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Teachers' ICT integration and students' e-learning perception in secondary schools in Katabi Town Council, Wakiso District. A cross-sectional study.

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Abstract

Background:

The integration of Information and Communication Technology (ICT) in education has become essential for enhancing teaching and learning outcomes. It has transformed the global educational landscape, influencing pedagogical practices, access to information, and the overall learning experience. This study aimed to determine teachers' ICT integration and students' e-learning perception in secondary schools in Katabi Town Council, Wakiso District.

Methodology:

A mixed-methods approach, integrating quantitative and qualitative research methods among teachers and students from Airforce Army SSS, Entebbe SS, and Jovens SS Entebbe Maryland High School in Wakiso District, Uganda. Stratified random sampling technique was used to select 169 participants; questionnaires were used to collect data and were analysed using the Statistical Package for Social Sciences (SPSS). Findings were presented in the form of descriptive statistics such as means, frequencies, and standard deviations.

Results:

The study involved 169 participants, 112 students and 57 teachers. Findings showed that all students (100%) acknowledged that teachers' ICT integration significantly influences their perceptions and engagement in e-learning environments. 41% of students agreed that ICT promotes teamwork and collaboration. All (100% of teachers agreed that ICT enhances lesson delivery through multimedia resources, demonstrating a strong acceptance of technology in teaching. While 79% of teachers reported improved assessment practices due to ICT, 80% of teachers acknowledged the importance of training in boosting their confidence and willingness to adopt ICT.

Conclusion:

ICT contributes to improved instructional practices by promoting learner-centred environments and enhancing access to information.

Recommendation:

Schools and educational institutions should prioritise investment in ICT infrastructure to address the challenges highlighted by respondents. There should be improved access to reliable internet, digital devices, and stable electricity is essential for effective ICT integration. Strengthening infrastructure will enable students to fully benefit from digital learning tools, thereby enhancing their engagement, interaction, and overall learning outcomes.

Keywords: *ICT integration, E-learning, Perception, Katabi Town Council, Wakiso*
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Background

The use of Information and Communication Technology (ICT) in education has evolved significantly since the late 20th century. The introduction of computers in schools in the 1980s marked the beginning of digital transformation in teaching and learning (Tondeur, Scherer, & Siddiq, 2021). Over time, ICT advanced from basic computer-assisted instruction to more sophisticated forms such as online learning, blended learning, and mobile learning. The 21st century has witnessed rapid global adoption of e-learning platforms as a response to the demand for accessible, flexible, and learner-centred education (Ali, 2023).

In Uganda, the integration of ICT in education gained prominence in the early 2000s, following the implementation of the National ICT Policy (2003) and the National ICT in Education Policy (2014), both aimed at

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enhancing digital inclusion and instructional innovation (Muwagga & Mugimu, 2022). The COVID-19 pandemic further accelerated ICT adoption, compelling educational institutions to shift from traditional face-to-face instruction to online modalities (Kizza, Kasule, Amonya, Nakimuli, & Komugabe, 2021). Despite these advancements, disparities remain in teachers' ICT competencies, access to resources, and institutional readiness, which continue to shape students' perceptions of e-learning.

This study was guided by two major theoretical frameworks: the Technology Acceptance Model (TAM) and Constructivist Learning Theory. The Technology Acceptance Model (TAM), proposed by Davis (1989), posits that individuals' acceptance and use of technology are determined by perceived usefulness and perceived ease of use. Applied to this study, TAM helps explain how teachers' attitudes toward ICT integration influence their instructional practices, and consequently, how students perceive e-learning environments. Teachers who find ICT tools useful and easy to use are more likely to integrate them effectively, thereby enhancing learners' engagement and satisfaction.

The Constructivist Learning Theory, advanced by Piaget and Vygotsky, emphasises that learners construct knowledge through interaction, experience, and collaboration. ICT provides platforms that support constructivist learning through interactive multimedia, online discussions, and problem-based learning environments (Tondeur et al., 2021). Therefore, both theories offer a foundation for understanding the relationship between teachers' ICT integration and students' e-learning perception within digital learning contexts.

