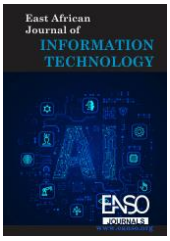

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Original Article

Teacher Training Programs and the Effective Use of ICT in Education: Evidence from Public School Teachers in Rwanda

Daniel Mulindwa[1*] *& Aggrey Ankwatse*[2]

[1] Adventist University of Central Africa, P. O. Box 2462 Kigali, Rwanda.
[2] Green Hills Academy, P. O. Box 6419, Kigali, Rwanda.
[*] Author for Correspondence ORCID ID; https://orcid.org/0000-0001-7165-4798; Email: daniel.mulindwa@auca.ac.rw

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ABSTRACT

This study investigates the relationship between teacher training programs and the effective integration of Information and Communication Technology (ICT) in public schools in Rwanda. A structured questionnaire was administered to 166 teachers, of whom 54% were male and 46% female. The majority were aged 31-40 years (39%), with 35% having 5-10 years of teaching experience. In terms of education, most held a bachelor's degree (58%), followed by diploma holders (24%) and master's degree holders (15%). Results show that 74% of teachers regularly use ICT tools in their teaching, and 85% believe ICT improves student engagement. Only 48% felt their training was adequate, while 72% cited poor internet connectivity and 69% cited lack of equipment as significant barriers. Descriptive statistics revealed that the mean ICT usage score was 3.8 (SD = 0.9), while perceptions of ICT impact had a mean of 4.2 (SD = 0.7). Regression analysis revealed that teacher training positively predicted ICT usage ($\beta = 0.57$, $p < 0.001$), whereas perceived barriers negatively predicted usage ($\beta = -0.43$, $p < 0.001$). The study concludes that systematic, pedagogically focused training, coupled with improved infrastructure and ongoing support, is essential for strengthening ICT integration in Rwanda's education system.

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INTRODUCTION

Information and Communication Technology (ICT) integration in education is globally recognised as a transformative driver for improving teaching efficiency, learning engagement, and educational outcomes (OECD, 2019). In recent years, the Government of Rwanda has made significant strides toward embedding ICT in the education system through initiatives such as the One Laptop per Child (OLPC) program, smart classrooms, digital content development, and nationwide internet connectivity projects. These strategies align with national development agendas, including Vision 2050 and the Education Sector Strategic Plan 2018/19–2023/24, which position ICT as a catalyst for human capital development and socio-economic transformation (MINEDUC, 2019). As a result, infrastructure and access to digital tools in schools have improved considerably.

Despite this progress, successful ICT integration relies on more than hardware deployment; it depends largely on teachers' digital competence, pedagogical readiness, and attitudes toward technology use in instructional practices (Mukama & Andersson, 2008). Several studies in sub-Saharan Africa suggest that while access to ICT is increasing, many educators still lack the training, confidence, or support needed to use technology effectively in the classroom. In the Rwandan context, limited professional development opportunities, insufficient technical assistance, and inadequate contextualised digital content remain persistent challenges.

This study sought to bridge this gap by examining the extent to which teacher training programs influence ICT integration in Rwandan schools. Specifically, it explores how teachers utilise digital tools in their instructional practices, the barriers they encounter, and their perceptions of ICT's impact on teaching and learning. By investigating these dimensions, the study aims to provide evidence-based insights that can guide policymakers, training institutions, and school leaders in strengthening ICT-supported pedagogy. Ultimately, understanding the relationship between teacher preparation and technology use is critical to ensuring that national investments in ICT translate into meaningful educational gains.

LITERATURE REVIEW

Theoretical Framework

This study is grounded in the Technology Acceptance Model (TAM) developed by Davis (1989), which posits that the likelihood of adopting new technology depends primarily on two key perceptions: perceived usefulness (PU) and perceived ease of use (PEOU). Perceived usefulness reflects the extent to which individuals believe that using a particular technology will enhance their job performance, while perceived ease of use refers to the degree to which the individual believes that using the technology will be free of effort. In educational settings, teachers are more inclined to integrate ICT into their classroom practices if they perceive that doing so improves their teaching effectiveness and is user-friendly (Teo, 2011).

