

# Digital Collaborative Learning and Students' Academic Performance: A Case of The Catholic University of Eastern Africa

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## **Abstract**

*This study examined the relationship between Digital Collaborative Learning (DCL) and academic performance among students at the Catholic University of Eastern Africa (CUEA). Grounded in Collaborative Learning Theory and Vygotsky's Zone of Proximal Development, it examined the role of peer interaction, digital tools, active listening during online discussions, and institutional support in shaping students' academic success. To achieve a thorough analysis, the study adopted a mixed-methods research design, combining both quantitative and qualitative methods. Cross-sectional survey was adopted for the quantitative method while a case study was adopted for the qualitative method. The research focused on a target population of 4,496 students and 150 faculty members. The sample had 335 students selected through stratified random sampling and 15 faculty members selected purposively using criterion sampling. Data collection instruments included questionnaires for students and interview guides for faculty staff. The validity of the instruments was confirmed through expert review and pilot testing. Reliability of quantitative instruments was established using Cronbach's Alpha at 0.990. Trustworthiness of qualitative tools and processes was established. Quantitative data were analyzed using descriptive and inferential statistics while qualitative data were analyzed using thematic analysis. The results showed a strong positive relationship of ( $r= 0.623$ ) between students' involvement in digital collaborative learning and their academic performance. Additionally, active listening during virtual discussions enhanced comprehension, reflection, and critical thinking. Institutional support, particularly in training, infrastructure, and technical assistance, proved crucial to the successful implementation of DCL. The study concluded that well-organized digital collaborative learning promotes learner engagement, equitable participation, and better academic results. The study recommended that higher institutions of learning should increase their investment in digital infrastructure to support these initiatives.*

**Keywords:** Digital Collaborative Learning, Students' Academic Performance, Collaborative Learning Theory, Vygotsky's Zone of Proximal Development

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## **I. Introduction and Background to the Study**

In recent decades, the integration of technology into education has transformed how learners' access, process, and interact with academic content. The shift toward technology-enabled pedagogies has expanded opportunities for engagement beyond traditional classroom boundaries. Among the most prominent approaches emerging from this transformation is Digital Collaborative Learning (DCL), a pedagogical strategy that leverages digital tools and platforms to promote peer interaction, shared knowledge construction, and co-learning (Liu et al., 2020; Jeong et al., 2019). This study focused on the relationship between learners' engagement in DCL and their academic performance at the Catholic University of Eastern Africa (CUEA), a faith-based institution in Langata sub-county, Nairobi County, Kenya.

DCL involves structured group-based learning activities facilitated through digital platforms such as Google Docs, Microsoft Teams, Zoom, WhatsApp groups, online discussion boards, and learning management systems (LMS). These platforms allow learners to collaborate synchronously and asynchronously, engaging in brainstorming, sharing resources, problem-solving, and providing constructive feedback (Liu et al., 2020). Rooted in Collaborative Learning Theory, as articulated by Vygotsky (1978), DCL emphasizes the social dimensions of learning, highlighting that meaningful peer interaction stimulates cognitive growth, deepens understanding, and enhances academic achievement.

Globally, DCL has been shown to improve student engagement, critical thinking, and academic outcomes. Higher education institutions have recognized the potential of DCL to improve student engagement, knowledge retention, and academic performance. Research indicates that DCL promotes critical thinking,

teamwork, and deeper learning outcomes (Fiock, 2020; Al-Fraihat et al., 2020). For example, Lee et al. (2021) found that South Korean students who engaged in collaborative online settings performed better on assessments and demonstrated enhanced conceptual understanding. Similarly, Garrison et al. (2010) reported that DCL in Canada improved learners' reflective thinking and communication skills.

The COVID-19 pandemic accelerated the adoption of DCL as countries worldwide sought to sustain education during prolonged school closures. Nations such as Germany, Australia, and the United States expanded digital infrastructure to support blended and remote learning models (Bond et al., 2021; Martin & Bolliger, 2018). In India, Joshi et al. (2020) observed that digital collaboration significantly improved student satisfaction, participation, and retention rates during emergency remote instruction. However, successful implementation often depended on the quality of institutional infrastructure, faculty readiness, and student access to resources.

In Africa, the growing demand for higher education has heightened the urgency for innovative strategies such as DCL to improve access, equity, and quality. In Nigeria, Adedoyin and Soykan (2020) found that tools like Google Classroom and WhatsApp enhanced engagement and collaboration during remote learning. In Rwanda, Uwamahoro et al. (2021) demonstrated that DCL improved comprehension in STEM courses, although poor internet connectivity and inadequate training limited its reach. A Zimbabwean survey revealed that over 97% of lecturers facilitating open, distance, and digital learning lacked prior experience in remote teaching, underscoring the need for professional development (Nyongesa et al., 2024). Similarly, in Ethiopia, Alemayehu and Zeleke (2022) noted that despite students' positive attitudes toward DCL, weak support systems and poor infrastructure impeded widespread adoption.