ICT integration refers to the systematic inclusion of digital tools, resources, and technologies into teaching and learning processes to enhance educational outcomes (Kundu, Bej, & Sahoo, 2022). It encompasses the use of computers, projectors, multimedia content, internet resources, and learning management systems to facilitate instruction. Teachers' ICT integration competence involves not only technical skills but also pedagogical and content knowledge necessary for effective technology use in the classroom (Tondeur et al., 2021).

E-learning, on the other hand, is defined as the delivery of instruction through digital platforms, enabling learners to access materials and interact with instructors and peers remotely (Ali, 2023). Students' e-learning perception encompasses their attitudes, beliefs, and satisfaction toward online learning experiences. Positive perceptions often correlate with higher motivation, engagement, and achievement, while negative ones may result from poor instructional design, inadequate interaction, or technological barriers (Abel, Tondeur, & Sang, 2022). Thus, teachers' capacity to integrate ICT effectively plays a crucial role in shaping students' perceptions and experiences in e-learning environments.

In Uganda, ICT integration has been recognised as a key driver of educational transformation, yet its implementation remains inconsistent across institutions. The National ICT Policy for Education (2014) advocates for ICT-enhanced teaching to promote digital literacy, innovation, and equitable access to learning opportunities. However, the adoption of ICT in schools and universities has been hindered by limited infrastructure, inadequate training, and financial constraints (Muwagga & Mugimu, 2022). Studies have shown that many teachers still rely on traditional methods of instruction, citing insufficient technical skills and lack of institutional support as major obstacles (Kizza et al., 2021).

Furthermore, students' perceptions of e-learning in Uganda vary widely, depending on access to technology, quality of instruction, and the degree of teacher engagement. According to Kpolovie and Awusaku (2021), while e-learning has expanded educational access, its effectiveness largely depends on teachers' readiness to use ICT pedagogically. The contextual gap lies in the limited understanding of how teachers' ICT integration practices directly influence students' perceptions of e-learning within Ugandan educational settings. Addressing this gap is essential for designing effective digital learning interventions and fostering a culture of technology-enhanced education.

The integration of Information and Communication Technology (ICT) in education has become a cornerstone of modern teaching and learning, enabling interactive, learner-centred pedagogies and expanding access to knowledge (Tondeur, Scherer, & Siddiq, 2021). Globally, ICT has transformed traditional classrooms into digital learning environments where teachers can utilise multimedia tools, online platforms, and collaborative applications to enhance instruction. Theoretical frameworks such as the Technology Acceptance Model (TAM) and Constructivist Learning Theory underscore the importance of teachers' perceptions, attitudes, and competencies in successfully integrating ICT into pedagogical practice (Davis, 1989; Tondeur et al., 2021). Teachers who effectively adopt and use ICT not only improve instructional delivery but also shape students' engagement, motivation, and overall perception of e-learning (Abel, Tondeur, & Sang, 2022).

In the Ugandan context, ICT integration has been prioritised through national policies such as the National ICT Policy for Education (2014), yet implementation remains uneven due to limited infrastructure, insufficient teacher training, and inconsistent institutional support (Muwagga & Mugimu, 2022). Students' perceptions of e-learning are therefore influenced by both the availability of digital resources and the effectiveness of teachers' ICT use. Previous studies indicate that while e-learning offers flexibility and wider access to learning, its effectiveness is contingent upon teachers' pedagogical integration of ICT tools (Kizza, Kasule, Amonya, Nakimuli, & Komugabe, 2021). This

study investigates the relationship between teachers' ICT integration and students' e-learning perception, seeking to inform strategies that enhance digital pedagogy and foster meaningful learning experiences in Ugandan educational institutions. This study aimed to determine teachers' ICT integration and students' e-learning perception in secondary schools in Katabi Town Council, Wakiso District.

Methodology

Research Method

This study employed a mixed-methods approach, integrating quantitative and qualitative research methods. Overall, this mixed-methods approach aligns with the descriptive correlational research design, enabling both numerical measurement and contextual understanding of how teachers' ICT integration influences students' e-learning perceptions in Ugandan educational institutions.

