated notably high levels of self-efficacy, with the highest means recorded for confidence in integrating technology (M=4.60, SD=0.624) and ability to organize technology-based activities (M=4.54, SD=0.596). However, teachers showed relatively lower confidence in troubleshooting technical issues (M=4.09, SD=0.919), suggesting a potential area for professional development while correlation analysis revealed a strong positive relationship between teachers' ICT self-efficacy and ICT integration ($r^2 = 0.501, p < 0.01$) correlation coefficient suggests that teachers' confidence in their ability to use technology explains approximately 50% of the variance in their ICT integration practices, as indicated by the coefficient of determination ($r^2 = 0.501$). The regression analysis also provided strong evidence of ICT self-efficacy's influence, emerging as the most powerful predictor of technology integration ($\beta=0.571$, $t=8.227$, $p<.001$).This study recommends that schools implement structured mentoring programs pairing technology-confident teachers with those needing support, while education administrators should establish regular hands-on training sessions focusing specifically on troubleshooting skills where teachers showed lower confidence.*

Keywords*: ICT integration, Teacher-self efficacy, Teachers, Technology Acceptance Model*

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1. Introduction

The integration of information and communication technology into geography Instruction presents significant opportunities for enhancing teaching and learning experiences, yet the realization of these benefits remains constrained by various teacher-related factors, particularly ICT self-efficacy. Research consistently demonstrates that teachers' confidence in their ability to effectively utilize technology serves as a fundamental

determinant of successful ICT integration in educational settings. In the context of Kenyan secondary schools, low ICT self-efficacy emerges as one of the primary barriers preventing geography teachers from embracing and effectively implementing technological innovations in their instructional practices.

The field of geography education stands to benefit tremendously from ICT integration, particularly through geospatial technologies such as GPS, GIS, remote sensing, virtual globes, and online mapping platforms, which offer powerful tools for spatial analysis, data visualization, fieldwork, and active learning experiences that make geography more engaging and relevant for students (Kadhim, 2020; West, 2020; Storey, 2021). These technologies enable students to interact with authentic data, solve real-world problems, conduct investigations, collaborate with peers and experts, create multimedia artifacts, and participate in virtual field trips. Effective use of ICT in geography classrooms can enhance spatial thinking skills, geographical knowledge, motivation, attitudes towards learning, self-directed and inquiry-based learning, and academic achievement (Cox & Abbott, 2017; Lee & Catling, 2016).

In the Kenyan educational context, the government recognizes the importance of ICT in enhancing access, quality, and equity in education and has undertaken policy initiatives such as the National ICT Policy (2006), ICT Strategy for Education and Training (2006), establishment of computer labs in some schools, and integration of ICT into curricula and teacher training (Amuko et al., 2015; Kenya MoE, 2019). However, implementation gaps persist, with a student-computer ratio of 250:1 in secondary schools and most lacking internet connectivity (Kenya MoE, 2016). More critically, only 39% of secondary teachers felt confident using ICT in lessons (Salamba, Yusuf, 2019), directly reflecting the low self-efficacy that characterizes many educators' relationship with technology.

Barriers cited by Kenyan teachers include inadequate facilities, lack of training and support, insufficient time, heavy workloads, exam-oriented curricula, and negative attitudes (Atsiaya et al., 2019; Mwangi & Khatete, 2017). In the context of Kenyan secondary schools, the integration of geospatial technologies in geography education remains particularly low, with only 5% of schools having access to GIS software (Akelo & Omondi, 2018), and most teachers relying on conventional resources like globes and printed maps (Wakhungu, 2016). Challenges identified include the lack of GIS-trained teachers, inadequate computer facilities, unsupportive school leadership, and a curriculum emphasis on factual knowledge over inquiry skills (Kerski & Baker, 2019; Oganyo & Samkange, 2021).

The research literature reveals significant gaps in understanding the specific contextual factors influencing ICT integration in geography instruction in Kenyan public secondary schools. Many studies have focused on general ICT use rather than subject-specific integration in learning areas like geography (Agbo & Ugwoke, 2021). Additionally, there is limited empirical research examining how teacher-related factors such as ICT self-efficacy, attitudes towards technology, and pedagogical strategies interact with the school support system to shape ICT integration in geography classrooms in the Kenyan context (Kisirkoi, 2015; Namirembe et al., 2022). While teachers may have positive attitudes towards ICT, they often face challenges such as lack of facilities, inadequate skills, and limited training opportunities (Ajagbe, 2023).

