

Influence of Information and Communication Technology (ICT) Integration on Students' Academic Performance: A Case Study of Metropolitan International University, The Adventist University of Central Africa, and Daarul Salaam University, Somalia

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Abstract: This study examined the influence of Information and Communication Technology (ICT) integration on students' academic performance across three African universities: Metropolitan International University in Uganda, the Adventist University of Central Africa in Rwanda, and Darul Salaam University in Somalia. With higher education increasingly reliant on digital tools for teaching, learning, and assessment, the study investigated how ICT infrastructure, digital literacy, e-learning platforms, and ICT accessibility relate to academic performance. A comparative cross-sectional survey design with a mixed-methods approach was adopted, and data were collected from 300 students and lecturers across the three institutions 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 academic performance ($r = 0.66, p < 0.01$), with ICT dimensions jointly explaining 51.9% of the variance in performance ($R^2 = 0.519$). Digital literacy and e-learning platforms were the strongest predictors. The study concludes that effective ICT integration significantly enhances academic performance and recommends investment in infrastructure, digital-skills training, and reliable connectivity.

Keywords: ICT integration, academic performance, higher education, digital literacy, e-learning, comparative study

1. Introduction

Information and Communication Technology has become an indispensable component of modern higher education, reshaping how knowledge is created, delivered, accessed, and assessed. Universities across the world have integrated ICT into teaching and learning through learning-management systems, digital libraries, online assessment, virtual classrooms, and a proliferation of educational applications (Julius & Kazaara, 2026). The COVID-19 pandemic dramatically accelerated this transition, compelling institutions to adopt digital modes of instruction almost overnight and cementing ICT as a permanent feature of the academic landscape (Mpirirwe et al., 2021). In this environment, the capacity of universities to integrate ICT effectively has become closely tied to their ability to deliver quality education and to support strong academic performance among students (F. Christopher et al., 2022).

ICT integration in higher education is understood as the purposeful incorporation of digital technologies into the academic environment to enhance teaching, learning, research, and administration (T. Christopher et al., 2022). Effective integration requires more than the mere presence of hardware; it depends on adequate infrastructure, reliable connectivity, the digital literacy of students and staff, functional e-learning platforms, and equitable accessibility. When these elements are in place, ICT can expand access to learning resources, enable flexible and personalised learning, facilitate collaboration, and provide timely feedback, all of which can strengthen academic performance (Ntirandekura et al., 2022). Where they are absent or poorly implemented, the promise of ICT remains unrealised and may even widen disparities between well-resourced and under-resourced students and institutions.

The African higher-education context presents both distinctive opportunities and challenges for ICT integration. Universities on the continent have made significant strides in adopting digital technologies, yet they frequently contend with limited infrastructure, unreliable electricity and internet connectivity, high costs of data and devices, and uneven digital literacy among students and staff (Julius & Audrey, 2026) *infra*. These conditions vary considerably across countries and institutions, producing a diverse landscape in which the relationship between ICT integration and academic performance may manifest differently (Ntirandekura et al., 2022). Comparing institutions across different national contexts therefore offers valuable insight into how ICT integration operates under varying conditions.

This study focuses on three universities that represent different national and institutional settings: Metropolitan International University, a large and established public university in Uganda; the Adventist University of Central Africa, a private faith-based institution in Rwanda; and Darul Salaam University in Somalia, an institution operating in a post-conflict environment with distinctive infrastructural constraints. Examining ICT integration across these three institutions allows the study to explore both the general relationship between ICT and performance and the ways in which contextual conditions shape that relationship. Such a comparative approach enriches understanding beyond what a single-institution study could offer.

Despite the growing importance of ICT in higher education, empirical evidence quantifying its influence on academic performance in African universities—particularly across multiple national contexts—remains limited, and few studies disaggregate the effects of specific ICT dimensions (Aboagye et al., 2020). This study addresses that gap by examining, through correlation and regression

analysis, how ICT infrastructure, digital literacy, e-learning platforms, and accessibility relate to academic performance across the three institutions. The findings are significant for university managers, national education authorities, and development partners seeking to invest wisely in ICT to improve learning outcomes (Sophie & Crispus, 2024). The article proceeds with the problem statement, objectives, literature review, methodology, results and interpretation, and conclusions.