TAM provides a robust lens through which to examine teachers' technology integration behaviour because it connects psychological attitudes to practical behaviours. Several scholars have extended TAM to include additional constructs such as self-efficacy, subjective norms, and facilitating conditions to capture the complex realities of ICT adoption in education (Venkatesh & Davis, 2000; Tondeur et al., 2017). The model's emphasis on perception aligns with the current study's focus on teachers' attitudes toward ICT use, their confidence in applying it pedagogically, and the contextual barriers they face. Thus, TAM serves not only as a theoretical foundation but also as an interpretive framework for understanding how teacher training can shape perceptions that influence ICT integration in Rwanda's public schools.

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ICT Integration and Teacher Training

The effective integration of ICT in education is widely recognised as a key driver for transforming teaching and learning processes. Studies have consistently shown that teacher professional development is among the most significant predictors of successful ICT use in classrooms (Ertmer & Ottenbreit-Leftwich, 2010; Tondeur et al., 2017). Teachers who receive structured, continuous, and contextually relevant ICT training are more likely to use digital tools to enhance instruction, promote student engagement, and improve learning outcomes.

However, the content and delivery of ICT training programs are crucial. Research suggests that training programs focusing solely on technical skills, such as how to operate computers or use specific applications, are often insufficient (Hennessy et al., 2010). Instead, pedagogical integration training, which connects technology use to instructional strategies and learning objectives, leads to more sustained adoption. This distinction aligns with the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasises the intersection of technology, pedagogy, and subject content knowledge as the foundation for effective digital teaching (Mishra & Koehler, 2006).

Globally, teacher training programs that incorporate mentorship, classroom-based practice, and reflective learning have demonstrated better results in developing teachers' capacity to integrate ICT (Law & Chow, 2008; Tondeur et al., 2016). Such programs enable teachers to internalise technology use as part of their everyday pedagogical repertoire rather than as an optional or external add-on. In developing countries, including those in sub-Saharan Africa, teacher training programs often face challenges such as limited funding, inadequate training materials, and insufficient follow-up support (Karsenti & Foko, 2010). As a result, while many teachers express positive attitudes toward ICT, they struggle to translate training into consistent classroom practice. Continuous professional development that includes practical exposure, peer collaboration, and institutional encouragement is therefore essential for sustained ICT integration.

Barriers to ICT Adoption

Even when teachers are willing to use technology, several barriers can hinder effective ICT adoption. Hew and Brush (2007) classified these barriers into first-order barriers (external factors such as lack of access, insufficient infrastructure, and inadequate technical support) and second-order barriers (internal factors such as beliefs, attitudes, and resistance to change). In African contexts, first-order barriers tend to dominate because of persistent infrastructural limitations, unreliable electricity, poor internet connectivity, and the high cost of ICT maintenance (Unwin, 2005; Karsenti & Foko, 2010).

Studies in Kenya, Uganda, and Ghana indicate that teachers' competence, ongoing training, and access to ICT tools strongly affect the degree of classroom implementation (Aesaert & van Braak, 2015; Nyaigotti-Chacha, 2007). Yet, even when hardware and training are provided, inadequate technical support, heavy workloads, and rigid curricula often limit the effective application of acquired skills (Gudmundsdottir & Hatlevik, 2018). Similarly, in Rwanda, Ngaboyeka (2020) and Twinomugisha (2017) observed that many teachers still experience difficulties integrating ICT into instruction due to a lack of sustained professional development, limited digital resources, and inconsistent administrative support.