Addressing these gaps requires targeted professional development initiatives that build teachers' technical skills and equip them with pedagogical strategies for integrating ICT into geography instruction. Realizing the transformative potential of geospatial technologies in geography education requires a comprehensive approach that addresses teachers' TPACK, digital literacy, and subject-specific pedagogical strategies for integrating technology effectively. Addressing these challenges requires a collaborative effort from policymakers, administrators, and teachers to prioritize ICT integration and provide necessary resources and support. Merely providing infrastructure is insufficient; effective integration requires addressing the human factor, particularly teachers' self-efficacy beliefs about their ability to successfully implement technology in their geography instruction.

Therefore, the integration of ICT into Geography Instruction offers the potential to enhance teaching and learning experiences, equip students with digital literacy skills, and improve educational outcomes. However, despite these acknowledged benefits, actual levels of ICT integration by geography teachers remain low due to various barriers, with teacher ICT self-efficacy serving as a critical factor that determines the success or failure of technology integration efforts. The COVID-19 pandemic has further exposed the digital divide and the urgent need to equip schools and teachers to deliver education through ICT. Addressing these systemic challenges requires a coordinated effort from education policymakers, educators, and stakeholders to invest in infrastructure, provide regular professional development, align curricula, and support teachers in developing the necessary skills, attitudes, and pedagogical strategies for effective technology integration. Only by addressing the complex interplay of individual, technological, and contextual factors, with particular attention to building teacher self-efficacy, can the transformative potential of ICT be realized in geography education.

1.2 Research Objectives

The specific objective of this study is:

To determine the influence of teachers' ICT self-efficacy on ICT integration in geography teaching in selected Kenyan National and Extra -county secondary schools.

1.3 Hypotheses

H_{01}: Teachers' ICT self-efficacy has no statistically significant influence on their integration of ICT in geography instruction.

1.4 Theoretical Framework

This study draws upon Technology Acceptance Model as a theoretical frameworks to understand the factors influencing teachers' integration of ICT in geography instruction: The Technology Acceptance Model (TAM).The model aimed to address the gap between technology availability and actual usage by identifying key psychological factors that determine user acceptance behaviors. The Technology Acceptance Model comprises two fundamental constructs that predict technology adoption: perceived usefulness and perceived ease of use (Venkatesh & Davis, 2000). Perceived usefulness refers to the degree to which an individual believes that using a particular technology will enhance their job performance or effectiveness, while perceived ease of use represents the extent to which a person believes that using the technology will be free of effort and complexity. These constructs interact dynamically, with perceived ease of use directly influencing perceived usefulness, as technologies that are easier to use are more likely to be viewed as useful. Both constructs subsequently influence behavioral intention to use technology, which serves as the primary predictor of actual system usage. External variables such as system characteristics, training, and organizational support indirectly affect usage through their impact on perceived usefulness and ease of use. Perceived ease of use addresses teachers' confidence in their technical abilities and their assessment of the effort required to successfully integrate ICT tools into their geography lessons, which directly connects to the concept of self-efficacy in technology.

2. Literature Review

2.1 Influence of Teachers' ICT Self-Efficacy on ICT integration

Chen and Ma (2022) in their study "The influence of teacher support on vocational college students' information literacy: The mediating role of network perceived usefulness and information and communication technology self-efficacy" employed a structural equation modelling approach. They found that teachers' support is positively correlated with ICT self-efficacy ($r=0.582$, $p<0.01$) and that ICT self-efficacy plays a significant mediating role between teachers' support and students' information literacy. The study concludes that improving teachers' ICT self-efficacy is crucial for enhancing students' information literacy. However, the study focused on vocational college students in China, and its applicability to geography instruction in Kenyan secondary schools may be limited.

Arhin et al. (2022) conducted a descriptive survey in their study "Influence of teachers' self-efficacy and attitude towards the integration of ICT into teaching and learning at the basic school level." The study revealed that most teachers have a high level of self-efficacy and positive attitudes towards ICT integration. However, there was a significant difference between male and female teachers' attitudes towards ICT integration. The study concludes that stakeholders should provide periodic ICT workshops for in-service teachers. While the study provides insights into teachers' self-efficacy and attitudes towards ICT integration, it does not specifically address the influence of self-efficacy on ICT integration in geography instruction.

