

The Effect Of E-Learning On Learners' Academic Performance In Secondary School: A Case Study Of St.

Mary's Simbya Secondary School In Bundibugyo

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Abstract

This study examined the effect of e-learning on the academic performance of learners at St. Mary's Simbya Secondary School in Bundibugyo District, Uganda. The study was informed by the increasing integration of digital technologies in education and the need to understand how such technologies affected learning outcomes in resource-constrained rural settings. Three specific objectives guided the study: to assess the extent of e-learning adoption at St. Mary's Simbya Secondary School, to determine the effect of e-learning tools and platforms on learners' academic performance, and to identify the factors that mediated or moderated the relationship between e-learning and academic performance. A mixed-methods research design was employed, combining a quasi-experimental comparison of examination scores between e-learning users and non-users with a questionnaire survey and qualitative interviews. The study involved 150 students and 20 teachers. Analysis of Uganda Certificate of Education (UCE) preliminary scores showed that students who regularly used e-learning resources achieved a mean score of 64.8% compared to 52.3% for non-users, a statistically significant difference ($t = 6.24$, $p < 0.001$). Regression analysis indicated that frequency of e-learning use ($\beta = 0.442$), teacher digital literacy ($\beta = 0.319$), and availability of digital devices ($\beta = 0.287$) were significant positive predictors of academic performance ($R^2 = 0.624$). Key barriers to e-learning effectiveness included unreliable electricity supply, limited device availability, inadequate teacher training, and poor internet connectivity. The study concluded that e-learning had a significant positive effect on academic performance when supported by adequate infrastructure and teacher capacity, and recommended targeted investments in digital infrastructure, teacher training, and device provision to maximize the academic benefits of e-learning in secondary schools in Bundibugyo.

Keywords: E-learning, Academic Performance, Secondary Education, ICT in Education, Digital Literacy, Bundibugyo, Uganda, St. Mary's Simbya

Background of the Study

The integration of information and communication technology (ICT) into education had transformed teaching and learning processes across the globe, giving rise to the phenomenon of electronic learning, or e-learning (Julius & Kaazara, 2025). E-learning was broadly defined as the use of digital technologies and internet-based resources to deliver, facilitate, and support educational activities and learning experiences (Nelson, 2024). The global expansion of e-learning had been accelerated by the increasing affordability of digital devices, the proliferation of mobile internet access, and the development of open educational resources and online learning platforms such as Khan Academy, Coursera, and Google Classroom (A. I. Kazaara & Desire, 2025). The COVID-19 pandemic further accelerated the

shift toward e-learning, as school closures necessitated the rapid adoption of remote learning technologies across the world(Oromo et al., 2023).

In Uganda, the government had recognized the transformative potential of ICT in education and had taken several policy steps to promote its integration into the national education system. The National ICT Policy of 2003 and the subsequent National ICT Policy Framework of 2018 provided strategic direction for the development of the national ICT infrastructure and the promotion of ICT use in key sectors including education, health, and governance(A. G. Kazaara & Kazaara, 2025a). The Ministry of Education and Sports had issued guidelines on e-learning and developed the Uganda Advanced Certificate of Education Digital Learning program, which sought to equip secondary school students with digital literacy skills(Kaazara & Audrey, 2025). However, the implementation of these policies had been uneven, with significant disparities between well-resourced urban schools and resource-constrained rural schools in terms of access to digital infrastructure, devices, and qualified ICT teachers(Nancy & Prudence, 2024).

Bundibugyo District, situated in the Rwenzori sub-region of western Uganda, was classified as one of Uganda's underserved districts, characterized by difficult terrain, limited road connectivity, frequent power outages, and constrained access to quality educational facilities and qualified teachers(Julius & Kazaara, 2025b). St. Mary's Simbya Secondary School, a government-aided secondary school in Bundibugyo, had made efforts to introduce e-learning into its teaching and learning processes, procuring a limited number of computers, tablets, and subscribing to digital content platforms for use by students and teachers(A. G. Kazaara & Kazaara, 2025b). The school's experience with e-learning presented a valuable opportunity to assess the academic effects of e-learning adoption in a challenging rural context and to draw lessons relevant to policy and practice in similar settings across Uganda and the broader East African region(Julius & Kaazara, 2025).