In Kenya, the rapid advancement of ICT has prompted many universities, including among others, the University of Nairobi, Kenyatta University, and Jomo Kenyatta University of Agriculture and Technology, to integrate LMS platforms such as Moodle and Blackboard into teaching and learning (Muuro et al., 2014; Algahtani, 2021). Kihoro et al. (2023) found that DCL positively influenced academic performance and motivation at Kenyatta University, particularly in science and technology disciplines. Nevertheless, the benefits of DCL are unevenly distributed. Wambua and Mwololo (2022) reported that students at Masinde Muliro University faced challenges, including limited device access and unstable internet connectivity, which reduced the effectiveness of collaborative learning.

Faith-based institutions, such as the Catholic University of Eastern Africa, a private university, face additional barriers, including intermittent electricity supply, limited bandwidth, and limited digital literacy among faculty (Otieno et al., 2024). Although tools like Zoom, Google Meet, and Teams have become more common according to Mwangi (2024), students often cite unequal participation, delayed feedback, and restricted access to collaborative sessions as persistent challenges (Muuro et al., 2019).

Given these realities, there is a pressing need for empirical studies to assess how DCL impacts student academic performance in private, faith-based university contexts, such as the Catholic University of Eastern Africa. Understanding these dynamics will not only address institutional challenges but also inform policy frameworks and pedagogical strategies to enhance digital collaborative learning.

## **1.1 Rationale**

More than 60% of students in Kenyan universities encounter barriers to effective distance learning, including inconsistent connectivity, limited access to devices, and insufficient digital skills (Muuro et al., 2019). Despite improvements in awareness and incremental increases in internet access, at the Catholic University of Eastern Africa, students continue to face limited peer interaction, weak feedback mechanisms, and underutilization of available collaborative tools (Micheni & Onsongo, 2023; Asenahabi et al., 2024). The current study sought to examine this problem to provide evidence-based strategies for enhancing effective digital collaborative learning at CUEA and comparable institutions in Kenya and the wider African region.

## **1.2 Statement of the Problem**

While digital collaborative learning (DCL) has been shown to enhance academic performance in well-resourced contexts, its effectiveness in Kenyan Private Universities, such as CUEA, remains underexplored. Students face challenges such as limited peer interaction, underutilization of collaborative tools, and insufficient institutional support (Pischetola, 2020). In well-resourced contexts, DCL promotes retention and academic success when supported by robust infrastructure and strong faculty involvement (Garrison et al., 2010). However, in Sub-Saharan Africa, including Kenya, these benefits are constrained by persistent challenges such as poor internet access, low digital literacy, and inadequate instructional support (Adedoyin & Soykan, 2020; Gachago et al., 2021).

In Kenyan universities, more than 60% of students encounter barriers to effective distance learning, including inconsistent connectivity, limited access to devices, and insufficient digital skills (Muuro et al., 2019). Despite improvements in awareness and incremental increases in internet access at the Catholic University, students continue to face limited peer interaction, weak feedback mechanisms, and underutilization of available collaborative tools (Micheni & Onsongo, 2023; Asenahabi et al., 2024).

This situation highlights a critical problem, as students are expected to participate in digital learning environments without sufficient institutional support. Existing research frequently generalizes findings across institutions or focuses primarily on access issues, without adequately examining how DCL practices affect academic performance in private universities such as the Catholic University of Eastern Africa. Consequently, the current study sought to investigate the relationship between digital collaborative learning and students' academic performance. An institution-specific investigation would provide evidence-based strategies for enhancing the effectiveness of digital learning at CUEA and comparable institutions in Kenya and the wider African region.

### **1.3 Research Questions**

The following research questions guided the study:

- 1) What is the relationship between peer interaction through digital collaborative learning (DCL) platforms and students' academic performance at the Catholic University of Eastern Africa?
- 2) What challenges hinder institutional support for effective digital collaborative learning at the Catholic University of Eastern Africa?
- 3) What measures can be implemented to strengthen institutional support for digital collaborative learning at the Catholic University of Eastern Africa?

### **1.4 Research Hypothesis**

The study tested the following null hypothesis:

- 1)  $H_{01}$  There is no statistically significant relationship between peer interaction through digital collaborative learning and students' academic performance at the Catholic University of Eastern Africa.

### **1.6 Theoretical Framework**

The study was anchored on Collaborative Learning Theory and Vygotsky's Zone of Proximal Development (ZPD) to investigate the relationship between digital collaborative learning (DCL) and students' academic performance at the Catholic University of Eastern Africa. Collaborative Learning Theory, first articulated by Kenneth Bruffee and later developed by scholars such as Johnson et al. (2014), emphasizes structured peer-to-peer engagement in which learners jointly solve problems, construct knowledge, and reflect on learning outcomes. Zheng, Chen, and Huang (2021) described collaborative learning as organized interactions that foster active participation, mutual support, and collective knowledge building. Within digital contexts, this theory underpins how learners use DCL tools to facilitate collaboration beyond physical classrooms.