Ybañez and Kintanar (2023) conducted a study titled "Path analysis of senior teachers' ICT adoption in teaching as influenced by their ICT skills, perception and motivation." They employed a path analysis method using a quantitative approach with a sample of 402 senior teachers. The study found that ICT skills, perception, and motivation had a positive significant relationship with ICT integration in teaching. These three variables were also significant predictors of ICT integration. The best fit model showed that ICT skills mediate the relationship between perception, motivation and ICT integration. The study concludes that enhancing senior teachers' ICT skills, perception and motivation can improve their ICT integration in teaching. However, the study focused on senior teachers in general and did not specifically examine geography teachers or the influence of self-efficacy.

Okoye and Okolo (2023), in their study "Development and validation of ICT self-efficacy scale for teachers in Anambra State," developed an instrument to measure teachers' ICT self-efficacy. They used an instrumentation research design with a sample of 300 teachers for trial testing, 600 for factor analysis, and 1000 for norming. The findings showed that the developed scale was valid and reliable for measuring teachers' self-efficacy. The study also found that age and academic discipline moderated teachers' ICT self-efficacy, with younger and science teachers being more self-efficacious. While this study provides a useful tool for measuring ICT self-efficacy, it did not directly investigate the influence of self-efficacy on ICT integration in teaching geography.

Joseph et al. (2023), in their conference paper "Teachers' factors influencing adoption and integration of

information and communication technology into teaching and learning," reviewed literature on factors influencing teachers' ICT integration. They highlighted several factors, including attitudes, workload, experience, gender, computer self-efficacy, and ICT competence. The paper concludes that positive attitudes, adequate training, reduced workload, and institutional support can promote teachers' ICT integration. However, as a literature review, this paper did not provide empirical findings specific to the influence of self-efficacy on ICT integration in geography teaching.

Chirwa and Mubita (2021) in their study "Preparedness of teachers and learners in the integration of Information Communication Technologies in the teaching and learning of geography in selected schools of Petauke District of Eastern Province in Zambia" employed a qualitative descriptive study design. They found that preparedness of teachers and learners to integrate ICTs relied on availability of ICT resources. The study concludes that teachers and learners need to be provided with adequate ICT resources to enhance effective integration. However, the study was localized to only four selected schools in Zambia, limiting its generalizability to the Kenyan context.

Afari et al. (2023) investigated computer self-efficacy and ICT integration in education through structural relationship analysis examining mediating effects among 267 pre-service teachers in Bahrain. Results revealed that basic technology skills and advanced technology skills significantly mediated the relationship between technology-for-pedagogy self-efficacy and technology integration intentions, with the direct path from technology-for-pedagogy to constructivist use being $\beta = 0.34$, $t(265) = 4.67$, $p < 0.001$, while indirect effects through basic skills ($\beta = 0.23$, $p < 0.01$) and advanced skills ($\beta = 0.18$, $p < 0.05$) were also statistically significant. The researchers explained these findings through the hierarchical nature of technology competence development and cognitive load theory, emphasizing that teachers must achieve automaticity in basic technology operations before effectively focusing on pedagogical considerations and innovative instructional strategies.

Shahzad et al. (2024) examined factors influencing the intention to use information and communication technology implementation and acceptance in China's education sector, with particular focus on technological self-efficacy as a predictor of ICT usage behaviors among 382 business students from multiple universities across China. The research conceptualized technological self-efficacy as individuals' beliefs about their capabilities to use ICT tools effectively for educational purposes, encompassing both technical competence and confidence in applying technology to achieve learning objectives, while defining ICT acceptance through multiple dimensions including intention to use ICT tools for information gathering, interactive learning activities, and actual usage behaviors. The researchers attributed these findings to self-efficacy's fundamental role in shaping behavioral intentions and actual performance, emphasizing that self-efficacious individuals develop greater confidence in technology reliability and security, enhancing their willingness to engage with ICT applications for educational purposes.

In conclusion, while these studies provide valuable insights into teachers' self-efficacy, attitudes, and digital competence in relation to ICT integration, none of them specifically investigated the influence of teachers' ICT self-efficacy on ICT integration in geography instruction in Kenyan public secondary schools. There is a need for further research that specifically examines this relationship in the context of geography teaching in Kenya, taking into account the unique challenges and opportunities present in this setting

3. Methodology

3.1 Research Design and Philosophy

This study adopted a pragmatic research philosophy employing a convergent mixed methods design. The pragmatic approach facilitated the use of both quantitative and qualitative methods to investigate the complex factors influencing ICT integration in geography instruction. This philosophy acknowledges that reality is both objective and socially constructed, allowing knowledge to be derived from empirical observation and subjective understanding.