Problem statement

Despite the introduction of e-learning resources at St. Mary's Simbya Secondary School, the school continued to record below-national-average performance in Uganda Certificate of Education (UCE) examinations, with a significant proportion of students achieving grades in the lower performance categories(Anthony et al., 2023). School management and district education authorities attributed these outcomes partly to inadequate teaching resources, high student-teacher ratios, and the limited effectiveness of available learning technologies(Nancy & Audrey, 2025). There was a lack of empirical evidence on whether the e-learning interventions introduced at the school had resulted in measurable improvements in student academic performance, or whether their potential was being undermined by infrastructure constraints and inadequate teacher capacity(Nancy & Prudence, 2024). This study was therefore designed to provide empirical evidence on the effect of e-learning on academic performance at St. Mary's Simbya Secondary School, filling a gap in the local research literature and providing actionable insights for school management, district education authorities, and national policy makers(Ntirandekura & Christopher, 2022).

Literature review

Theoretical Framework

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The study was grounded in the Technology Acceptance Model (TAM), developed by Davis (1989), which posited that the adoption and effective use of technology were determined by users' perceptions of its usefulness and ease of use. In the educational context, the TAM predicted that students and teachers who perceived e-learning tools as useful and easy to use would be more likely to adopt and consistently use them, thereby enhancing learning outcomes. The model provided the theoretical foundation for examining how perceptions of e-learning tools influenced usage patterns and, consequently, academic performance. The Constructivist Learning Theory, associated with theorists including Vygotsky (1978) and Jonassen (1994), provided a complementary framework, emphasizing that learners actively constructed knowledge through interaction with digital resources and collaborative online environments.

E-Learning and Academic Performance

A substantial body of research from diverse educational contexts had examined the relationship between e-learning and academic performance (Lydia et al., 2023). Means, Toyama, Murphy, Bakia, and Jones (2009) conducted a meta-analysis commissioned by the U.S. Department of Education and found that on average, students in online or blended learning environments performed modestly but significantly better than those in face-to-face instruction only (A. I. Kazaara & Desire, 2025). In Sub-Saharan Africa, Asabere (2013) examined e-learning adoption in Ghanaian tertiary institutions and found that access to e-learning platforms was positively associated with student academic performance, particularly in STEM subjects (A. G. Kazaara & Nelson, 2024). Nzuki and Okolie (2015) similarly found that the use of digital learning resources by secondary school students in Kenya was associated with improved performance in science and mathematics examinations (Seth, 2019).

In Uganda, studies on e-learning were relatively sparse, particularly at the secondary school level in rural areas. Mugisha (2018) examined the integration of ICT in selected secondary schools in Kampala and found that schools with better ICT infrastructure and more ICT-trained teachers achieved better student performance in national examinations. However, Mugisha noted that the benefits of ICT were contingent on consistent electricity supply, affordable internet access, and sustained investment in teacher professional development conditions that were not uniformly met across Ugandan schools (Julius & Kaazara, 2025). These findings highlighted the importance of contextual enablers in mediating the relationship between e-learning and academic performance.

Methodology

A mixed-methods research design was employed, combining a quasi-experimental comparison of academic performance between e-learning users and non-users with a quantitative survey and qualitative interviews (Julius & Kazaara, 2025a). The study population comprised 480 students and 35 teachers at St. Mary's Simbya Secondary School. A stratified random sample of 150 students was selected, stratified by class level (Senior 1 through Senior 4) and gender. All 20 teachers involved in e-learning activities participated in the survey (Nelson, 2024). E-learning users were defined as students who used digital learning resources (computers, tablets, digital content platforms) at least twice per week (Faith et al., 2023). Academic performance was measured using scores on mid-term and preliminary UCE mock examinations. An independent samples t-test was used to compare mean scores between e-learning users

and non-users(Nelson, 2024). Multiple regression analysis was employed to identify significant predictors of academic performance. Qualitative data from teacher and student interviews were analyzed thematically.