Research Design

The study adopted a descriptive correlational research design. This design was appropriate because it allowed the description of the existing conditions regarding ICT integration and e-learning perceptions and the examination of the relationships between variables. The descriptive aspect focused on determining the extent to which ICT was integrated into teaching, while the correlational aspect analysed the degree of association between teachers' ICT integration and students' perceptions of e-learning.

Study Population

The target population included teachers and students from selected secondary schools or higher education institutions within Wakiso District, Uganda, that have adopted e-learning systems. Teachers were selected because they were responsible for implementing ICT in instruction, while students were included to capture their perceptions of ICT-supported learning.

Sampling Procedure and Sample Size

A stratified random sampling technique was employed to ensure that both teachers and students from various institution types (public and private) were proportionally represented. Within each stratum, random sampling was used to select participants. The sample size was determined using Krejcie and Morgan's (1970) formula. For a population of approximately 300 participants, a sample of about 169 respondents was selected, comprising both teachers and students in proportion to their population sizes in each institution.

Table 1: Sample frame

Category	Institution Type	Population (N)	Sample Size (n)	Sampling Technique
Teachers	Public Secondary Schools	60	34	Stratified Random Sampling
Teachers	Private Secondary Schools	40	23	Stratified Random Sampling
Students	Public Secondary Schools	120	67	Stratified Random Sampling
Students	Private Secondary Schools	80	45	Stratified Random Sampling
Total		**300**	**169**	

Source: Krejcie and Morgan (1970)

Description

The population (N) represented the total number of potential participants within each category.

The sample size (n) was determined using Krejcie and Morgan's (1970) sample size determination table for a population of 300, which yields approximately 169 participants.

Random sampling ensured proportional representation of teachers and students from both public and private institutions.

This sampling frame provided a balanced representation, ensuring that findings reflect perspectives across institutional types.

Data Collection Methods and Instruments

Data were collected using two main instruments:

Structured Questionnaires;

These contained both closed- and open-ended questions designed to gather data on teachers' ICT integration practices, students' perceptions of e-learning, and related contextual factors.

Semi-Structured Interviews;

These provided qualitative insights into teachers' and students' lived experiences with ICT use in teaching and learning.

Both instruments were developed based on validated constructs from existing models such as the Technology Acceptance Model (TAM) and Constructivist Learning Theory (Barz, 2024; Fabian, 2024).

Validity and Reliability of Instruments

To ensure content validity, the research instruments were reviewed by three experts in educational technology and research methodology. The Content Validity Index (CVI) was computed, and only items with a CVI score of 0.80 or higher were retained.

For reliability, a pilot study was conducted involving 20 participants from a similar institution not included in the main study. The Cronbach's Alpha coefficient was used to measure internal consistency, with values above 0.70 considered acceptable.

Data Analysis Techniques

Quantitative data were analysed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics such as means, frequencies, and standard deviations were used to summarise responses, while Pearson's correlation coefficient (r) tested relationships between teachers' ICT integration and students' perceptions of e-learning.

Qualitative data from interviews were analysed thematically. Emerging themes were coded, categorised, and interpreted to complement the quantitative findings. Integration of both datasets that occured during interpretation to provide a comprehensive understanding of the study results.

Ethical Considerations

Ethical standards were strictly adhered to throughout the research process. Approval was sought from the University of Kisubi Research Ethics Committee and the participating institutions. Informed consent was obtained from all participants before data collection. Confidentiality and anonymity were maintained by using pseudonyms and secure data storage. Participation was voluntary, and respondents had the right to withdraw at any point without any penalty.

Results

Table 2: The sample population data that responded to the questionnaires sent to the different schools

SCHOOLS	STATUS	GENDER	STUDENT RESPONDENTS	TEACHERS RESPONDENTS
Airforce Army SSS (A)	PUBLIC	MIXED	32	20
Entebbe Maryland High School (B)	PRIVATE	MIXED	25	10
Entebbe ss (C)	PUBLIC	MIXED	35	14
Jovens SS (D)	PRIVATE	MIXED	20	13

The schools that were represented were **Airforce Army SSS, Entebbe SS, and Jovens SS. Entebbe Maryland High school** that is were given represented by alphabetical letters, that is, A, B, C, and D, respectively.