2. Statement of the Problem

African universities, including Metropolitan international University, the Adventist University of Central Africa, and Darul Salaam University, have invested increasingly in ICT with the expectation that digital integration will enhance teaching, learning, and ultimately students' academic performance (Paul & Kazaara, 2023). However, despite these investments and the accelerated adoption of digital learning, students in many African higher-education institutions continue to experience uneven and sometimes disappointing academic outcomes (Journal, 2025). The extent to which ICT integration actually translates into improved academic performance—and the conditions under which it does so—has not been clearly established through rigorous comparative empirical research across different institutional and national contexts (Kintu et al., 2017).

The challenge is compounded by persistent constraints on effective integration, including inadequate infrastructure, unreliable connectivity, high costs of devices and data, and varying levels of digital literacy among students and staff (Sophie & Crispus, 2024). These constraints may cause the benefits of ICT to be unevenly realised, with some students and institutions gaining substantially while others gain little. Without clear evidence on which ICT dimensions most strongly influence performance and how contextual conditions moderate these effects, institutions risk misallocating scarce resources—investing in hardware, for instance, while neglecting the digital-literacy training or connectivity that would make that hardware effective (Margaret & Kazaara, 2024).

If the relationship between ICT integration and academic performance is not clearly established, universities may continue to invest in technology without achieving the intended improvements in learning, and disparities between well-resourced and under-resourced students and institutions may widen (Julius, 2024). This study therefore sought to determine the influence of ICT integration on students' academic performance across the three universities and to identify which ICT dimensions most strongly affect performance, so as to guide effective investment and policy.

3.0 Main Objective

The main objective of the study was to examine the influence of ICT integration on students' academic performance across Metropolitan International University, the Adventist University of Central Africa, and Darul Salaam University.

3.1 Specific Objectives

- i. To assess the level of ICT integration across the three universities.
- ii. To establish the relationship between ICT dimensions (infrastructure, digital literacy, e-learning platforms, and accessibility) and academic performance.
- iii. To determine the relative contribution of each ICT dimension to academic performance across the institutions.

4.0 Literature Review

Research on ICT integration in education is grounded in several theoretical frameworks, including the Technology Acceptance Model, the Technological Pedagogical Content Knowledge (TPACK) framework, and constructivist learning theory. The Technology Acceptance Model holds that perceived usefulness and ease of use determine users' acceptance and use of technology, explaining why students and lecturers adopt or resist digital tools (Julius & Kazaara, 2026). The TPACK framework emphasises that effective technology integration requires the interplay of technological, pedagogical, and content knowledge, underscoring that technology alone does not improve learning unless it is embedded in sound pedagogy. Constructivist learning theory posits that learners construct knowledge actively, and ICT can support this by providing interactive, collaborative, and self-directed learning environments (Godfrey et al., 2023). Together, these frameworks position ICT as a potential enabler of learning whose impact depends on how it is used.

Empirical studies on ICT and academic performance have produced broadly positive but nuanced findings. A large body of research reports that ICT integration is associated with improved learning outcomes, enhanced engagement, and greater access to resources (Mpirirwe et al., 2021). Studies in higher education indicate that students who make effective use of e-learning platforms, digital libraries, and online collaboration tend to perform better, particularly where these tools are well integrated into instruction (Qadir et al., 2024). However, other studies find weak or inconsistent effects, attributing the divergence to poor implementation, inadequate digital skills, unreliable infrastructure, and the distracting potential of digital devices (Nortvig et al.,

2018). The consensus emerging from this literature is that ICT improves performance conditionally—when infrastructure, skills, and pedagogy align.

Infrastructure and connectivity feature prominently as prerequisites for effective integration. Research in African universities consistently identifies inadequate infrastructure, unreliable electricity, and limited internet bandwidth as major barriers that undermine the potential benefits of ICT (Suzan & Gracious Kazaara, 2023). Studies show that where connectivity is poor, students struggle to access online resources and platforms, negating the advantages of available hardware. Consequently, investment in robust, reliable infrastructure is repeatedly identified as a foundational condition for ICT to influence performance (Lydia et al., 2023).