Vygotsky's Zone of Proximal Development complements this theory by highlighting the role of social interaction in cognitive growth. It posits that learning is maximized when individuals engage with peers or more knowledgeable others, enabling them to acquire skills and understand concepts they could not achieve independently. This aligns directly with the principles of DCL, where interactive technologies such as Google Docs, Microsoft Teams, Moodle, and Zoom enable students to share expertise, exchange feedback, and scaffold each other's learning. Johnson and Johnson (1994) expanded on these ideas through their cooperative learning model, which applies collaborative principles in educational settings. Their framework emphasizes positive interdependence, individual accountability, and group processing as key parts of effective group learning. In the context of DCL, these elements are adapted to online learning environments, where both synchronous and asynchronous tools support ongoing interaction, shared responsibility, and reflective group evaluation.

Guided by these theoretical perspectives, the current study examined the relationship between the adoption and use of DCL tools at the Catholic University of Eastern Africa (CUEA) and students' academic performance, with particular focus on the relationships among collaborative processes, institutional support, and students' Grade Point Averages (GPAs).

A key strength of collaborative learning theory lies in its capacity to foster active participation and promote deeper learning through structured interaction. When learners engage in joint problem-solving, discussion, and the construction of shared knowledge, they develop higher-order thinking skills and attain a more comprehensive understanding of the subject matter (Gillies, 2016). Such collaborative exchanges encourage learners to articulate, defend, and refine their ideas, thereby strengthening analytical reasoning and critical reflection.

Another notable advantage of the theory is its ability to enhance learner motivation, accountability, and persistence. Slavin (2014) observed that students who engaged in collaborative activities often demonstrated greater commitment to challenging tasks when a sense of mutual responsibility to peers is present. This heightened engagement not only improves cognitive outcomes but also cultivates socio-emotional skills essential for academic and professional success. In addition, collaborative learning facilitates the development of communication, teamwork, and interpersonal skills, competencies that are highly valued in contemporary workplaces. In technology-enhanced environments, integrating collaborative learning has been shown to produce measurable improvements in academic performance. For instance, Laal and Ghodsi (2012) found that students

participating in digital collaborative learning environments reported higher academic achievement and greater satisfaction compared to those in traditional instructional settings.

Finally, the theory aligns with principles of inclusive education by fostering peer support systems that accommodate diverse learning needs. This inclusive dimension ensures that students with varying academic abilities benefit equitably from the collaborative process, promoting a culture of mutual respect and shared growth.

### **1.6. 1 Application of the Theory in Education**

Collaborative Learning Theory has broad applicability in contemporary education, particularly within higher institutions of learning, where there is blended or fully online learning models. In digital collaborative learning (DCL), learners use platforms such as discussion forums, shared online workspaces, and video conferencing systems to collaborate on academic tasks. This approach proved especially valuable for sustaining academic continuity during periods of significant disruption, including the COVID-19 pandemic (Bao, 2020; Daniel, 2020).

Evidence from African higher education further supports the theory's relevance. For instance, Muriithi and Mwanja (2017) reported a positive association between the adoption of collaborative learning strategies and improved academic outcomes in Kenyan public universities. Likewise, Chukwuyenum, Ogbuiyi, and Egbule (2014) found that collaborative approaches significantly enhanced student performance within Nigerian higher education contexts. These findings underscore the theory's adaptability across diverse educational and cultural settings.

While weaknesses such as uneven participation, group conflict, and difficulties in assessing individual contributions are acknowledged, these challenges can be mitigated through strategies informed by other reviewed theories. For example, principles from self-determination theory encourage intrinsic motivation, ensuring balanced engagement among all group members. Elements of social presence theory strengthen interpersonal connections in virtual settings, reducing misunderstandings and fostering group cohesion. Furthermore, constructivist approaches provide structured guidelines and scaffolding, which enhance clarity of roles and expectations, thereby improving both efficiency and fairness in collaborative tasks.

Within the context of the Catholic University of Eastern Africa, the combined insights from collaborative learning theory and the complementary theories create a framework for designing digital learning environment that prioritize interaction, shared responsibility, and supportive structures. This integrated approach allows instructors to develop participatory online courses, encourage cooperative problem-solving, stimulate critical thinking, and ensure equitable participation, ultimately enhancing both learning outcomes and student satisfaction.

## **2.1 Review of Related Literature**

Review of related literature was guided by three research questions on digital collaborative learning and students' academic performance.

### **2.1.2 Digital Collaborative Learning Tools and Academic Performance**

Digital collaborative learning tools, such as online discussion forums, group work platforms, video conferencing, and social media, facilitate peer-to-peer interaction and knowledge sharing, which are essential elements in enhancing academic performance.