Importantly, barriers are not purely logistical. Teachers' confidence and pedagogical beliefs significantly mediate the extent to which ICT tools are used meaningfully in classrooms. When teachers feel unsupported or uncertain about their competence, they are less likely to experiment with technology-enhanced teaching methods (Ertmer & Ottenbreit-Leftwich, 2010). Therefore, successful ICT integration must simultaneously address both structural and psychological dimensions of teacher readiness.

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ICT and Learning Outcomes

ICT integration has been shown to enhance student learning by promoting active engagement, collaboration, and independent inquiry (UNESCO, 2011). Interactive technologies such as digital simulations, multimedia presentations, and online collaboration platforms enable learners to construct knowledge through exploration and critical thinking rather than rote memorisation. Furthermore, ICT tools can foster inclusive education by accommodating diverse learning needs through adaptive software and differentiated instruction (OECD, 2019).

Empirical evidence indicates that students taught by ICT-competent teachers tend to demonstrate improved academic performance, motivation, and digital literacy (Ertmer & Ottenbreit-Leftwich, 2010). However, the relationship between ICT use and learning outcomes is mediated by how technology is used pedagogically. Superficial or sporadic use of ICT-for example, using PowerPoint slides for lectures without interactive engagement, has limited educational value. Conversely, when technology is integrated into inquiry-based, student-centred instruction, it enhances critical thinking, creativity, and collaboration (Tondeur et al., 2017).

In Rwanda, the government's continued investment in digital infrastructure aims to replicate such global successes. Initiatives such as Smart Classrooms, Teacher Laptop Programs, and digital curriculum reforms demonstrate political will to mainstream ICT across education levels (MINEDUC, 2019). Yet, as studies reveal, the link between access and pedagogical application remains weak. Many teachers continue to rely on traditional teaching methods despite the availability of digital tools, underscoring the need for pedagogically grounded training programs and supportive school environments (Mukama & Andersson, 2008; Ngaboyeka, 2020).

Empirical Gap

Although numerous studies have explored ICT integration in African education systems, few have quantitatively examined the direct relationship between teacher training programs, ICT usage, and perceived barriers within the Rwandan context. Much of the existing literature is descriptive, focusing either on infrastructure or policy initiatives, with limited emphasis on the interplay between teacher preparation and actual classroom practices. Moreover, while previous research highlights teachers' positive perceptions of ICT's potential, empirical evidence linking those perceptions to measurable ICT use remains scarce.

This study addresses this gap by employing descriptive and regression analyses to determine how teacher training and perceived barriers predict ICT usage among public school teachers in Rwanda. By situating the analysis within the Technology Acceptance Model, it contributes theoretically grounded insights to the discourse on ICT integration in developing-country contexts.

METHODOLOGY

Research Design

This study employed a quantitative survey design to investigate the relationship between teacher training and the effective use of Information and Communication Technology (ICT) in Rwandan public schools. The quantitative approach was appropriate because it allows the systematic collection of data from a relatively large population, enabling the identification of statistical relationships among variables (Creswell & Creswell, 2018). Specifically, the study adopted a cross-sectional design, gathering data from teachers at a single point in time to assess the association between training, ICT use, and perceived barriers.

The rationale for using a survey design lies in its suitability for exploring behavioural patterns, attitudes, and practices among educators. Moreover, quantitative designs facilitate objective measurement of relationships using statistical tools such as descriptive statistics and regression analysis. This approach provides empirical insights into the extent to which teacher training influences ICT integration, while also identifying

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structural or attitudinal factors that may hinder effective usage.

Population and Sampling Procedures

The study targeted public school teachers across selected urban and rural districts in Rwanda. The inclusion of both urban and rural schools ensured that the sample captured diverse educational environments and reflected the varying levels of ICT access and infrastructure across the country.

A total of 166 teachers participated in the study. Schools were first selected using purposive sampling, focusing on institutions that had at least some level of ICT infrastructure (such as computers, projectors, or internet access). This ensured that participants could meaningfully respond to questions regarding ICT use. Within each selected school, convenience sampling was used to identify teachers who were available and willing to participate in the study.