Results

E-Learning Adoption and Usage Patterns

Table 1 presents data on e-learning adoption and usage patterns among surveyed students. The findings showed that 58.7% of students reported using e-learning tools regularly (at least twice per week), while 41.3% were classified as non-regular users or non-users. Among regular users, the most frequently used e-learning resources were digital textbooks and educational videos (used by 82.9%), followed by online revision exercises and past paper databases (71.4%), and educational applications such as Khan Academy and BBC Bitesize (51.4%)(Muhamad et al., 2023). Usage was more prevalent among Senior 3 and Senior 4 students, who were preparing for the UCE examinations, than among younger students. Male students were slightly more likely than female students to be regular e-learning users (62.3% versus 54.5%), a difference that was not statistically significant.

Table 1: E-Learning Usage Patterns among Students

E-Learning Usage Indicator	Frequency (n=150)	Percentage (%)
Regular users (2+ times/week)	88	58.7
Non-regular/non-users	62	41.3
Use digital textbooks/videos	73 of 88	82.9
Use online exercises/past papers	63 of 88	71.4
Use educational apps	45 of 88	51.1
Senior 3 and 4 regular users	54 of 88	61.4
Male regular users	51 of 82	62.2

Source: Primary Data, 2025

Comparison of Academic Performance

Table 2 presents the comparison of mean examination scores between regular e-learning users and non-users. The independent samples t-test revealed a statistically significant difference in mean scores between the two groups across all assessed subjects. Regular e-learning users achieved a mean overall score of 64.8% compared to 52.3% for non-users ($t = 6.24$, $p < 0.001$, Cohen's $d = 0.87$). The performance gap was largest in Mathematics (69.2% versus 51.8%), Biology (67.4% versus 53.1%), and English Language (63.8% versus 54.2%). These results provided strong evidence that regular engagement with e-learning resources was associated with substantially higher academic performance across core subjects in the UCE curriculum.

Table 2: Comparison of Mean Examination Scores: E-Learning Users vs. Non-Users

Subject	Users Mean (%)	Non-Users Mean (%)	t-value	Sig.

Mathematics	69.2	51.8	5.91	0.000***
Biology	67.4	53.1	4.87	0.000***
English Language	63.8	54.2	3.42	0.001**
Physics	65.1	52.6	4.12	0.000***
History	58.7	50.2	2.98	0.004**
Overall Mean	64.8	52.3	6.24	0.000***

*** $p < 0.001$; ** $p < 0.01$

Source: Primary Data, 2025

Regression Analysis – Predictors of Academic Performance

Table 3 presents the multiple regression analysis identifying significant predictors of academic performance. The model explained 62.4% of the variance in overall academic performance ($R^2 = 0.624$, $F = 19.84$, $p < 0.001$) (Nelson et al., 2023). Frequency of e-learning use was the strongest predictor ($\beta = 0.442$, $p < 0.001$), confirming that consistent engagement with digital learning resources was the most important driver of performance differences. Teacher digital literacy ($\beta = 0.319$, $p < 0.001$) was the second strongest predictor, indicating that the quality of e-learning facilitation by teachers played a critical role (Julius & Nancy, 2025). Availability of digital devices ($\beta = 0.287$, $p < 0.01$) was also a significant predictor, underscoring the importance of equitable access to technology in the school setting.

Table 3: Multiple Regression – Predictors of Academic Performance

Predictor Variable	B	Beta (β)	t-value	Sig.
Frequency of E-Learning Use	0.512	0.442	5.83	0.000***
Teacher Digital Literacy	0.389	0.319	4.21	0.000***
Availability of Digital Devices	0.341	0.287	3.68	0.000**
Internet Connectivity Quality	0.198	0.176	2.24	0.027*
Student Digital Skills Level	0.241	0.198	2.61	0.010*