According to a study by Garrison (2021), "Digital Collaborative Learning and Student Engagement in Higher Education" by Garrison (2021), conducted in Canadian universities, used a mixed-methods approach to examine how digital platforms impact student engagement and learning. With a sample of 200 undergraduate students using tools like Google Docs and Moodle, the study found that digital collaboration enhances critical thinking, problem-solving, knowledge retention, and real-world applications. In line with Carter (2018), the study recommended integrating collaborative tools into curricula and providing educator training. However, it did not address how these findings translate to under-resourced settings like private universities in Nairobi County, Kenya, highlighting a gap in localized, context-specific research.

Huang et al. (2022) found that such digital tools provide an interactive learning environment that can improve students' academic performance by enabling them to participate more actively and by enhancing their learning experience. This objective would help determine whether the use of such tools in Catholic University correlates with improved academic performance. Simelane-Mnisi (2023) examined the effectiveness of learning management systems (LMS) tools used by academics to foster students' engagement. The study aimed to determine how features within learning management systems influenced students' participation and academic achievement. The research relied on a sample of students and instructors across various education levels, employing questionnaires and performance logs. Data were analyzed through descriptive and inferential statistics, particularly person correlations and regression analysis. Findings showed that interactive LMS elements, such as discussion forums, quizzes, and content-sharing tools, lead to significant improvements in motivation and academic outcomes across K-12, secondary, and tertiary environments.

Also, Candia et al. (2022) investigated how collective intelligence in LMS discussion forums influenced academic performance, especially among disadvantaged students during emergency remote learning due to COVID-19. The study analyzed data from 7,528 undergraduates, incorporating GPA results, socioeconomic controls, and natural language processing of forum posts. Regression techniques revealed that students who engaged more deeply in online peer discussions, especially those with weaker high school backgrounds, showed significantly higher GPAs, highlighting the critical role of collective, collaborative dialogue in online academic success.

Further on, Chng et al. (2023) conducted an experimental evaluation of online collaborative learning enhanced with thinklets, investigating satisfaction responses among university students in Beijing. Their objective was to test whether structured collaborative sequences (thinklets), underpinned by Yield Shift Theory, could improve students' satisfaction in online teamwork. Using 113 participants divided into control and intervention groups, satisfaction levels were measured and analyzed statistically using ANOVA. Results showed significantly greater satisfaction in the thinklet-enhanced group, supporting both the application of thinklets and the Yield Shift Theory model for enhancing digital collaboration experiences.

Wardhani et al. (2024) explored the impact of collaboration learning platforms on students' creativity. Targeting a cohort of university-level learners, they employed a pre- and post-test assessments, creativity rubrics, platform usage logs, paired tests, and thematic content analysis. The study found that digital collaborative tools significantly enhanced creative thinking and problem-solving skills, indicating that these platforms not only improve academic performance but also foster higher-order competencies such as inventiveness and teamwork.

Bashiri and Kowsari (2024) examined the role of large language models (LLMs) and AI tools in shaping student engagement and collaborative learning on social media platforms (Bashiri & Kowsari, 2024). Using data from the University Cube environment, the study employed a mixed methods design that included usage analytics, surveys, and performance records. Data analyses included descriptive statistics, sentiment coding, and comparative tests. Their results showed that AI-enhanced peer matching and content-personalization features improved academic performance, critical thinking, and engagement by filtering out irrelevant content and facilitating more productive online collaboration.

Despite the potential benefits, the use of digital collaborative learning tools often faces significant challenges, particularly in low-resource settings. These challenges include limited access to reliable internet, inadequate digital literacy, and insufficient training or support (Dhawan, 2020). Uban (2021) examined how limited access to digital infrastructure, such as devices and internet connectivity, can undermine the intended benefits of digital learning tools, particularly in rural and underserved educational settings. His objective was to assess the extent to which digital integration policies matched realities in schools facing structural barriers. Anchored in critical educational technology theory, Cuban focused on K–12 learners in under-resourced American school districts. While the study was not quantitative, it used a case study approach with document reviews and stakeholder interviews. Findings revealed that the mere presence of digital tools did not equate to effective integration; instead, systemic inequality in access and training undermined learning outcomes. Students in poorly equipped schools could not meaningfully engage in digital collaborative tasks, limiting both engagement and academic gains. The study created a methodological gap in the use of only document review and stakeholder interviews. The current study addressed this gap by adopting both qualitative and quantitative data collection tools such as questionnaires.

Lin et al. (2022) explored social media-based collaborative learning among 583 university students in China. Their main objective was to assess how peer interaction via social media affects collaborative learning and academic performance. Using the Technology Acceptance Model and the Social Constructivism framework, the study employed surveys, which were analyzed using SEM and hierarchical regression. They found that perceived benefits, such as active learning and interaction significantly predicted collaborative learning. Academic self-efficacy moderated the link to performance.