Although probability sampling might offer greater generalizability, the combined purposive–convenience approach was suitable given logistical constraints and the exploratory nature of the study. This approach also allowed for the inclusion of teachers who were directly involved in classroom instruction and thus had firsthand experience with ICT integration.

Research Instrument

Data were collected using a structured questionnaire developed by the researchers. The instrument was informed by previous studies on ICT integration and teacher training (Tondeur et al., 2016; Ngaboyeka, 2020) and adapted to reflect the Rwandan educational context. The questionnaire consisted of two main sections: Section A: Collected demographic information such as gender, age, educational qualification, and years of teaching experience. Section B: Contained 20 items measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These items were distributed across four domains: ICT usage, ICT training, perceived barriers, and perceptions of ICT's impact on teaching and learning.

To ensure content validity, the questionnaire was reviewed by three experts in educational technology and research methodology from Rwandan higher education institutions. Their feedback led to minor revisions in wording and item sequencing to enhance clarity. A pilot study was subsequently conducted with 20 teachers not included in the main sample. The pilot results confirmed the instrument's reliability, with a Cronbach's alpha coefficient of .87, indicating high internal consistency across items.

Data Collection Procedures

Data collection was conducted over a three-week period in collaboration with school administrators and district education officers. Prior to distribution, official permission was obtained from the Ministry of Education (MINEDUC) and relevant district education offices. The researchers personally visited each selected school, explained the purpose of the study, and emphasised confidentiality and voluntary participation.

Participants were informed that their responses would be used solely for academic research purposes and would remain anonymous. Informed consent was obtained before administering the questionnaire. Teachers were given ample time approximately 30-40 minutes, to complete the instrument, and researchers were present on-site to address any questions or clarifications.

Completed questionnaires were collected immediately after completion to minimise response loss. The overall response rate was approximately 92%, reflecting a high level of engagement and interest among participants.

Ethical Considerations

The study adhered to ethical research standards established by the Adventist University of Central Africa Research Ethics Committee. Participants were fully informed about the purpose and procedures of the study and were assured that their participation was voluntary and confidential. No personal identifiers were collected, and participants were free to withdraw at any stage without penalty.

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Furthermore, care was taken to ensure that all data were stored securely, accessible only to the researchers. The study also observed principles of beneficence and respect for participants, ensuring that the research process did not disrupt normal school activities or impose undue burden on teachers.

RESULTS

Demographic Characteristics of Respondents

A total of 166 public school teachers participated in the study. Table 1 presents their demographic characteristics, including gender, age group, years of teaching experience, and education level.

Table 1: Demographic Characteristics of Participating Teachers (N = 166)

Demographic		Frequency	Percentage (%)
Gender	Male	90	54
	Female	76	46
Age Group	20-30 years	47	28
	31-40 years	65	39
	41-50 years	34	20
	51+ years	20	13
Teaching Experience	<5 years	37	22
	5-10 years	58	35
	11-15 years	33	20
	16-20 years	22	13
	>20 years	16	10
Education Level	Diploma	40	24
	Bachelor's degree	96	58
	Master's degree	25	15
	Other	5	3

As shown, male teachers constituted a slightly higher proportion (54%) compared to female teachers (46%). The largest age group was 31-40 years (39%), followed by 20-30 years (28%). In terms of teaching experience, 35% of respondents had between 5-10 years, while 22% had fewer than five years of experience, indicating that the sample comprised both early-career and mid-career educators. Regarding education level, 58% held bachelor's degrees, 24% diplomas, and 15% master's degrees, demonstrating a relatively high level of qualification among respondents.