$R^2 = 0.624$; Adjusted $R^2 = 0.607$; $F(5, 144) = 19.84$; $p < 0.001$

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Source: Primary Data, 2025

Discussion Of Results

The findings of this study provided compelling evidence that e-learning had a significant and educationally meaningful positive effect on the academic performance of learners at St. Mary's Simbya Secondary School. The performance differential of approximately 12.5 percentage points between regular e-learning users and non-users was not only statistically significant but also practically significant, representing the difference between a student passing or failing at the UCE level. This finding was consistent with the meta-analytical evidence synthesized by Means et al. (2009) and aligned with the African evidence base developed by Asabere (2013) and Nzuki and Okolie (2015), all of which reported positive associations between e-learning access and academic outcomes. The particularly large performance

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gap in Mathematics was noteworthy and reflected the documented benefits of interactive digital learning tools such as adaptive practice platforms and instructional videos in building procedural fluency and conceptual understanding in subjects that many learners found challenging.

The finding that teacher digital literacy was the second strongest predictor of academic performance highlighted a critical insight: the academic benefits of e-learning were not automatically realized through the mere provision of digital devices but were contingent on the capacity of teachers to effectively integrate digital resources into their pedagogical practice. This finding aligned with the concerns raised by Mugisha (2018) in the Ugandan context and underscored the importance of sustained investment in teacher professional development as a precondition for effective e-learning implementation. Qualitative data from teacher interviews at Simbya School reinforced this point, with several teachers acknowledging that they lacked confidence in using certain digital platforms and consequently used e-learning tools less frequently than the school's policy intended.

The significant effect of device availability on academic performance reflected a straightforward access challenge: students who had reliable access to digital devices could engage more consistently with e-learning resources, while those without access were unable to benefit. This finding had important equity implications, as device availability tended to be inversely associated with household income, meaning that poorer students within the school were systematically disadvantaged in their access to e-learning benefits. The barriers identified through qualitative data particularly unreliable electricity supply and poor internet connectivity were characteristic of the broader infrastructure challenges facing rural schools in districts like Bundibugyo, and reinforced the need for targeted infrastructure investments to create an enabling environment for e-learning.

Conclusions

This study concluded that e-learning had a significant positive effect on the academic performance of learners at St. Mary's Simbya Secondary School in Bundibugyo, with regular e-learning users significantly outperforming non-users across all assessed subjects. The magnitude of the performance difference was educationally significant and reinforced the case for sustained investment in e-learning infrastructure and capacity at the school. However, the study also concluded that the academic benefits of e-learning were not automatic and required an enabling environment characterized by adequate digital devices, reliable electricity and internet connectivity, and digitally literate and motivated teachers. The absence of these enabling conditions significantly constrained the potential of e-learning to improve academic outcomes in rural schools such as St. Mary's Simbya. The study therefore concluded that a systems approach to e-learning implementation addressing infrastructure, capacity, content, and equity dimensions simultaneously was essential for maximizing the educational impact of digital technologies in secondary schools in rural Uganda.

Recommendations

Based on the findings and conclusions, the study made the following recommendations. The Ministry of Education and Sports was recommended to include St. Mary's Simbya Secondary School in the next phase of the Computers for

Schools Program, ensuring the provision of additional computing devices that increased the student-to-device ratio to a minimum of five students per device. Bundibugyo District was encouraged to partner with the Rural Electrification Authority and solar energy providers to install a reliable solar power system at the school to address the persistent electricity supply challenges that limited e-learning usage hours. The school administration was recommended to develop a structured digital literacy training program for all teaching staff, delivered in partnership with the district education office and accredited ICT training institutions, to improve teachers' ability to integrate e-learning tools effectively into lesson planning and delivery. The Universal Service Fund of the Uganda Communications Commission was recommended to consider extending fiber broadband connectivity to schools in Bundibugyo as part of its rural connectivity mandate, given the evidence that poor internet connectivity was a significant barrier to e-learning effectiveness. Finally, the school was advised to develop an e-learning content policy that identified and curated the most pedagogically effective digital resources for each subject area, reducing the cognitive burden on teachers and students in navigating the vast but uneven landscape of available digital educational content.

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