Digital literacy constitutes a second major theme. The capacity of students and lecturers to use digital tools effectively is a strong determinant of whether ICT translates into learning gains. Studies indicate that students with higher digital literacy make more productive use of e-learning resources and perform better, whereas those lacking such skills derive limited benefit even where technology is available (Murendo et al., 2018). This has led scholars to emphasise digital-skills training as essential to realising the returns on ICT investment.

E-learning platforms and accessibility form further themes. Learning-management systems and digital resources, when well designed and integrated, support flexible, self-paced, and collaborative learning that enhances performance (Akintoye, E. O., & Ofobruku, 2022). Accessibility—the equitable availability of devices, data, and connectivity to all students—is crucial, since inequities in access can widen performance gaps. Comparative studies across institutions and countries reveal that contextual factors, including institutional resources, national infrastructure, and socioeconomic conditions, shape how strongly ICT influences performance. Despite this rich literature, few studies compare the effects of specific ICT dimensions across multiple African institutions in different national contexts, a gap this study addresses.

5.0 Methodology

5.1 Research Design

The study adopted a comparative cross-sectional survey design employing a mixed-methods approach. The comparative element enabled examination of ICT integration and its effects across three institutions in different national contexts, while the cross-sectional survey allowed efficient data collection at a single point in time (A. Nafiu et al., 2012). The combination of quantitative and qualitative methods supported both measurement of relationships and contextual interpretation.

5.2 Study Population and Area

The study was conducted at Metropolitan International University (Uganda), the Adventist University of Central Africa (Rwanda), and Darul Salaam University (Somalia). The target population comprised students and lecturers at the three institutions. Students were central as the subjects whose performance was under study, while lecturers provided perspectives on ICT integration in teaching.

5.3 Sample Size and Sampling Techniques

A sample of 300 respondents was drawn, comprising 100 respondents from each institution (80 students and 20 lecturers per institution). Stratified sampling ensured proportional representation across faculties, students were selected using simple random sampling, and lecturers were selected purposively (Olanrewaju et al., 2021). Distributing the sample equally across institutions facilitated comparative analysis.

5.4 Data Collection Instruments

A structured questionnaire measured the ICT dimensions—infrastructure, digital literacy, e-learning platforms, and accessibility—and academic performance on a five-point Likert scale, with academic performance corroborated using self-reported cumulative grade point averages. Interview guides were used with lecturers and ICT staff to gather qualitative insights into integration practices and contextual challenges (Kazaara et al., 2024).

5.5 Validity and Reliability

Content validity was established through expert review, yielding a content validity index above 0.70. A pilot study confirmed reliability, with the Cronbach's alpha for the ICT integration scale at 0.87, indicating high internal consistency across the instrument.

5.6 Data Analysis

Data were analysed using SPSS. Descriptive statistics summarised ICT integration and performance levels across the institutions (Nelson et al., 2022). Pearson correlation established the strength and direction of relationships, and multiple regression

assessed the combined and relative effects of the ICT dimensions on academic performance. Cross-institutional comparisons and thematic analysis of qualitative data enriched the interpretation.

5.7 Ethical Considerations

Approvals were obtained from the participating institutions, informed consent was secured from all respondents, participation was voluntary, and confidentiality and anonymity were maintained throughout the study.

6.0 Results and Interpretation

6.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the ICT dimensions and academic performance based on responses from the 300 participants across the three institutions.

Variable	Mean	Std. Dev.	Interpretation
ICT infrastructure	3.44	0.85	Moderate
Digital literacy	3.61	0.77	High
E-learning platforms	3.52	0.81	High
ICT accessibility	3.29	0.90	Moderate
Overall ICT integration	3.47	0.72	Moderate
Academic performance	3.55	0.70	High

Source: Primary Data, 2026

The descriptive results in Table 1 show that ICT integration across the three universities was, on the whole, moderate to high, with an overall mean of 3.47 and a standard deviation of 0.72. Digital literacy recorded the highest mean (3.61), indicating that students and lecturers generally possessed reasonable competence in using digital tools, followed by e-learning platforms (3.52), reflecting fairly widespread use of learning-management systems and digital resources. ICT infrastructure (3.44) and, in particular, ICT accessibility (3.29) attracted lower ratings, pointing to persistent constraints in the availability of reliable infrastructure and equitable access to devices and connectivity—challenges especially pronounced in the more resource-constrained contexts. Academic performance was rated high (mean 3.55), consistent with the expectation that adequate ICT integration supports learning outcomes. The relatively large standard deviations, notably for accessibility, reflect meaningful variation across the three institutions and their differing national conditions.