3.2 Study Area and Population

The study was conducted in the North Rift region of Kenya, comprising 7 counties (Nandi, Uasin-Gishu, Baringo, Elgeiyo Marakwet, West Pokot and Trans-Nzoia) with a total of 144 National and Extra-County secondary schools. The target population included principals, heads of geography departments, and geography teachers from these institutions, totaling 863 potential respondents. Most of the National and Extra-County schools used for the study also came from close proximate of modern Urban centers with several learning institution, Moi university being the center of producing and distributing laptops and tablets to the schools ,where one would expect a diffusion effect on use of modern ICT gadgets in school

3.3 Sampling Procedure

Sample sizes were determined using Taro Yamane's formula at 5% margin of error. Proportionate stratified random sampling ensured adequate representation across school types and respondent categories.

$n = N / [1 + N(e^2)]$
Where: n = sample size, N = population size, e = margin of error (0.05

Table 1: Sample Size of Schools by Stratum

School Type	Population Size	Prop	Sample Size
National	32	0.2222	24
Extra-County	112	0.7778	82
Total	**144**	**1.0000**	**106**

Table 2: Sample Size of Units of Observation by Stratum

Unit of Observation	Population Size	Proportion	Sample Size
Principals	106	0.1228	34
Heads of Geography Departments	106	0.1228	34
Geography Teachers	651	0.7543	206
Total	863	1.0000	274

3.4 Research Instruments

Data collection employed three instruments: structured questionnaires, semi-structured interview guides, and document analysis. The questionnaire contained six sections measuring demographic characteristics, ICT self-efficacy, attitudes towards technology, pedagogical strategies, school support system, and ICT integration levels using 5-point Likert scales.

Semi-structured interviews with selected principals and heads of geography departments explored contextual factors and experiences related to ICT integration. Document analysis examined school ICT policies, strategic plans, and professional development records to supplement primary data.

3.5 Validity and Reliability

Content validity was established through expert judgment from five specialists in educational technology and geography education. Scale Content Validity Index (S-CVI) values ranged from 0.92 to 1.00, exceeding the recommended threshold of 0.80. Reliability was conducted by calculating Cronbach's alpha coefficients for the construct.The results show strong internal consistency on Teachers' ICT Self-efficacy (α=0.859),

3.6 Data Collection Procedures

Ethical approval was obtained from Moi University and research permits from NACOSTI. County Directors of Education effected the permit and school principals granted permission for data collection. Informed consent was secured from all participants before questionnaire

administration and interviews. Questionnaires were distributed personally by the researcher, taking approximately 10-15 minutes to complete. Face-to-face interviews were conducted at participants' convenience and audio-recorded with permission. All data were stored securely with unique identification codes to ensure confidentiality.

3.7 Data Analysis Techniques

Quantitative data analysis utilized SPSS version 27 for descriptive statistics, inferential statistics, diagnostic tests, and the linear regression analysis. While qualitative data was analyzed thematically using Nvivo. Diagnostic tests confirmed normality (skewness: -0.624 to -0.980; kurtosis: 0.745 to 1.232), homoscedasticity (Levene's test $p > 0.05$),absence of multicollinearity (VIF < 5, tolerance > 0.2), absence of outliers with Minimum Cook's Distance observed being 0.002 and maximum of 0.178.

The regression model was expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Where: Y = ICT integration, X_1 = ICT self-efficacy

Qualitative data from interviews underwent thematic analysis following Braun and Clarke's six-phase process. NVivo software facilitated data organization and theme identification. Trustworthiness was ensured through member checking, triangulation, thick description, and maintenance of audit trails.

4. Results and Discussion

4.1 Questionnaire Return Rate

The questionnaire return rate analysis provides insights into the response levels achieved in the study. Table 3 presents the sample size, number of returned questionnaires, and the corresponding response rate.

Table 3: Questionnaire Return Rate

Sample Size	Responses Received	Response Rate
240	190	79.1%

As shown in table 3, out of the 240 questionnaires distributed, 190 were completed and returned, representing a response rate of 79.1%. According to Stockemer and Bordeleau (2023), a response rate of 75% or higher is considered excellent for survey research in social sciences. The achieved response rate of 79.1% exceeds this threshold, indicating a highly satisfactory level of participation.