Sahoo and Khuntia (2024) conducted a quasi-experimental study in Odisha, India, to evaluate the effectiveness of social media-based collaborative learning on undergraduate students' engagement and academic performance. Grounded in Vygotsky's Social Constructivism and the Zone of Proximal Development, the study sought to determine how peer interactions via platforms such as WhatsApp and Facebook impacted academic outcomes. A sample of 200 undergraduate students from four colleges was randomly selected. Data collection involved pre- and post-intervention questionnaires, academic records, social media activity logs, and semi-structured interviews. The data were analyzed using Pearson correlation, quasi-experimental comparisons, and qualitative thematic coding. Results showed a significant positive correlation between collaborative engagement and academic improvement ( $r=0.68$ ,  $p<0.001$ ), with the treatment group recording a 15% academic gain over the control group. However, some concerns about digital distractions and privacy were raised. Gaps in this study were confined to a single Indian state and lacked long-term follow-up, limiting its generalizability beyond that state. Future studies could explore discipline retention and compare it across different digital platforms.

Palahan (2025) conducted a cross-sectional study across multiple universities in Bangkok, Thailand, to examine how students' positions within academic and social peer networks affected their academic performance.

Using Social Network Theory and Social Constructivism, the study categorized students into network roles such as central, isolator, clique member, and liaison, then examined correlations with academic success. The target population consisted of 384 undergraduate students, whose peer networks were mapped via questionnaires, while their GPA records were used for outcome comparison.

Permutation tests and social network analysis metrics were used for statistical analysis. Findings revealed that students who are central to both academic and social networks had significantly higher academic performance, whereas isolated students scored the lowest. The cross-sectional design does not establish causality, and no analysis of digital interaction patterns was conducted. Further research is needed using digital collaboration logs and interventions to test whether changing a student's peer role improves academic outcomes.

Parmar et al. (2025) conducted a regional study across five African countries, including Kenya, Nigeria, South Africa, Ghana, and Uganda, to assess how digital peer support networks impact academic performance and engagement among university students during blended and remote learning. Based on the Community of Inquiry framework and Social Presence Theory, the study targeted approximately 500 undergraduate students from public universities. It analyzed peer collaboration through forum interactions, group chats, and support channels on learning management systems. Data collection involved digital platform usage logs, surveys, and semester GPA records, and regression analysis was used to examine the relationship between peer interaction intensity and academic outcomes.

Results indicated a strong positive relationship between online peer support and both student engagement and academic achievement, particularly in mitigating feelings of isolation during online learning. The study pooled data across countries, masking country-specific differences. There is a need for more contextualized research within individual African nations, as well as subject-level analysis and differentiated platform effectiveness studies.

Hussein et al. (2023) investigated barriers encountered by Malaysian undergraduate business students when using online distance learning platforms, especially those designed for collaborative learning. Applying technology acceptance and online learning readiness frameworks, the study used structured questionnaires to measure technology confidence, platform usability, and instructor interaction. Findings indicated that poor internet connectivity, limited technical support from instructors, and unintuitive platform interfaces negatively impacted students' motivation and ability to engage effectively in collaborative activities. However, the study did not explore these barriers within the context of public universities in Sub-Saharan Africa nor assess how institutional support systems might mitigate these challenges. The current study addressed these gaps by examining similar barriers at the Catholic University of Eastern Africa in Kenya and evaluated the roles of institutional and peer support in enhancing the effectiveness of digital collaborative learning and academic performance in a low-resource setting.

In Saudi Arabia, Mujallid (2024) investigated the social-emotional and engagement-related challenges postgraduate students faced in a blended collaborative learning environment. Drawing on Merrill's First Principles of Instruction and socioemotional learning theory, the quasi-experimental study involved 90 postgraduate students, divided into control and intervention groups. Data were collected through structured questionnaires and follow-up interviews and analyzed using paired t-tests and qualitative coding. Students reported significant emotional stress due to a lack of informal interaction with peers, limited instructor presence, and technical difficulties. However, students in the intervention group, which received structured collaborative guidance, experienced fewer challenges, suggesting the value of well-designed digital scaffolds.

Alowooja (2023) evaluated the impact of ICT-enabled collaborative learning on Cost Accounting performance among Nigerian NCE Business Education students. Guided by collaborative and social learning theories, the quasi-experimental design included 100 students split evenly into experimental (using Google Docs, WhatsApp, Teams, Padlet) and control (traditional lecture) groups. Using pre- and post-tests, tool usage logs, and satisfaction questionnaires, analyses via t-tests demonstrated the experimental group's mean gain (22.4%) was significantly higher than the control (10.6%). Qualitative feedback also highlighted heightened motivation and critical thinking.

Locally, in the Kenyan context, Asenahabi et al. (2024) examined the adoption of technology-enabled learning (TEL) at Alupe University. Their objective was to assess the extent of digital readiness among students and faculty and how this affected collaborative digital learning. The study used a TEL framework and collected data from over 300 students and 50 faculty members via surveys and institutional audits. Data analysis involved both frequency distribution and cross-tabulation. Findings revealed moderate use of digital collaborative tools, hindered primarily by limited institutional investment in bandwidth, insufficient capacity for digital content creation, and unclear policy guidelines. Students and lecturers alike cited low engagement in group-based digital tasks due to a lack of structured support and follow-through from the institution.

