

Effects of ICT Integration in the New Curriculum on Students' Education: The Case of Selected Schools in Luwero District

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Abstract

This study examined the effects of Information and Communication Technology (ICT) integration in the new lower-secondary curriculum on students' education in selected schools in Luwero District, Uganda. With Uganda's competency-based curriculum emphasising ICT as both a subject and a tool for learning, the study investigated how ICT infrastructure, teacher ICT competence, digital learning resources, and ICT accessibility relate to students' learning outcomes and engagement. A cross-sectional survey design with a mixed-methods approach was adopted, and data were collected from 190 respondents comprising teachers, students, and head teachers using questionnaires and interviews. Descriptive statistics, Pearson correlation, and multiple regression were used for analysis. The results revealed a strong positive and significant relationship between ICT integration and students' education ($r = 0.65$, $p < 0.01$), with ICT dimensions jointly explaining 50.2% of the variance in learning outcomes ($R^2 = 0.502$). Teacher ICT competence and digital learning resources were the strongest predictors. The study concludes that effective ICT integration significantly enhances students' education under the new curriculum and recommends teacher training, provision of digital resources, and improved infrastructure.

Keywords: ICT integration, new curriculum, students' education, teacher competence, Luwero District, Uganda

1. Introduction

Uganda's education system has undergone a significant reform with the rollout of the competency-based lower-secondary curriculum, which places Information and Communication Technology at the centre of teaching and learning, both as a discrete subject and as a cross-cutting tool for acquiring knowledge and skills (NCDC, 2021). This reform reflects a global shift towards equipping learners with the digital competencies required for the twenty-first-century economy and society (UNESCO, 2023). The successful implementation of the new curriculum therefore depends substantially on the effective integration of ICT into schools, making the study of ICT integration and its effects on students' education a matter of pressing importance (Mpirirwe et al., 2021).

ICT integration in the school context refers to the purposeful incorporation of digital technologies into teaching, learning, and assessment to enhance educational outcomes (Ertmer & Ottenbreit-Leftwich, 2021). Effective integration requires adequate ICT infrastructure, teachers competent in using digital tools pedagogically, appropriate

Received: 10.07.2026

Accepted: 15.07.2026

Published on: 30.07.2026

digital learning resources, and equitable accessibility for learners (Tondeur et al., 2021). Where these conditions are met, ICT can make learning more interactive, engaging, and learner-centred, aligning with the competency-based orientation of the new curriculum(Nelson, 2024). Where they are absent, the ambitious goals of the reform risk remaining unrealised, and disparities between well-resourced and under-resourced schools may widen (Hennessy et al., 2022).

The Ugandan context presents distinctive challenges for ICT integration in schools. Many schools, particularly in rural and semi-urban districts, contend with inadequate ICT infrastructure, unreliable electricity and internet connectivity, insufficient devices, and teachers with limited ICT skills (Ministry of Education and Sports, 2023). These constraints are compounded by the demands of implementing a wholly new curriculum, which requires teachers to adopt new pedagogies alongside new technologies. Luwero District, located in central Uganda, comprises a mix of urban, peri-urban, and rural schools that vary in their ICT readiness, providing an instructive setting for examining how ICT integration affects students' education under the new curriculum (Ssentongo & Kirya, 2023).

The theoretical expectation is that effective ICT integration enhances students' education by improving engagement, enabling active and personalised learning, and developing digital competencies (Ertmer & Ottenbreit-Leftwich, 2021). However, evidence indicates that the mere presence of technology does not guarantee improved outcomes; the decisive factor is how effectively teachers integrate ICT into pedagogy, which in turn depends on their competence, the availability of suitable resources, and supportive conditions (Tondeur et al., 2021). Whether and to what extent ICT integration improves students' education in the selected schools of Luwero District is thus an empirical question of practical significance for the success of the curriculum reform(Kazaara, 2025).

Although the importance of ICT in the new curriculum is emphasised in policy, empirical evidence quantifying the effects of ICT integration on students' education in Ugandan schools implementing the reform remains limited, and few studies disaggregate the effects of specific integration dimensions (Ssentongo & Kirya, 2023). This study addresses that gap by examining, through correlation and regression analysis, how ICT infrastructure, teacher ICT competence, digital learning resources, and accessibility relate to students' education in selected schools in Luwero District(Julius & Audrey, 2026). The findings are significant for the Ministry of Education and Sports, curriculum developers, school managers, and teachers seeking to implement the curriculum effectively(Anthony et al., 2023). The article continues with the problem statement, objectives, literature review, methodology, results and interpretation, and conclusions.