This high response rate enhances the reliability and representativeness of the study findings. Gordon (2023) suggests that response rates above 80% minimize the risk of non-response bias and provide sufficient statistical power for meaningful analysis. The achieved response rate indicates strong engagement from the target population and supports the validity of subsequent analyses.

4.3 Demographic Characteristics of Respondents

Understanding the demographic characteristics of respondents provides important context for interpreting the study results and assessing the representativeness of the sample. The analysis examines gender distribution, age groups, education levels, and teaching experience of the respondents.

4.4 Gender Distribution of Respondents

The gender distribution of respondents provides insights into the representation of male and female geography teachers in the study sample. Table 5 presents the gender distribution of the respondents.

Table 5: Respondents Distribution by Gender

Gender	Frequency	Percent
Male	127	66.8
Female	63	33.2
Total	**190**	**100.0**

As shown in table 5, male respondents constituted 66.8% (n=127) of the sample, while female respondents made up 33.2% (n=63). This gender distribution indicates a significant disparity in representation between male and female geography teachers in the sampled schools. According to Heumann et al. (2023), such demographic patterns should be considered when interpreting study findings and making generalizations. The gender disparity observed in this study aligns with previous research findings. Chirwa and Mubita (2021) found similar gender imbalances in geography teaching staff in Zambian secondary schools, while Omwoki et al. (2023) reported comparable patterns in Kenyan schools. This persistent gender gap may reflect broader societal patterns in STEM subject teaching assignments and could influence technology integration approaches in geography instruction.

4.5 Distribution of Respondents

The age distribution of respondents provides insights into the generational composition of geography teachers and its potential implications for ICT integration. Table 6 presents the age distribution of the respondents.

Table 6: Respondents Distribution by Age

Age Range (Years)	Frequency	Percent
24-30	32	16.9
31-35	59	31.0
36-40	58	30.5
41-45	29	15.3
46-50	12	6.3
Total	**190**	**100.0**

As shown in table 6, the majority of respondents (61.5%) were between 31-40 years old, with 31.0% aged 31-35 years and 30.5% aged 36-40 years. Younger teachers (24-30 years) constituted 16.9% of the sample, while those aged 41 years and above represented 21.6%. This age distribution suggests a relatively experienced teaching workforce in their prime professional years. The predominance of middle-aged teachers may have implications for ICT integration. Islam (2022) found that teachers in this age range often combine sufficient teaching experience with openness to technological innovation. However, Bekele (2022) noted that age-related differences in technology adoption can impact the effectiveness of ICT integration initiatives in schools.

4.6 Educational Qualification of Respondents

The educational qualifications of respondents reflect their academic preparation and potential capacity for implementing educational innovations. Table 7 presents the distribution of respondents by highest education level attained.

Table 7: Respondents Distribution by Education Level

Education Level	Frequency	Percent
Diploma	8	4.2
Bachelor's Degree	152	80.0
Master's Degree	30	15.8
Total	**190**	**100.0**

As shown in table 7, the majority of respondents (80.0%) held bachelor's degrees, while 15.8% had attained master's degrees, and 4.2% held diplomas. This distribution indicates a well-qualified teaching workforce, with 95.8% of respondents having at least a bachelor's degree.The high proportion of degree holders aligns with Kenya's professional requirements for secondary school teachers. Eshete (2022) and Şahin and Dursun (2022) suggest that teachers' educational qualifications can influence their self-efficacy and attitudes toward technology integration. The presence of a substantial number of postgraduate degree holders (15.8%) may contribute positively to innovation adoption and implementation in geography instruction.

4.7 Descriptive Statistics

The descriptive statistics section presents a comprehensive analysis of the study variables, examining the means, standard deviations, and distribution patterns for each construct. The analysis employs a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Following South et al. (2022), mean scores are interpreted using the following thresholds: 1.00 - 1.50 (Strongly Disagree), 1.51 - 2.50 (Disagree), 2.51 - 3.50 (Neutral), 3.51 - 4.50 (Agree), and 4.51 - 5.00 (Strongly Agree). Standard deviations are interpreted according to Brown (2011) as follows: SD ≤ 0.75 (High Agreement), SD 0.76 - 1.25 (Moderate Agreement), and SD > 1.25 (Low Agreement). This section examines teachers' self-perceived capability to effectively integrate and utilize technology in their geography instruction using 10 aspects to assess the Construct The table below shows the results.