Micheni and Onsongo (2023) further investigated the challenges students faced in four Kenyan universities when using e-learning platforms for collaborative learning. Theories of collaborative learning and instructional support informed the study. Although the sample size was not explicitly stated, the researchers employed surveys and open-ended questionnaires and analyzed the data using mixed methods approaches. The

findings showed that more than 50% of the respondents were not actively engaging in group tasks. Many instructors failed to integrate meaningful collaborative assignments into online teaching, while 30% of students cited poor internet as a barrier. Furthermore, the lack of regular instructor feedback weakened the effectiveness of online peer collaboration. Micheni and Onsongo (2023) also investigated the barriers students face when participating in digital collaborative learning environments across public universities, including infrastructural and pedagogical limitations. Grounded in constructivist learning theory, their study employed a mixed-methods approach with 412 students from Nairobi-based universities. Data collection involved online surveys and focus group discussions. Analysis included descriptive statistics and thematic coding. Their findings revealed that over 60% of students struggled with group assignments due to poor internet connectivity, limited instructor engagement, and a lack of institutional investment in LMS platforms. These constraints led to fragmented collaboration, low motivation, and poorer academic outcomes in group-based assessments.

In Teso North sub-county, Busia County, Kenya, Omasete et al. (2024) evaluated the effects of the cooperative learning approach on English literature performance among secondary school students. Drawing on social constructivist theory, the researchers used a quasi-experimental design involving 120 Form 3 students (60 in the control group, 60 in the experimental group) across two public secondary schools. The experimental group engaged in structured peer interaction, while the control group followed conventional teacher-centered instruction. Data collection tools included pre- and post-tests, observational checklists, and student feedback forms, with analysis conducted using paired t-tests and descriptive statistics. The experimental group recorded a mean gain of 15.89 points, significantly outperforming the control group's 6.28-point gain. Although peer learning improved performance, the study was conducted in a traditional (non-digital) setting. There is still a research gap on how digital collaborative platforms influence peer learning among Kenyan secondary school students, especially in rural or low-resource contexts.

### **2.1.3 Challenges hindering Institutional Support for Effective Digital Collaborative Learning**

Integrating digital learning tools in education has gained prominence worldwide, driven by technological advancements and the need for flexible learning environments. Despite the benefits, various challenges hinder effective implementation, ranging from infrastructural deficiencies to pedagogical limitations (UNESCO, 2021). Inadequate infrastructure, including unreliable internet connectivity and a lack of necessary hardware such as computers and tablets (Selwyn, 2020), has been a significant barrier. According to a UNESCO (2021) report, many developing and even developed countries struggle with equitable access to digital resources, exacerbating the digital divide.

Instructors often lack adequate training on how to effectively integrate digital tools into their pedagogy, resulting in suboptimal learning outcomes (Mishra & Koehler, 2019). Many educators have not received sufficient professional development in digital literacy, which limits their ability to effectively utilize technological resources in the classroom (Redecker, 2019). Moreover, the rapid evolution of digital tools necessitates continuous training, which many institutions fail to provide due to financial and logistical constraints (UNESCO, 2021). Consequently, instructors struggle with adapting digital content to diverse learning needs, further exacerbating educational inequalities (World Bank, 2020). Research by Njoroge (2022), a Kenyan, highlights that most teachers lack sufficient ICT skills, making it difficult for them to effectively incorporate digital tools into their teaching methodologies. Resistance to change from traditional teaching methods poses a challenge, as educators and institutions sometimes prefer conventional face-to-face instruction over digital alternatives (Redecker, 2019).

Many learning institutions, particularly in low-income regions, struggle to secure funds for purchasing and maintaining digital infrastructure (World Bank, 2020). Even when funding is available, it is often insufficient for scaling digital learning initiatives for all students leading to disparities in access and quality education (Waweru & Gichohi, 2021). The cost of acquiring digital devices, establishing internet connectivity, and maintaining learning management systems (LMS) places a significant financial burden on these institutions (UNESCO, 2021). Additionally, students from marginalized communities often face difficulties in accessing digital devices, limiting their participation in digital learning.

With increased reliance on digital platforms, there has been a rise in cyber threats, data breaches, and unauthorized access to student information, making security a top priority (García-Peñalvo et al., 2019). Schools and universities collect vast amounts of sensitive data, including student records, financial details, and assessment results, all of which are susceptible to cyberattacks (Bond, 2020). Unfortunately, many institutions lack the necessary cybersecurity infrastructure and expertise to protect this data, leading to increased vulnerability. Additionally, students and educators may not always be aware of best practices for online safety, which can further expose systems to phishing attacks and malware (Kshetri, 2020). To mitigate these risks, educational institutions must invest in secure learning management systems (LMS), enforce strong password policies, conduct regular security audits, and provide cybersecurity training to staff and students, which might be costly for most schools (West, 2019).