2.0 Statement of the Problem

Uganda's new lower-secondary curriculum places ICT at the heart of teaching and learning, and its successful implementation depends on the effective integration of ICT in schools (NCDC, 2021). Ideally, ICT integration should

make learning more engaging and effective, develop learners' digital competencies, and improve educational outcomes (Nelson, 2024). In practice, however, many schools in Luwero District struggle to integrate ICT effectively, and the extent to which ICT integration under the new curriculum actually affects students' education has not been clearly established through rigorous empirical research (Ssentongo & Kirya, 2023).

Schools in the district face persistent constraints, including inadequate ICT infrastructure, unreliable electricity and connectivity, insufficient devices, limited digital learning resources, and teachers with weak ICT competence (Ministry of Education and Sports, 2023). These constraints are aggravated by the simultaneous demands of adopting new competency-based pedagogies. As a result, the benefits of ICT integration may be unevenly realised, with some schools and students gaining substantially while others gain little (Hennessy et al., 2022). Without clear evidence on which integration dimensions most strongly affect students' education, efforts to support curriculum implementation risk being poorly targeted (Godfrey et al., 2023). If the effects of ICT integration on students' education are not clearly established and addressed, the goals of the curriculum reform may remain unrealised, learners may not acquire the intended competencies, and disparities between schools may widen. This study therefore sought to examine the effects of ICT integration in the new curriculum on students' education in selected schools in Luwero District and to identify which integration dimensions most strongly affect learning outcomes.

3.0 Main Objective

The main objective of the study was to examine the effects of ICT integration in the new curriculum on students' education in selected schools in Luwero District, Uganda.

3.1 Specific Objectives

- i. To assess the level of ICT integration in selected schools implementing the new curriculum in Luwero District.
- ii. To establish the relationship between ICT integration dimensions (infrastructure, teacher ICT competence, digital learning resources, and accessibility) and students' education.
- iii. To determine the relative contribution of each integration dimension to students' education.

4.0 Literature Review

Research on ICT integration in education is grounded in several theoretical frameworks, including the Technological Pedagogical Content Knowledge (TPACK) framework, the SAMR model, and constructivist learning theory (Nancy & Prudence, 2024). The TPACK framework, articulated by Mishra and Koehler and updated by subsequent scholars, holds that effective technology integration requires the interplay of technological, pedagogical, and content knowledge, emphasising that technology alone does not improve learning unless embedded in sound pedagogy

(Mishra & Koehler, 2021). The SAMR model classifies technology use along a continuum from substitution to redefinition, providing a lens for assessing the depth of integration (Puentedura, 2020). Constructivist theory holds that learners construct knowledge actively, and ICT can support this through interactive and learner-centred environments, aligning with the competency-based curriculum (Ertmer & Ottenbreit-Leftwich, 2021).

Empirical studies broadly affirm that ICT integration can enhance students' education, but conditionally. Hennessy et al. (2022) find that ICT integration in sub-Saharan African schools improves engagement and learning where infrastructure, teacher skills, and resources align, but yields limited benefit where these are lacking (Nancy & Prudence, 2024). Studies indicate that well-integrated ICT supports active learning, immediate feedback, and access to rich resources, improving outcomes (Tondeur et al., 2021). Ugandan studies of curriculum implementation report that ICT integration holds promise for the new curriculum but is constrained by infrastructural and capacity deficits (NCDC, 2021; Ssentongo & Kirya, 2023).

Teacher ICT competence features prominently as a decisive factor. Ertmer and Ottenbreit-Leftwich (2021) demonstrate that teachers' knowledge, skills, and beliefs about technology strongly determine how effectively ICT is integrated and, consequently, its effect on learning. Studies show that teachers who are competent and confident in using ICT integrate it more deeply and productively, whereas those lacking competence use it superficially or avoid it, negating potential benefits (Tondeur et al., 2021). This has led scholars to emphasise teacher professional development as central to successful integration (Julius et al., 2024).