Table 8: Descriptive Statistics for Teachers' ICT Self-Efficacy

Statements	SD	D	N	A	SA	Mean	Std. Dev
The teacher feels confident integrating technology into geography lessons.	0 (0.0%)	2 (1.1%)	8 (4.2%)	54 (28.4%)	126 (66.3%)	4.60	0.624
The teacher can use digital tools like GIS, GPS, and online maps effectively for teaching.	7 (3.7%)	5 (2.6%)	16 (8.4%)	68 (35.8%)	94 (49.5%)	4.25	0.980
The teacher is able to evaluate and select appropriate educational technologies.	0 (0.0%)	5 (2.6%)	14 (7.4%)	63 (33.2%)	108 (56.8%)	4.44	0.745
The teacher can troubleshoot basic technical issues during technology use.	2 (1.1%)	8 (4.2%)	36 (18.9%)	69 (36.3%)	75 (39.5%)	4.09	0.919
The teacher can guide students on using technology for geographic research.	0 (0.0%)	0 (0.0%)	16 (8.4%)	59 (31.1%)	115 (60.5%)	4.52	0.648
The teacher can organize and manage classroom activities involving technology.	0 (0.0%)	0 (0.0%)	10 (5.3%)	67 (35.3%)	113 (59.5%)	4.54	0.596
The teacher can provide alternative technology-based instructional approaches.	2 (1.1%)	0 (0.0%)	12 (6.3%)	91 (47.9%)	85 (44.7%)	4.35	0.695
The teacher feels comfortable allowing students to work independently with technology.	0 (0.0%)	11 (5.8%)	18 (9.5%)	60 (31.6%)	101 (53.2%)	4.32	0.871
The teacher can effectively assess student learning when using technology.	0 (0.0%)	3 (1.6%)	13 (6.8%)	56 (29.5%)	118 (62.1%)	4.52	0.695
Overall, the teacher feels capable of integrating technology to enhance instruction.	0 (0.0%)	3 (1.6%)	13 (6.8%)	49 (25.8%)	125 (65.8%)	4.56	0.693

As shown in table 8, teachers exhibited strong confidence in integrating technology into geography lessons (M = 4.60, SD = 0.624). The mean score falls within the "Strongly Agree" range (4.51 - 5.00) according to South et al. (2022), with a substantial majority (66.3%) strongly agreeing and 28.4% agreeing with this statement. The low standard deviation (SD < 0.75) indicates high agreement among respondents. This high level of confidence aligns with the theoretical framework of Technological Pedagogical Content Knowledge (TPACK), which emphasizes the importance of teachers' confidence in successfully integrating technology into subject-specific instruction (Mishra & Koehler, 2006). The strong self-efficacy demonstrated supports findings by Cox and Abbott (2017) and Lee and Catling (2016), who identified teacher confidence as a crucial factor in successful technology integration in geography education.

Regarding the use of digital tools such as GIS, GPS, and online maps (M = 4.25, SD = 0.980), teachers demonstrated strong capability, with 49.5% strongly agreeing and 35.8% agreeing about their effectiveness in using these tools. The mean score falls within the "Agree" range (3.51 - 4.50), while the moderate standard deviation (0.76 - 1.25) suggests some variation in perceived competence. This finding aligns with studies by Kadhim (2020) and West (2020), who emphasized the importance of teachers' proficiency in using geospatial technologies. Teachers demonstrated strong ability to evaluate and select appropriate educational technologies (M = 4.44, SD = 0.745), with 56.8% strongly agreeing and 33.2% agreeing. The mean score falls within the "Agree" range, while the standard deviation indicates high agreement among respondents. This competency in technology selection aligns with Chisango and Marongwe's (2021) emphasis on teachers' ability to make informed decisions about educational technology. The high level of agreement also reflects the growing emphasis on technology evaluation skills in teacher training programs, as highlighted by Amuko et al. (2015) and supported by Kenya's ICT Strategy for Education and Training (2006).