### **2.1.4 Institutional Support Systems to Promote Effective Digital Collaborative Learning**

Institutional support, including the availability of resources, training, and access to digital infrastructure, plays a crucial role in determining the success of digital collaborative learning initiatives. Carter (2018) investigated the impact of institutional support structures, such as training programs and support services, on the adoption of digital learning tools in higher education. Framed by diffusion of innovations theory, the study aimed to understand how these support structures influenced instructors' and students' ability to integrate digital tools collaboratively. The target population comprised faculty and students across 15 universities in the U.S., with over 1,200 participants. Data collection involved surveys assessing the availability of professional development, help desk support, and tool access, complemented by focus group interviews. Analysis included descriptive statistics and regression analysis. Carter found that mere availability of technology was insufficient; robust support systems, especially ongoing training and responsive help desks, were essential for sustained, effective use of collaborative learning tools.

Huang et al. (2022) explored how university-level technical support and educator development programs facilitate the effective use of collaborative learning platforms. Grounded in Social Learning Theory, the study focused on 620 instructors and 2,100 students across six Chinese research universities. Data were gathered via mixed-mode surveys and institutional usage logs. Multi-level modeling revealed that institutions offering modern tools, on-demand tech support, and tailored professional development saw significantly higher usage of collaborative features (e.g., shared workspaces, discussion boards). Findings indicated a positive correlation between such support and academic performance, with supported learners achieving, on average, 0.28 GPA points higher than peers without support.

Yulin & Danso (2025) conducted a mixed-methods study across multiple universities globally to assess institutional pedagogical readiness for digital innovation and collaborative learning. Grounded in institutional theory and change readiness frameworks, the study surveyed and interviewed 450 faculty and IT staff. Data included quantitative surveys on training access, beliefs, and technical support, as well as qualitative interviews. Analysis showed that although faculty valued digital tools, lack of structured training, weak institutional policies, and resistance to change hindered implementation. Gap: The study lacks data on students' perspectives and on academic outcomes to determine how institutional readiness translates into collaborative learning effectiveness.

Maksum (2025) explored how institutional support, including platform interactivity, teacher immediacy, social presence, and peer connectedness, influences collaborative learning effectiveness in digital classrooms at Xinzhou Normal University, Shanxi, China. Using social presence and community of inquiry theory, 312 undergraduate students were surveyed. Structural equation modeling revealed that strong institutional support in platform design and teacher engagement enhanced peer collaboration and perceived learning quality.

Bach (2024) surveyed 298 undergraduates enrolled in asynchronous online teacher education courses in Europe to assess students' perceptions of institutional interaction quality. Anchored in online collaborative learning and social presence theories, the study used a questionnaire measuring interaction quality and sense of community, which were then correlated with self-reported learning gains and satisfaction. Results showed that students who reported higher-quality institutional interaction, including timely feedback and structured discussions, also reported greater learning gains.

Abera (2023) compared e-learning implementation at the University of Rwanda and the University of Gondar, Ethiopia, to evaluate institutional support mechanisms (leadership commitment, policies, faculty training, infrastructure) for digital collaborative learning. Guided by organizational change and institutional readiness theory, the mixed-methods approach involved faculty, students, and IT staff ( $N \approx 350$ ) and used surveys and interviews. Analysis found that institutional leadership, clear policy frameworks, and inclusive infrastructure were key enablers, while a lack of support for disabled learners and coordination across units were critical gaps.

Tenya et al. (2023) studied institutional digital resource platforms in selected Kenyan public universities, including Kisii University, and evaluated faculty and library staff's ability to access and use digital tools. Anchored in UTAUT and information-interchange theory, the sample comprised 113 respondents (86 academic staff, 23 librarians). Data collected through surveys and interviews, analyzed via SPSS and thematic analysis. Findings showed that limited platform types, poor usability, and a mismatch with user expectations hindered the effective use of digital resources essential for collaborative learning.

Kiruma (2023) examined institutional readiness, learner diversity, and participation in distance learning at the University of Nairobi, focusing on the support system for inclusive digital collaborative learning. Based on equity and inclusion theory, the study surveyed undergraduate distance learners ( $N = 250$ ) and administrators. Analysis revealed that a lack of tailored support for diverse learners, insufficient training for e-tutors, and unclear e-learning theory limit the effectiveness of digital collaboration. However, the study did not link institutional factors to collaboration outcomes or measurable academic achievement.

Anonymous (2024) explored learning support strategies at the Open University of Kenya (OUK) during the implementation of digital learning. The study, guided by community inquiry and organizational support theory, employed mixed methods: surveys of 300 students and staff, interviews with support personnel, and platform

analytics. Findings highlighted that institutional support, such as responsive help desks, peer mentoring, and digital literacy training, directly improved student satisfaction and participation in collaborative learning forums.