The population of students from the selected schools was three hundred (300); however, the duly filled questionnaires collected from the schools were one hundred sixty-nine (169), that is, 112 students and 57 for teachers.

The teachers, together with the students, were randomly interviewed since the research topic necessitated all of them despite their education and status, and they responded accordingly.

Table 3: The impact of teachers' ICT integration on students' perceptions and engagement in e-learning environments.

Impacts	Students Responded				Total	Percentage
	A	B	C	D		
Influences students' perceptions and engagement in e-learning environments	30	30	30	22	112	100%

Enhances students' interaction with digital learning tools	10	15	10	15	50	45%
Effective technology use can boost students' confidence and engagement in educational activities	15	08	12	12	47	42%
Digital tools facilitate increased interaction and teamwork among students	10	10	10	16	46	41%

The impact of teachers' ICT integration on students' perceptions

This section presents findings on the impact of teachers' ICT integration on students' perceptions and engagement in e-learning environments, based on responses obtained from students across the four selected schools (A, B, C, and D).

The study findings revealed that all 112 student respondents (100%) across the selected schools agreed that teachers' ICT integration influences students' perceptions and engagement in e-learning environments. Specifically, 30 students from School A, 30 from School B, 30 from School C, and 22 from School D supported this view. This unanimous response indicated that ICT integration is a critical factor in shaping how students perceive and participate in digital learning, suggesting a widespread recognition of its importance in modern education. Table 3, as argued by Panigrahi, R., Srivastava, P. R., & Panigrahi, P. K. (2021).

In addition, 50 out of the 112 students (45%) indicated that ICT integration enhances students' interaction with digital learning tools. Among these, 10 respondents were from School A, 15 from School B, 10 from School C, and 15 from School D. These findings were in line with **Toma (2023),** as they suggested an effect of ICT integration. This finding suggested that nearly half of the students experience improved engagement with learning technologies when teachers effectively incorporate ICT into their instructional practices. The relatively higher responses from private schools (B and D) were more focused on the practical use of digital tools in these institutions. Table 4.1

Furthermore, 47 students (42%) reported that effective use of technology boosts their confidence and engagement in educational activities. School A contributed 15 respondents, School B had 8, School C had 12, and School D had 12. These findings highlight that ICT integration not only facilitates access to learning materials but also empowers students by increasing their confidence in using digital platforms, thereby promoting active participation in learning, as proved by Jiang (2025)

Similarly, 46 students (41%) agreed that digital tools facilitate increased interaction and teamwork among students. The responses were distributed as 10 from School A, 10 from School B, 10 from School C, and 16 from School D. This suggests that ICT tools, such as collaborative platforms and online discussion forums, play a significant role in promoting peer interaction and cooperative learning, particularly in environments where such tools are effectively utilised.

According to Panigrahi (2021), he proves that the effectiveness of e-learning is mediated by student engagement and perceived learning effectiveness, as the findings demonstrated that teachers' ICT integration has a substantial positive impact on students' perceptions and engagement in e-learning environments. While all students acknowledged its general importance, a considerable proportion also identified specific benefits such as enhanced interaction with digital tools, increased confidence, and improved collaboration. These results underscore the need for schools to strengthen ICT integration practices to further enhance student engagement and learning outcomes.

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Table 4: Showing the teachers' responses

Impacts	Teachers responded				Total	Percentage
	A	B	C	D		
Teachers feel that ICT enables them to act as facilitators, promoting student-centered learning rather than just being conveyors of knowledge	10	10	08	10	38	66%
ICT encourages teachers to create interactive and engaging lessons using multimedia resources	20	17	10	10	57	100%
Digital tools improve how teachers assess student performance through instant feedback and faster grading	15	08	10	12	45	79%
Training improves confidence and willingness to adopt tools	10	10	10	16	46	80%

The population of teachers that responded was fifty-seven, and they reacted to the topic within Table 4, and their findings were explained in the following paragraphs below; The findings indicated that ICT integration is significantly transforming the role of teachers in the teaching and learning process. A majority of respondents (66%) agreed that ICT enabled teachers to act more as facilitators rather than mere transmitters of knowledge. This suggested a shift toward student-centred learning, where teachers guide learners in constructing their own understanding using digital tools. However, the percentage also showed that some teachers were still adjusting to this new role, indicating the need for further support and orientation.