Descriptive Analysis of ICT Usage and Related Variables

Descriptive statistics were computed to assess levels of ICT use, training adequacy, perceived barriers, and teachers' perceptions of ICT's impact on learning. ICT Usage: Teachers reported a mean score of 3.8 (SD = 0.9), with 74% indicating regular use of ICT tools such as projectors, computers, and digital content in their teaching. ICT Training: The mean score for training adequacy was 3.5 (SD = 0.9), with 48% of teachers considering their ICT training sufficient to support instructional integration. Perceived Barriers: The mean score was 3.6 (SD = 0.8). Commonly cited barriers included poor internet connectivity (72%), insufficient ICT equipment (69%), lack of technical support (60%), and time constraints (55%). Perceptions of ICT Impact: Teachers expressed highly positive perceptions of ICT's educational value, with a mean of 4.2 (SD = 0.7). Notably, 85% agreed that ICT enhances student engagement and motivation, while 78% believed it promotes critical thinking and active learning.

Overall, these descriptive results suggest a strong awareness among teachers of ICT's potential benefits, though infrastructural and technical barriers continue to limit effective implementation.

Inferential Analysis

To examine the predictive power of teacher training and perceived barriers on ICT usage, a multiple regression analysis was conducted. Table

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2 presents the regression coefficients, standard errors, and significance levels.

Table 2: Multiple Regression Analysis Predicting ICT Usage

Predictor	B	SE B	Beta	T	P
Constant	1.15	0.22	–	5.23	<0.001
ICT Training	0.54	0.06	0.57	8.90	<0.001
Barriers	-0.38	0.07	-0.43	-5.43	<0.001

Model Summary: $R^2 = 0.50$, Adjusted $R^2 = 0.49$, Std. Error = 0.42

The regression model was statistically significant ($F(2, 163) = 81.34$, $p < .001$), explaining approximately 49% of the variance in ICT usage. Teacher training was found to positively and significantly predict ICT use ($\beta = 0.57$, $p < .001$), suggesting that higher levels of training correspond with greater ICT integration in the classroom. Conversely, perceived barriers had a negative and significant influence ($\beta = -0.43$, $p < .001$), indicating that infrastructural and institutional challenges substantially reduce ICT usage among teachers.

Interpretation of Results

The findings demonstrate that teacher training is a strong and consistent predictor of ICT use in Rwandan public schools. Teachers who received continuous, hands-on, and pedagogically focused training were more confident and likely to integrate digital tools into their lessons. This aligns with prior research emphasising that professional development is a critical determinant of ICT adoption (Ertmer & Ottenbreit-Leftwich, 2010; Tondeur et al., 2017).

At the same time, the study revealed that systemic barriers—particularly unreliable internet connectivity, lack of equipment, and insufficient technical support—remain major obstacles. These findings are consistent with those of Ngaboyeka (2020) and Twinomugisha (2017), who identified infrastructural inadequacies as central to the slow pace of ICT diffusion in Rwandan schools.

Interestingly, although many teachers rated their training as only moderately adequate, they still reported highly positive attitudes toward ICT's educational value. This suggests a strong latent readiness among educators: they are willing and motivated to use ICT but constrained by contextual limitations. Such readiness is an important precursor to deeper ICT adoption, indicating that once infrastructural barriers are addressed, usage levels could rise significantly.

The regression model's explanatory power ($R^2 = .50$) further underscores that teacher-related variables particularly training and perceived barriers, collectively account for about half of the variance in ICT usage. This highlights that, while teacher competence and motivation are critical, external factors beyond individual control continue to influence technology adoption in Rwandan classrooms.

DISCUSSION

ICT Usage and Teacher Training

The findings of this study reveal that ICT usage among Rwandan public school teachers is moderately high, with 74% reporting regular use of digital tools in instruction. The positive relationship between teacher training and ICT usage ($\beta = 0.57$, $p < .001$) underscores the critical role of professional development in fostering effective technology integration. This aligns with the Technology Acceptance Model (TAM), which posits that individuals are more likely to adopt technology when they perceive it as useful and easy to use (Davis, 1989). In this study, teachers' high perception of ICT's benefits ($M = 4.2$) reflects a strong sense of perceived usefulness, which, when combined with adequate training, translates into greater classroom adoption.