In terms of troubleshooting basic technical issues (M = 4.09, SD = 0.919), teachers showed moderate to high capability, with 39.5% strongly agreeing and 36.3% agreeing. The mean score falls within the "Agree" range, while the moderate standard deviation suggests some variation in technical problem-solving abilities. This finding aligns with Islam's (2022) observation that technical troubleshooting remains a challenge for many teachers. The moderate agreement level suggests varying degrees of technical confidence, consistent with Chirwa and Mubita's (2021) findings about the importance of technical support systems in schools.Teachers showed strong ability to guide students in using technology for geographic research (M = 4.52, SD = 0.648), with 60.5% strongly agreeing and 31.1% agreeing. The mean score falls within the "Strongly Agree" range, while the low standard deviation indicates high agreement among respondents. This strong capability in guiding student research aligns with the theoretical framework of TPACK, particularly in terms of technological pedagogical knowledge. The finding supports Ni'matussyahara et al.'s (2023) emphasis on teachers' role in facilitating technology-enhanced geographic inquiry. The ability to organize and manage classroom activities involving technology showed strong results (M = 4.54, SD = 0.596), with 59.5% strongly agreeing and 35.3% agreeing. The mean score falls within the "Strongly Agree" range, while the low standard deviation indicates high agreement among respondents. The positive results suggest successful implementation of professional development initiatives aimed at enhancing teachers' classroom management skills with technology.

Teachers demonstrated strong capability in providing alternative technology-based instructional approaches (M = 4.35, SD = 0.695), with 44.7% strongly agreeing and 47.9% agreeing. The mean score falls within the "Agree" range, while the low standard deviation indicates high agreement among respondents. The high level of agreement also reflects Mensah et al.'s (2022) observations about teachers' growing capacity to implement varied technology-based approaches, though the presence of 6.3% neutral responses suggests ongoing opportunities for professional development in this area.

Regarding comfort with allowing students to work independently with technology (M = 4.32, SD = 0.871), teachers showed strong positive responses, with 53.2% strongly agreeing and 31.6% agreeing. The mean score falls within the "Agree" range, while the moderate standard deviation suggests some variation in comfort levels. The results support Razali's (2019) emphasis on the importance of student autonomy in technology-enhanced learning, while also reflecting Diyal and Pandey's (2022) findings about teachers' growing confidence in supporting independent student work with technology. Teachers demonstrated strong capability in effectively assessing student learning when using technology (M = 4.52, SD = 0.695), with 62.1% strongly agreeing and 29.5% agreeing. The mean score falls within the "Strongly Agree" range, while the low standard deviation indicates high agreement among respondents. This strong assessment capability aligns with Toma et al.'s (2023) findings about teachers' effectiveness in technology-based assessment. The results support Arhin et al.'s (2022) emphasis on the importance of assessment competency in technology integration. This overall positive self-efficacy provides a strong foundation for continued development of technology-enhanced geography instruction in Kenyan secondary schools.

4.8 Regression Analysis

Multiple regression analysis was conducted to examine the effects of teachers' self-efficacy on ICT integration in geography instruction and test the study's hypotheses. The analysis began with examining model fit statistics, followed by ANOVA results to assess model significance, and finally, the regression coefficients to test specific hypotheses. Following Sürücü et al. (2023), the significance level was set at $\alpha = 0.05$ for hypothesis testing, and standardized beta coefficients were used to compare the relative importance of predictor. The analysis also included diagnostic statistics to ensure the validity of regression assumptions and reliability of results.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.760	0.578	0.572	0.61463

The regression model demonstrated strong predictive power, with an R value of 0.760 indicating a robust relationship between the predictor variables and ICT integration. The R Square value of 0.578 indicates that approximately 57.8% of the variance in ICT integration can be explained by the combined influence of teachers' ICT self-efficacy, attitudes towards technology, and pedagogical strategies. According to Gordon (2023), R Square values above 0.50 in educational research indicate substantial explanatory power. The Adjusted R Square value of 0.572 suggests that the model maintains its predictive power even when accounting for the number of predictors, indicating efficient use of variables in the model. The standard error of the estimate (0.61463) indicates relatively precise predictions, as it represents less than one standard deviation unit on the five-point scale used to measure ICT integration. This level of model fit aligns with findings from similar studies in educational technology adoption, such as those reported by Gómez-Fernández and Mediavilla (2022), who found comparable levels of explained variance in their studies of technology integration in educational settings.