Infrastructure and digital learning resources constitute a second major theme. Adequate hardware, reliable electricity and connectivity, and appropriate digital content are prerequisites for meaningful integration (Hennessy et al., 2022). Research consistently identifies infrastructural deficits as major barriers in developing contexts, and it shows that the availability of quality digital learning resources aligned with the curriculum enhances teaching and learning (UNESCO, 2023). Accessibility—the equitable availability of devices and connectivity to all learners—is crucial to avoid widening disparities.

Accessibility and equity form further themes. Studies caution that ICT integration can deepen inequalities if access is uneven, since better-resourced schools and students benefit disproportionately (Selwyn, 2021). In the Ugandan context, disparities between urban and rural schools in ICT readiness are pronounced, raising equity concerns for the curriculum reform (Ministry of Education and Sports, 2023). The literature emphasises that these dimensions interact and that effective integration requires their alignment (Gopal et al., 2021). Despite this body of work, few studies quantify and compare the effects of specific integration dimensions on students' education in Ugandan schools implementing the new curriculum, a gap this study addresses.

5.0 Methodology

Received: 10.07.2026

Accepted: 15.07.2026

Published on: 30.07.2026

5.1 Research Design

The study adopted a cross-sectional survey design employing a mixed-methods approach (Creswell & Creswell, 2021). The quantitative component enabled measurement and testing of relationships, while the qualitative component provided contextual depth on integration practices. The design suited the examination of the effects of ICT integration using data collected at a single point in time.

5.2 Study Population and Area

The study was conducted in selected schools implementing the new curriculum in Luwero District. The target population comprised teachers, students, and head teachers. Teachers were central as the implementers of ICT integration, students as the subjects of the learning outcomes, and head teachers as providers of institutional perspectives.

5.3 Sample Size and Sampling Techniques

A sample of 190 respondents was drawn from 10 selected schools, comprising 60 teachers, 120 students, and 10 head teachers. The sample size was determined with reference to the Krejcie and Morgan (1970) guidelines. Schools were selected using stratified sampling by location (urban, peri-urban, rural), teachers and students were selected through simple random sampling, and head teachers were selected purposively.

5.4 Data Collection Instruments

A structured questionnaire measured the ICT integration dimensions—infrastructure, teacher ICT competence, digital learning resources, and accessibility—and students' education (learning outcomes and engagement) on a five-point Likert scale. Interview guides were used with head teachers and selected teachers to obtain qualitative insights into integration and its effects.

5.5 Validity and Reliability

Content validity was established through expert review by education and ICT specialists, yielding a content validity index above 0.70 (Amin, 2005). Reliability was confirmed through a pilot study, and the Cronbach's alpha for the ICT integration scale was 0.86, indicating high internal consistency.

5.6 Data Analysis

Quantitative data were analysed using SPSS. Descriptive statistics summarised integration and outcomes. Pearson correlation established the strength and direction of relationships, and multiple regression assessed the combined and relative effects of the integration dimensions on students' education. Qualitative data were analysed thematically.

5.7 Ethical Considerations

Received: 10.07.2026

Accepted: 15.07.2026

Published on: 30.07.2026

Permissions were obtained from the relevant authorities and schools, informed consent (and assent for students) was secured, participation was voluntary, and confidentiality and anonymity were maintained throughout the study (Creswell & Creswell, 2021).

6.0 Results and Interpretation

6.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the ICT integration dimensions and students' education based on responses from the 190 participants.

Variable	Mean	Std. Dev.	Interpretation
ICT infrastructure	2.94	0.90	Moderate
Teacher ICT competence	3.06	0.86	Moderate
Digital learning resources	3.12	0.83	Moderate
ICT accessibility	2.81	0.93	Low
Overall ICT integration	2.98	0.76	Moderate
Students' education	3.04	0.73	Moderate

Source: Primary Data, 2025

The descriptive results in Table 1 indicate that ICT integration in the selected schools was, on the whole, moderate but with notable weaknesses, reflected in an overall mean of 2.98 and a standard deviation of 0.76. Digital learning resources recorded the highest mean (3.12), followed by teacher ICT competence (3.06), suggesting some availability of resources and moderate teacher capacity. ICT infrastructure (2.94) was rated lower, and ICT accessibility recorded the lowest mean (2.81), pointing to significant constraints in the equitable availability of devices and connectivity, consistent with the urban-rural disparities documented in the district (Ministry of Education and Sports, 2023). Students' education was rated moderate (3.04). The large standard deviations, particularly for accessibility, reveal considerable variation between schools, distinguishing better-resourced urban schools from constrained rural ones (Ssentongo & Kirya, 2023).