These results also resonate with prior research highlighting the importance of pedagogically focused training programs. Ertmer and Ottenbreit-Leftwich (2010) argue that professional development must go beyond technical skills to

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include instructional strategies, lesson planning, and curriculum alignment. In the Rwandan context, the findings suggest that while teachers possess basic operational ICT skills, many still lack the confidence and knowledge to apply these tools fully in learner-centred instruction. The observed moderate confidence level (M = 3.7) reflects this gap between functional competence and pedagogical integration.

Barriers to ICT Integration

Despite the generally positive attitudes toward ICT, teachers reported significant barriers that impede effective adoption. Poor internet connectivity (72%), insufficient equipment (69%), and limited technical support (60%) emerged as the most prominent challenges. These findings are consistent with studies conducted in Rwanda and other sub-Saharan African countries, where infrastructural constraints remain a major limiting factor in technology integration (Ngaboyeka, 2020; Karsenti & Foko, 2010; Unwin, 2005).

The negative regression coefficient for barriers ($\beta = -0.43$, $p < .001$) indicates that these external challenges substantially reduce ICT usage, even when teachers are trained and motivated. This finding supports the conceptual distinction between first-order barriers (external, resource-related) and second-order barriers (internal, attitudinal) proposed by Hew and Brush (2007). In Rwanda, first-order barriers appear to dominate, limiting the translation of teachers' readiness into actual classroom practice.

Interestingly, teachers' positive perceptions of ICT, despite these barriers, suggest a state of "conditional readiness", a willingness to adopt technology constrained primarily by structural factors rather than lack of motivation or skill. This finding challenges earlier assumptions in African ICT research that teacher attitudes are the main impediment (Mukama & Andersson, 2008). Instead, the data indicate that systemic support, access, and infrastructure are now the critical determinants of successful ICT integration.

Implications for Policy and Practice

The study's findings have several practical and policy implications:

Enhancing Teacher Training Programs: Training initiatives should move beyond operational ICT skills to include pedagogically oriented modules, curriculum integration strategies, and classroom-based mentorship. Programs that offer hands-on practice and ongoing support are more likely to result in sustained ICT adoption (Tondeur et al., 2017).

Investing in Infrastructure: Addressing first-order barriers, such as inadequate internet access and insufficient equipment is essential. Schools must be equipped with reliable digital infrastructure to ensure that teachers can implement learned ICT skills effectively.

Supporting Continuous Professional Development: One-off workshops are insufficient for deep learning. Continuous professional development, including refresher courses, peer learning communities, and technical support, can reinforce teachers' competence and confidence.

Aligning Policy with Classroom Realities: National initiatives such as the *One Laptop per Child* program and *Smart Classrooms* must be accompanied by realistic support structures. Without addressing the operational and contextual challenges teachers face, policy investments may yield only superficial or sporadic ICT adoption.

Integration with Theory

From a TAM perspective, the findings highlight that both perceived usefulness and facilitating conditions are essential for technology adoption. While teachers perceive ICT as highly useful, the ease of use is compromised by structural barriers. This suggests that enhancing facilitating conditions through infrastructure and institutional support is crucial to realising the full potential of ICT in education.

Similarly, the study resonates with the TPACK framework, which emphasises the integration of technological, pedagogical, and content

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knowledge. The results indicate that while teachers may possess basic technological knowledge, their pedagogical application of ICT is limited by insufficient training and systemic constraints. Strengthening the intersection of technology and pedagogy through targeted professional development is therefore essential for achieving meaningful integration.

Finally, applying Rogers' Diffusion of Innovation theory (2003), Rwanda appears to be transitioning from the early adoption phase to the implementation phase. Teachers show willingness and positive attitudes, but widespread and consistent usage depends on improved infrastructure and ongoing support systems. Without addressing these factors, ICT adoption risks remaining superficial, characterised by occasional or ancillary use rather than transformative classroom integration.