Table 10: ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	96.375	3	32.125	85.037	.000
Residual	70.266	186	0.378		
Total	**166.642**	**189**			

The ANOVA results demonstrate that the regression model is statistically significant ($F(3, 186) = 85.037$, $p < .001$), indicating that the combination of teacher-related factors significantly predicts ICT integration in geography instruction. According to Ho (2023), a significant F-statistic indicates that the model explains more variance than would be expected by chance alone. The large F-value suggests substantial explanatory power, with the model accounting for a significant portion of the variance in ICT integration in Geography Instruction. The results are further supported by findings obtained from Teachers performance and appraisal Document where teachers demonstrated ability to appropriately integrate ICT into Geography Instruction, a good example is Geography teacher number 12 who uploaded animated video showing comprehensive explanation of volcanic processes and their effects on environment from a Geological tool kit. The mean square regression value of 32.125 compared to the mean square residual of 0.378 indicates that the model explains considerably more variance than it leaves unexplained. This strong model fit supports the theoretical framework underlying the study, which posits that teacher-related factors significantly influence technology integration practices. The significant ANOVA results align with previous research by Taroreh et al. (2023) and Gómez-Fernández and Mediavilla (2022), who found similar patterns of relationship between teacher factors and technology integration in educational settings.

Table 12: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-0.043	0.689		-0.062	0.950
ICT Self-efficacy (X_{01})	1.067	0.130	0.571	8.227	0.000

The regression coefficients reveal significant relationships between teacher self-efficacy factor and ICT integration by emerging as the strongest predictor ($\beta = 0.571$, $t = 8.227$, $p < .001$), indicating that for each unit increase in self-efficacy, ICT integration increases by 1.067 units when other variables are held constant. This finding supports previous research by Chen and Ma (2022) and Arhin et al. (2022), who identified self-efficacy as a crucial determinant of technology integration. The standardized coefficient indicates that self-efficacy has the largest relative influence among the predictors, explaining a substantial portion of the variance in ICT integration. Heumann et al. (2023) suggest that standardized coefficients above 0.50 indicate strong predictive relationships in educational research, making this finding particularly noteworthy for understanding factors that influence technology integration in geography instruction.

Table 13: Summary of Hypothesis Testing Results

Hypothesis	Description	Results	Decision
H_{01}	Teachers' ICT self-efficacy has no significant influence on ICT integration in geography teaching	$\beta = 0.571$, $t = 8.227$, $p < .001$	Reject Ho_1

The comprehensive analysis of the study's hypotheses revealed significant relationships between teacher-related factors and ICT integration in geography instruction. The first hypothesis (H_{01}) regarding teachers' ICT self-efficacy was rejected based on strong statistical evidence ($\beta = 0.571$, $t = 8.227$, $p < .001$), indicating that self-efficacy substantially influences technology integration practices. This finding aligns with theoretical expectations from the Technology Acceptance Model and supports previous research by Chen and Ma (2022) and Arhin et al. (2022). Summary of Findings.

4.9 Qualitative finding

Data was collected by use of semi-structured interview with set of open ended questions focusing on various aspects of teachers' competence and confidence in ICT integration in Geography Instruction. The interview schedule had questions that were directed to the principals and the head of Geography Department which sought to find out some successful strategies or best practices they observed in their school for promoting effective technology integration in teaching and learning. Some responses are listed below:

"*We encourage peer mentorship among our teachers in order to provide them practical experience on the use of ICT"(*Interview, Principal number8)

"*Our school organizes collaborative forums with school alumni who are ICT experts on the use of ICT materials"(*Interview, HoD number24)

"We organize yearly Teacher's exchange programs through bench marking in order to share experiences and challenges

on ICT integration"(Interview, HoD number 11)

These findings from the principal and heads of Geography supports the magnitude of the correlation coefficient which suggests that teachers' confidence in their ability to use technology explains approximately 50% of the variance in their ICT integration practices, as indicated by the coefficient of determination ($r^2 = 0.501$).

5. Conclusions and Recommendations

5.1 Conclusions

Based on the objective examining teachers' ICT self-efficacy, the study concludes that self-efficacy is the most crucial factor influencing technology integration in geography instruction. The strong positive relationship ($\beta=0.571$, $p<.001$) demonstrates that teachers' confidence and perceived ability to use technology effectively directly impacts their level of ICT integration. This finding implies that building teachers' technological confidence and competence should be a primary focus of professional development initiatives. The high means across most self-efficacy indicators suggest that while teachers generally feel confident about basic technology integration, specific areas like troubleshooting technical issues require additional support and training.

5.2 Recommendations

1. Based on the finding that ICT self-efficacy is the strongest predictor of technology integration, it is recommended that schools implement structured mentoring programs pairing technology-confident teachers with those needing support.

2. Education administrators should establish regular hands-on training sessions focusing specifically on troubleshooting skills where teachers showed lower confidence.

3. Ministry of education should develop localized ICT integration guideline for Geography department in Secondary schools and guide lines should be accompanied by funding, training and evaluation Mechanisms tailored to specific regions

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