All respondents (100%) acknowledged that ICT encourages the creation of interactive and engaging lessons through the use of multimedia resources. This unanimous response highlighted the strong impact of technology in making lessons more dynamic, visually appealing, and easier for students to understand. It reflected that teachers widely recognise the value of ICT in enhancing classroom engagement and participation, as affirmed by Romero, E., & Artacho, J. M. (2018).

Furthermore, 79% of the teachers agreed that digital tools improve assessment practices by enabling instant feedback and faster grading. This demonstrated that ICT not only supported teaching delivery but also enhanced evaluation processes, making them more efficient and timelier. Nevertheless, a small proportion of respondents still faced challenges in fully utilising these tools for assessment purposes.

Finally, 80% of the respondents indicated that training played a crucial role in improving their confidence and willingness to adopt ICT tools. This finding underscored the importance of continuous professional development in ensuring effective technology integration. It implied that when teachers are adequately trained, they are more likely to embrace ICT and use it effectively in their teaching practices.

The extent to which teachers' ICT integration influences instructional practices in educational institutions.

Table 5: Showing the extent to which teachers' ICT integration influences instructional practices in education

Impacts	TEACHERS RESPONDED				Total	Percentage
	A	B	C	D		
ICT enables a shift toward learner-centred environments, encouraging collaboration and critical thinking	10	10	08	10	38	67%

Improving efficiency and access to information.	20	17	10	10	57	100%
Institutional Support	15	08	10	12	45	78%
Successful integration associated with teachers' confidence, technical skills	10	10	10	16	46	81%

The findings in Table 5 indicated that teachers' integration of ICT had a notable influence on instructional practices in education. The results showed that ICT played a significant role in shifting teaching approaches towards more learner-centred environments. A total of 38 responses (67%) agreed that ICT encourages collaboration and critical thinking among learners, suggesting that technology supports active participation rather than passive learning.

Similarly, the majority of respondents (57 responses, 100%) indicated that ICT improves efficiency and enhances access to information. This implies that teachers are able to deliver content more effectively while also enabling students to access a wider range of learning resources, thereby enriching the teaching and learning process.

However, the findings on institutional support presented a contrasting perspective. Only 78% of respondents acknowledged adequate institutional support, indicating that many schools may lack sufficient infrastructure, administrative backing, or policies to fully support ICT integration. This limitation could hinder effective implementation despite the recognised benefits of technology in teaching.

Furthermore, 81% of respondents agreed that successful ICT integration is associated with teachers' confidence and technical skills. This suggests that while ICT has potential to transform instructional practices, its effectiveness largely depends on teachers' competence and ability to use technological tools effectively. Without adequate training and confidence, the full benefits of ICT may not be realised.

Overall, the results demonstrate that ICT integration positively influences instructional practices by promoting learner-centred teaching and improving access to information. However, challenges such as limited institutional support and insufficient teacher preparedness remain significant barriers that need to be addressed.

The effect of teachers' ICT integration on students' learning outcomes in e-learning environments.

Table 6: Showing the students' responses towards the effect of teachers' ICT integration on students' learning outcomes in e-learning environments.

Impacts	**Students in selected schools**				Total	Percentage
	A	B	C	D		
Improved Collaboration and Communication:	20	20	30	10	80	71%
Infrastructure Gaps	30	27	33	22	112	100%
Virtual environments can create feelings of isolation	25	20	10	10	65	58%
Increased Distraction and Misinformation	30	20	10	16	76	67%

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The findings on the effects of teachers' ICT integration on students' learning outcomes in e-learning environments reveal a mixed pattern of both positive and negative impacts based on respondents from the selected schools (A, B, C, and D).