Comparisons with Prior Research

The study's findings are consistent with international evidence on ICT integration. Similar patterns of positive teacher attitudes coupled with infrastructural limitations have been observed in Kenya, Uganda, and Ghana (Aesaert & van Braak, 2015; Nyaigotti-Chacha, 2007). In high-income contexts, while technical infrastructure is rarely a limiting factor, barriers such as time constraints and insufficient pedagogical guidance continue to affect adoption (Hew & Brush, 2007). These comparisons suggest that while Rwanda has made notable progress in ICT policy and access, the challenges are now primarily operational and structural rather than attitudinal.

CONCLUSION

This study investigated the relationship between teacher training programs and the effective use of Information and Communication Technology (ICT) in Rwandan public schools. Findings indicate that teacher training is a significant predictor of ICT usage, with well-trained educators demonstrating higher levels of digital integration in classroom instruction. At the same time, structural barriers, including poor internet connectivity, insufficient equipment, and limited technical support, continue to impede effective adoption.

Despite these challenges, teachers generally exhibited positive perceptions of ICT's impact on student engagement, collaboration, and learning outcomes. This suggests a state of latent readiness: educators are willing and motivated to integrate technology, but contextual limitations restrict their ability to fully apply acquired skills. The study's regression analysis further revealed that while training enhances ICT adoption, barriers significantly reduce its impact, collectively explaining approximately 49% of the variance in ICT usage.

From a theoretical perspective, the findings align with the Technology Acceptance Model (TAM), highlighting the dual importance of perceived usefulness and facilitating conditions. They also support the TPACK framework, indicating that effective integration requires the intersection of technological competence, pedagogical skill, and content knowledge. Finally, Rwanda's ICT initiatives reflect a transition from the early adoption to the implementation phase of Diffusion of Innovation theory, wherein systemic support and infrastructure become critical for sustainable and meaningful integration.

In summary, while Rwanda has made notable strides in providing access to ICT and promoting teacher readiness, the pedagogical depth of ICT usage remains limited. Achieving transformational impact requires not only further investment in infrastructure but also systematic, contextually relevant, and ongoing professional development.

The study found that although 74% of teachers reported regular ICT use and 85% believed it improved student engagement, this usage remains largely functional rather than pedagogical. The regression analysis confirmed that ICT training significantly enhances usage ($\beta = 0.57$), while persistent barriers, particularly poor internet connectivity, limited equipment, and lack of technical support, exert a strong negative effect ($\beta = -0.43$). These results indicate that teacher

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motivation and willingness to use ICT are already well established; however, their ability to translate this willingness into meaningful classroom practice is constrained by inadequate professional preparation and systemic limitations.

Therefore, the conclusion is clear: Rwanda's progress in ICT integration has reached a pivotal stage where access alone is no longer the primary determinant of adoption capacity and support now are. Enhancing the pedagogical depth of ICT training, rather than focusing solely on operational competence, is necessary for shifting ICT use from occasional tool support to genuine instructional transformation. Likewise, addressing infrastructural deficiencies is essential to ensure that teachers' readiness is not undermined by inconsistent resources. If these conditions are met, the high levels of confidence and positive perceptions observed in this study suggest strong potential for ICT to become an integral component of effective teaching and learning in Rwandan schools.

Recommendations

Based on the study findings, the following recommendations are proposed for policymakers, educational leaders, and teacher training institutions:

Enhance Pedagogically Oriented Training: Teacher training programs should extend beyond technical skills to include curriculum integration, learner-centred approaches, and practical classroom applications. Hands-on, contextually relevant modules can strengthen pedagogical competence and confidence in ICT use.

Invest in Infrastructure and Technical Support: Schools must be equipped with reliable internet access, adequate ICT equipment, and technical maintenance services. Addressing these first-order barriers is essential to translating training into meaningful classroom integration.