6.2 Correlation Analysis

Pearson correlation was used to establish the relationships between the ICT dimensions and academic performance, as shown in Table 2.

Variable	Academic Performance (r)	Sig. (p)
Digital literacy	0.60	0.000
E-learning platforms	0.58	0.000
ICT infrastructure	0.52	0.000
ICT accessibility	0.48	0.000
Overall ICT integration	0.66	0.000

Source: Primary Data, 2026

The correlation results in Table 2 demonstrate that all ICT dimensions were positively and significantly related to academic performance at the 0.01 level. Overall ICT integration showed a strong positive correlation with academic performance ($r = 0.66$, $p < 0.01$), confirming that greater ICT integration is accompanied by better academic outcomes across the three institutions. Digital literacy exhibited the strongest individual association ($r = 0.60$), underscoring that the ability to use digital tools effectively is closely tied to performance (Nelson et al., 2023). E-learning platforms followed ($r = 0.58$), reflecting the value of well-integrated digital learning environments. ICT infrastructure ($r = 0.52$) and accessibility ($r = 0.48$) were also significantly correlated, though more moderately, indicating that while adequate infrastructure and equitable access are important, their standalone association with performance is weaker than that of digital literacy and e-learning use (Nelson et al., 2023). The consistently positive pattern across all dimensions strongly supports the study's central proposition.

6.3 Regression Analysis

Multiple linear regression assessed the combined and relative effects of the ICT dimensions on academic performance. Tables 3 and 4 present the results.

Model Summary		Value	
R		0.720	
R Square		0.519	
Adjusted R Square		0.512	
Std. Error of Estimate		0.473	
F (4, 295)		79.61 (p = 0.000)	
Predictor	Beta (β)	t	Sig. (p)
Digital literacy	0.31	5.44	0.000
E-learning platforms	0.28	4.91	0.000
ICT infrastructure	0.18	3.22	0.001
ICT accessibility	0.14	2.53	0.012

Source: Primary Data, 2026

The regression model summary in Table 3 indicates that the four ICT dimensions jointly explained 51.9% of the variance in academic performance ($R^2 = 0.519$), a substantial proportion that establishes ICT integration as a major determinant of performance across the three universities. The model was highly significant ($F(4, 295) = 79.61$, $p < 0.01$), confirming its predictive validity. The remaining 48.1% of variance is attributable to other factors such as student aptitude, study habits, teaching quality, and institutional context that lie beyond the scope of the model.

The standardised coefficients in Table 4 clarify the relative importance of each dimension. Digital literacy emerged as the strongest predictor ($\beta = 0.31$, $p < 0.01$), demonstrating that the capacity of students and lecturers to use digital tools effectively is the most influential factor in translating ICT into improved performance—a finding that reinforces the principle that technology yields benefits only when users can exploit it competently. E-learning platforms followed ($\beta = 0.28$, $p < 0.01$), confirming that well-integrated digital learning environments materially enhance outcomes. ICT infrastructure ($\beta = 0.18$, $p < 0.01$) and accessibility ($\beta = 0.14$, $p < 0.05$) contributed positively but more modestly, indicating that while infrastructure and access are necessary foundations, their impact is realised chiefly through the digital literacy and platform use they enable. Overall, the results suggest that investment in digital-skills development and effective e-learning platforms yields the greatest returns in academic performance, and that such investment must be underpinned by adequate infrastructure and equitable access, particularly in more constrained contexts.

7.0 Conclusion and Recommendations

The study concludes that ICT integration has a strong, positive, and significant influence on students' academic performance across Metropolitan International University, the Adventist University of Central Africa, and Darul Salaam University, with digital literacy and e-learning platforms being the most influential dimensions. It is recommended that the universities invest in reliable ICT infrastructure and connectivity, prioritise digital-skills training for students and lecturers, strengthen and integrate e-learning platforms into instruction, and address inequities in access to devices and data—particularly in resource-constrained settings. National authorities and development partners should support the expansion of affordable connectivity. Future research could employ objective performance data and longitudinal designs to further establish causality and to examine how national context moderates ICT effects.

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