Firstly, regarding improved collaboration and communication, a total of 80 student respondents (71%) agreed that ICT integration enhances interaction among students and between students and teachers. School C recorded the highest number of responses (30), followed by Schools A and B with 20 each, and School D with 10. This suggests that digital tools such as discussion forums, video conferencing, and shared platforms are significantly supporting teamwork and knowledge exchange in e-learning environments.

However, infrastructure gaps emerged as the most significant challenge, with all 112 respondents (100%) acknowledging this issue. School C again had the highest responses (33), followed by School A (30), School B (27), and School D (22). This indicates that inadequate access to reliable internet, limited digital devices, and unstable power supply remain major barriers to effective ICT integration, directly affecting students' learning outcomes.

In addition, virtual learning environments creating feelings of isolation were reported by 65 respondents (58%). School A had the highest number (25), followed by School B (20), while Schools C and D each recorded 10 responses. This showed that despite the connectivity offered by ICT, many students still experienced reduced social interaction and emotional engagement, which can negatively influence their motivation and academic performance.

Lastly, increased distraction and exposure to misinformation were identified by 76 respondents (67%). School A reported the highest number (30), followed by School B (20), School D (16), and School C (10). This suggested that while ICT provides access to vast information, it also exposes students to non-academic content and unreliable sources, which can hinder concentration and lead to poor learning outcomes.

In conclusion, the results indicated that while teachers' ICT integration has clear benefits in enhancing collaboration and communication accompanied by significant challenges such as infrastructure limitations, learner isolation, and increased distractions. These factors collectively influence the effectiveness of e-learning and the overall academic performance of students.

Table 7: Showing the teachers' responses towards the effect of ICT integration on students' learning outcomes in e-learning environments.

Impacts	**Teachers responded**				Total	Percentage
	A	B	C	D		
Teachers become more operative within virtual learning environments	10	10	10	10	40	70%
Infrastructure Gaps	12	12	20	13	57	100%
Professional Development Gaps	15	10	10	10	45	79%
Facilitated Professional Collaboration	10	12	10	16	48	84%

The findings from respondents indicated that ICT integration had a notable influence on teachers' effectiveness within virtual learning environments. A majority of teachers (70%) agreed that they had become more effective when using digital platforms, suggesting that exposure to e-learning tools enhanced their ability to plan, deliver, and manage lessons more efficiently. This implied that, despite varying levels of digital competence, many teachers were adapting positively to technology-supported teaching.

However, infrastructure gaps emerged as a significant challenge, with 100% of respondents acknowledging this issue. This unanimous response highlights persistent limitations such as unreliable internet connectivity, inadequate digital devices, and insufficient technical support, all of which hinder the smooth implementation of e-learning. These infrastructural shortcomings remain a major barrier to maximising the benefits of ICT in education.

In addition, 79% of teachers identified professional development gaps, indicating that many educators feel they

lack adequate training and continuous support in the effective use of ICT tools. This suggests that while teachers are willing to integrate technology into their teaching, insufficient training opportunities limit their full potential and confidence in using digital resources.

On a more positive note, 84% of respondents reported that ICT has facilitated professional collaboration among teachers. Digital platforms have enabled easier sharing of teaching materials, communication, and exchange of ideas, even across different schools. This enhanced collaboration contributes to improved teaching practices and fosters a sense of professional community among educators.

Overall, the responses reveal that while ICT integration is improving teacher effectiveness and collaboration, significant challenges—particularly in infrastructure and professional training—must be addressed to ensure its successful and sustainable implementation.