Provide Continuous Professional Development: One-off workshops are insufficient for sustained ICT adoption. Continuous professional development, refresher courses, mentoring programs, and professional learning communities can reinforce teacher competence and encourage innovative technology use.

Align Policy Initiatives with School Realities: National programs such as *One Laptop per Child* and *Smart Classrooms* must be complemented by practical support for teachers, including time allocation for ICT integration, access to teaching resources, and administrative encouragement.

Monitor and Evaluate ICT Implementation: Systematic evaluation of ICT programs can identify gaps, measure progress, and inform policy adjustments. Feedback mechanisms involving teachers can ensure that professional development remains responsive to classroom realities.

By implementing these recommendations, Rwanda can transition from surface-level ICT adoption to pedagogically meaningful integration, leveraging technology to enhance teaching quality, student engagement, and overall educational outcomes. Teachers' high motivation and positive perceptions indicate a strong potential for ICT to become an integral component of effective teaching and learning, provided that training and systemic support are prioritised.

REFERENCES

Aesaert, K., & van Braak, J. (2015). ICT in education in Africa: Teachers' perspectives. Computers & Education, 81, 63–75. https://doi.org/10.1016/j.compedu.2014.09.010

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approach (5th ed.). Sage.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319– 340. https://doi.org/10.2307/249008

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How

Article DOI: https://doi.org/10.37284/eajit.8.2.3883

knowledge, confidence, beliefs, and culture intersect. Journal of Research on Technology in Education, 42(3), 255– 284. https://doi.org /10.1080/15391523.2010.10782551

Gudmundsdottir, G. B., & Hatlevik, O. E. (2018). Factors influencing teachers' digital competence. Computers & Education, 122, 50– 61. https://doi.org/10.1016/j.compedu.20 18.02.009

Hew, K. F., & Brush, T. (2007). Integrating technology into K–12 teaching and learning: Current knowledge gaps and recommendations. Educational Technology Research and Development, 55(3), 223–252. https://doi.org/10.1007/s11423-006-9022-5

Karsenti, T., & Foko, T. (2010). Mobile phones in teaching and learning: Uses, benefits, and challenges. African Journal of Education and Technology, 6(1), 23–40.

Law, N., & Chow, A. (2008). ICT in education: Connecting policy and practice in Hong Kong. Computers & Education, 51(1), 120–136. https://doi.org/10.1016/j.compedu.2007. 04.002

MINEDUC. (2019). Education Sector Strategic Plan 2018/19–2023/24. Ministry of Education, Rwanda.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Mukama, E., & Andersson, S. B. (2008). Coping with change in ICT-based learning environments: Newly qualified Rwandan teachers' reflections. Journal of Computer Assisted Learning, 24(2), 156–166. https://doi.org/10.1111/j.1365-2729.2007.00262.x

Ngaboyeka, A. (2020). Teacher preparedness and ICT integration in Rwandan secondary schools. African Journal of Education and Technology, 10(1), 45–56.

Nyaigotti-Chacha, C. (2007). ICTs in African education: Challenges and perspectives. African Journal of Education, 12(1), 33–47.

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. Computers & Education, 57(4), 2432– 2440. https://doi.org /10.1016/j.compedu.2011.06.008

Tondeur, J., Aesaert, K., Pynoo, B., van Braak, J., Fraeyman, N., & Erstad, O. (2017). Developing a validated instrument to measure preservice teachers' ICT competencies: Meeting the demands of the 21st century. British Journal of Educational Technology, 48(2), 462–472. https://doi.org/10.1111/bjet.12442

Twinomugisha, A. (2017). Evaluating ICT teacher training programs in Rwanda: A longitudinal study. International Journal of ICT in Education, 14(3), 233–248.

Unwin, T. (2005). ICT4D: Information and communication technology for development. Cambridge University Press.

UNESCO. (2011). ICT competency framework for teachers. UNESCO.