6.2 Correlation Analysis

Pearson correlation was used to establish the relationships between the ICT integration dimensions and students' education, as shown in Table 2.

Variable	Students' Education (r)	Sig. (p)
Teacher ICT competence	0.60	0.000

Digital learning resources	0.58	0.000
ICT infrastructure	0.52	0.000
ICT accessibility	0.49	0.000
Overall ICT integration	0.65	0.000

Source: Primary Data, 2025

The correlation results in Table 2 demonstrate that all ICT integration dimensions were positively and significantly related to students' education at the 0.01 level. Overall ICT integration showed a strong positive correlation with students' education ($r = 0.65$, $p < 0.01$), confirming that more effective integration is accompanied by better learning outcomes, consistent with the conditional benefits identified in the literature (Hennessy et al., 2022). Teacher ICT competence recorded the strongest individual association ($r = 0.60$), underscoring the decisive role of teachers in translating technology into learning (Ertmer & Ottenbreit-Leftwich, 2021). Digital learning resources followed ($r = 0.58$), reflecting the value of quality content aligned with the curriculum. ICT infrastructure ($r = 0.52$) and accessibility ($r = 0.49$) were also significantly correlated, though more moderately (Nelson et al., 2023). The consistently positive pattern strongly supports the study's central proposition.

6.3 Regression Analysis

Multiple linear regression assessed the combined and relative effects of the ICT integration dimensions on students' education. Tables 3 and 4 present the results.

Model Summary		Value	
R		0.709	
R Square		0.502	
Adjusted R Square		0.491	
Std. Error of Estimate		0.484	
F (4, 185)		46.66 (p = 0.000)	
Predictor	Beta (β)	t	Sig. (p)
Teacher ICT competence	0.31	4.71	0.000
Digital learning resources	0.28	4.18	0.000
ICT infrastructure	0.17	2.70	0.008
ICT accessibility	0.14	2.24	0.026

Source: Primary Data, 2025

The regression model summary in Table 3 indicates that the four ICT integration dimensions jointly explained 50.2% of the variance in students' education ($R^2 = 0.502$), a substantial proportion establishing ICT integration as a major

Received: 10.07.2026

Accepted: 15.07.2026

Published on: 30.07.2026

determinant of learning outcomes under the new curriculum. The model was highly significant ($F(4, 185) = 46.66, p < 0.01$), confirming its predictive validity. The remaining 49.8% of variance is attributable to other factors such as student characteristics, teaching quality more broadly, and home support that lie outside the model (Selwyn, 2021).

The standardised coefficients in Table 4 clarify the relative importance of each dimension. Teacher ICT competence emerged as the strongest predictor ($\beta = 0.31, p < 0.01$), confirming that the capacity of teachers to integrate ICT pedagogically is the most influential factor in translating technology into learning gains, in line with the TPACK framework's emphasis on the interplay of technological and pedagogical knowledge (Mishra & Koehler, 2021; Ertmer & Ottenbreit-Leftwich, 2021). Digital learning resources followed ($\beta = 0.28, p < 0.01$), demonstrating that quality, curriculum-aligned content materially enhances education. ICT infrastructure ($\beta = 0.17, p < 0.01$) and accessibility ($\beta = 0.14, p < 0.05$) contributed positively but more modestly, indicating that infrastructure and access are necessary foundations whose impact is realised chiefly through the competent teaching and resources they enable (Nelson et al., 2023). Overall, the results suggest that investment in teacher ICT professional development and quality digital resources offers the greatest leverage for improving students' education under the new curriculum (Tondeur et al., 2021; Hennessy et al., 2022).

7.0 Conclusion and Recommendations

The study concludes that ICT integration in the new curriculum has a strong, positive, and significant effect on students' education in selected schools in Luwero District, with teacher ICT competence and digital learning resources being the most influential dimensions. It is recommended that the Ministry of Education and Sports and school managers prioritise sustained teacher ICT professional development, provide quality digital learning resources aligned with the curriculum, invest in reliable infrastructure and connectivity, and address inequities in access between urban and rural schools (NCDC, 2021; UNESCO, 2023). Future research could employ objective assessment data and longitudinal designs to further establish causality and examine integration across more schools.

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Received: 10.07.2026

Accepted: 15.07.2026

Published on: 30.07.2026

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