Discussion

ICT Integration and Students' Perceptions and Engagement

The findings revealed that all students (100%) acknowledged that teachers' ICT integration significantly influences their perceptions and engagement in e-learning environments. This indicated that ICT plays a central role in shaping how learners interact with digital education. The result supports existing literature which emphasises that effective ICT integration enhances student engagement when it is pedagogically aligned rather than used merely for content delivery (Msafiri, 2023; Fabian, 2024). It also aligns with constructivist perspectives, which highlight that interactive digital environments promote active learner participation

The result suggests that when teachers effectively integrate technology, students are more likely to develop positive attitudes toward learning and actively participate in lessons. Additionally, 45% of students reported improved interaction with digital learning tools, while 42% indicated increased confidence and engagement. This implies that ICT not only enhances accessibility to learning materials but also motivates learners to take part in academic activities. These findings are consistent with the Technology Acceptance Model (TAM), which identifies perceived usefulness and ease of use as key determinants of student engagement (Barz, 2024; Belew et al., 2024). However, the relatively moderate percentages suggest that the level of ICT integration may vary across schools, with some institutions utilising digital tools more effectively than others.

Furthermore, 41% of students agreed that ICT promotes teamwork and collaboration. This finding supports socio-cultural and constructivist theories, which emphasise the role of ICT in fostering collaborative learning environments (Tondeur et al., 2021; Fabian, 2024). This highlights the importance of digital platforms in fostering peer learning and interaction, although the percentage suggests that collaborative tools may not yet be fully utilised in all schools.

ICT Integration and Teachers' Instructional Practices

The study established that ICT integration has significantly transformed teaching practices. About 66% of teachers indicated that ICT enabled them to shift from traditional teaching methods to more learner-centred approaches. This finding aligns with constructivist learning theory, which positions teachers as facilitators of learning rather than transmitters of knowledge (Tondeur et al., 2021). This also suggests that teachers are gradually adopting facilitative roles, encouraging student participation and independent learning.

The findings indicated that 100% of teachers agreed that ICT enhances lesson delivery through multimedia resources, demonstrating a strong acceptance of technology in teaching. This indicated that ICT makes lessons more engaging, interactive, and easier for students to understand.

Moreover, 79% of teachers reported improved assessment practices due to ICT, highlighting benefits such as instant feedback and efficient grading systems. This shows that ICT is not only improving teaching delivery but also enhancing evaluation methods. (Osorio Vanegas, 2025).

The study further revealed that 80% of teachers acknowledged the importance of training in boosting their confidence and willingness to adopt ICT. This underscores the critical role of professional development in successful ICT integration.

ICT Integration and Instructional Effectiveness

The findings indicated that ICT contributes to improved instructional practices by promoting learner-centred environments (67%) and enhancing access to information (100%). This suggests that ICT enables both teachers and students to access a wide range of educational resources, thereby enriching the learning process.

However, only 78% of respondents reported adequate institutional support, pointing to gaps in infrastructure and administrative backing. This indicates that despite the recognised benefits of ICT, its implementation is still hindered by systemic challenges.

Additionally, 81% of teachers emphasised that successful ICT integration depends on their technical skills and confidence. This reinforces the importance of equipping teachers with the necessary competencies to effectively use digital tools.

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ICT Integration and Students' Learning Outcomes

The study findings showed both positive and negative effects of ICT integration on students' learning outcomes. On the positive side, 71% of students reported improved collaboration and communication, indicating that ICT enhances interaction and knowledge sharing. (Msafiri, 2023; Fabian, 2024).

However, several challenges were identified. Infrastructure gaps were reported by all respondents (100%), making it the most significant barrier. This suggests that lack of reliable internet, insufficient devices, and power interruptions greatly limit the effectiveness of ICT in education. (Odunga, 2024; Kizza et al., 2021).

Additionally, 58% of students experienced feelings of isolation in virtual learning environments, while 67% reported increased distraction and exposure to misinformation. These findings indicate that although ICT offers many benefits, it also introduces challenges that can negatively affect learning outcomes.

From the teachers' perspective, 70% reported improved effectiveness in virtual environments, while 84% highlighted enhanced professional collaboration. However, 79% pointed out gaps in professional development, further emphasising the need for continuous training.

Conclusion

The study findings clearly demonstrate that teachers' ICT integration has a significant influence on students' perceptions and engagement in e-learning environments. Technology is now a central component of modern education. This suggests that ICT integration positively affects how students perceive learning, making it more interactive and engaging. However, the relatively lower percentages in areas such as interaction with digital tools (45%), confidence building (42%), and teamwork (41%) indicate that while ICT is widely recognised, its full potential is not yet consistently realised across all schools.

In relation to instructional practices, the findings revealed that ICT integration has contributed to a shift toward learner-centred teaching approaches, as reported by 66% of teachers. This shows that technology is gradually transforming the role of teachers from knowledge transmitters to facilitators of learning. The unanimous agreement (100%) that ICT enhances lesson delivery through multimedia further confirms that digital tools make teaching more engaging and effective. Additionally, improvements in assessment practices (79%) demonstrate that ICT is enhancing not only how content is delivered but also how student performance is evaluated.

ICT integration positively influences instructional effectiveness by improving access to information (100%) and supporting collaborative, learner-centred environments (67%). However, the findings on institutional support (78%) highlight that not all schools have adequate systems in place to fully support ICT use. This suggests that despite the benefits of ICT, its successful implementation is still constrained by infrastructural and administrative limitations. Furthermore, the strong link between teachers' confidence and successful ICT integration (81%) emphasises the importance of equipping teachers with the necessary technical skills.

Regarding learning outcomes, the findings indicate that ICT integration has both positive and negative effects. On the positive side, improved collaboration and communication (71%) show that ICT enhances interaction among learners. However, the universal concern about infrastructure gaps (100%) reveals a major barrier that significantly limits the effectiveness of e-learning. Additionally, challenges such as student isolation (58%) and increased distraction and misinformation (67%) indicate that ICT, while beneficial, also introduces new difficulties that can negatively impact academic performance. Overall, the study concludes that ICT integration is essential in education, but its success depends on addressing these existing challenges.

Recommendation

Schools and educational institutions should prioritise investment in ICT infrastructure to address the challenges highlighted by respondents. There should be improved access to reliable internet, digital devices, and stable electricity, which is essential for effective ICT integration. Strengthening infrastructure will enable students to fully benefit from digital learning tools, thereby enhancing their engagement, interaction, and overall learning outcomes.

Further, schools should enhance institutional support systems to facilitate effective ICT use. Given that only 78% of respondents reported adequate support, there is a need for clear policies, technical support, and administrative commitment to ICT integration. Schools should also promote the use of collaborative digital platforms to address the relatively low levels of student interaction and teamwork (41%), ensuring that learners can fully benefit from cooperative learning opportunities.

Furthermore, continuous professional development for teachers should be emphasised. The findings showed that 80% of teachers acknowledged the importance of training, while 79% reported gaps in professional development. This indicates that equipping teachers with ICT skills will not only improve their confidence but also enhance their ability to implement learner-centred approaches effectively. Training programs should focus on both technical skills and pedagogical strategies for integrating ICT into teaching.

In addition, teachers should be supported in guiding students on responsible use of ICT tools to minimise challenges such as distraction (67%) and exposure to misinformation. This can be achieved through digital literacy programs that help students critically evaluate online information and use

technology productively. Addressing these issues will improve the quality of learning and ensure that ICT contributes positively to academic performance.

Finally, policymakers and government agencies should play a key role in supporting ICT integration by increasing funding for educational technology and ensuring equitable access to digital resources. Since the findings revealed disparities in ICT use and access, especially due to infrastructural limitations, national-level interventions are necessary to bridge these gaps. By addressing these issues, stakeholders can maximise the benefits of ICT integration and create more effective and inclusive e-learning environments.

List of abbreviations

ICT – Information and Communication Technology
TAM – Technology Acceptance Model
SPSS – Statistical Package for the Social Sciences
CVI – Content Validity Index
COVID-19 – Coronavirus Disease 2019
IV – Independent Variable
DV – Dependent Variable
PD – Professional Development

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Conflict of interest

The author declares that there was no conflict of interest.

Author contributions

JS- Developed and investigated the study.
AS- Supervised the study.

Data availability

Data are available upon request.

Informed consent

Written informed consent was obtained from all participants before their inclusion in the study. Participants were informed about the purpose of the study, procedures involved, potential risks and benefits, and their right to withdraw at any time without penalty.

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John Ssempeera holds a Bachelor of Arts in Education from the University of Kisubi.

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