At the national level in Kenya, Mutula (2023) examined how institutional readiness affects learners' uptake of digital collaborative tools. Using an adapted Technology Acceptance Model (TAM), the study surveyed 450 students and 150 faculty across public universities. Data were collected through questionnaires on IT infrastructure, training availability, and perceived usefulness of collaboration platforms, and analyzed using structural equation modeling. Results indicated that institutional support, especially in training and infrastructure, significantly influenced perceived ease of use, driving higher engagement with collaborative tools and resulting in modest improvements in coursework performance.

Micheni and Onsongo (2023) further investigated how a lack of institutional support undermined digital collaboration in Nairobi's public universities. Guided by constructivist learning theory, their mixed-methods study included 412 students and 52 faculty with data from surveys and focus groups. Analysis revealed that limited access to institutional training and weak IT helpdesks led to underutilization of collaborative features in LMS platforms. Students reported poor integration of these tools by the instructor and frequent connectivity issues, which correlated with lower engagement and group project performance.

At CUEA, Asenahabi et al. (2022) conducted a baseline study on technology-enabled learning (TEL). Guided by the TEL framework, they surveyed 300 students and 50 faculty members, supplemented by facility audits. Frequency analysis and SWOT mapping indicated moderate ICT access but insufficient bandwidth, a lack of formal training programs, and minimal support for digital content creation. Consequently, collaborative learning platforms remained underused. A follow-up impact report by Asenahabi et al. (2024) used learning analytics and interviews to show that while faculty-led workshops increased tool usage temporarily, a lack of sustained infrastructure upgrades and policy commitment limited long-term efficacy.

### 3.1 Methodology

This study employed a mixed-methods research design that integrated qualitative and quantitative approaches. The quantitative method used was a cross-sectional survey, while the qualitative method was a case study. The cross-sectional survey design enabled the study to examine associations and patterns without manipulating variables while in-depth interviews conducted with faculty members, department heads, and administrators, provided rich, contextual data on the opportunities and challenges associated with digital collaborative learning, the specific needs of faculty, and the effectiveness of existing institutional support systems. Johnson and Onwuegbuzie (2023) described mixed methods research as an approach that integrates qualitative and quantitative techniques, methods, approaches, and concepts within a single study. The study focused on a target population of 4,496 students, and 150 faculty members. The sample had 335 students selected through stratified random sampling and 15 faculty members purposively selected using criterion sampling. Data collection instruments included questionnaires for students and interview guides for faculty staff. The validity of the instruments was confirmed through expert review and pilot testing. Reliability of quantitative instruments was established using Cronbach's Alpha at 0.990. Trustworthiness of qualitative tools and processes was established through the principles of credibility, dependability and conformability. Quantitative data were analyzed using descriptive and inferential statistics while qualitative data were analyzed using thematic analysis.

### 4.1 Findings and Discussions

Globally, universities have been under pressure to embed digital transformation within teaching and learning processes, a shift accelerated by the COVID-19 pandemic, which normalized the use of virtual platforms for instruction (UNESCO, 2022). Yet in many African universities, systemic challenges such as inadequate infrastructure, limited training opportunities, and weak institutional frameworks continue to constrain the realization of digital learning initiatives (Ndungu et al., 2021; World Bank, 2023). For CUEA, understanding these challenges is critical to strengthening institutional capacity and ensuring effective student learning through digital collaboration. The responses from respondents on challenges faced in digital collaborative learning are summarized in Table 1.

**Table 1**

*Challenges in Digital Collaborative Learning*

Item	M	SD
Poor internet connectivity	4.10	0.81
Limited access to digital devices	3.95	0.87
Inadequate training for students and faculty	3.88	0.91
Insufficient technical support services	3.84	0.89

Item	M	SD
Resistance to using digital learning platforms	3.65	0.95
Lack of clear institutional policies	3.72	0.93
<b>Composite Mean</b>	<b>3.86</b>	<b>0.89</b>

Source: Researcher, 2026

The results in Table 1 reveal that students experience multiple challenges that hinder effective engagement in Digital Collaborative Learning (DCL). The composite mean of 3.86 (SD = 0.89) suggests that, on average, respondents moderately to strongly agreed that these barriers significantly impact their learning experiences. Among the challenges, poor internet connectivity emerged as the most critical issue (M = 4.10, SD = 0.81), reflecting a persistent infrastructural gap that directly affects the consistency and quality of online engagement. This was closely followed by limited access to digital devices (M = 3.95, SD = 0.87), highlighting inequities in student access to essential learning tools.

Institutional challenges also featured prominently. Respondents reported concerns about inadequate training for both students and faculty (M = 3.88, SD = 0.91) and insufficient technical support services (M = 3.84, SD = 0.89), pointing to capacity gaps in both digital literacy and ongoing support systems. Furthermore, lack of clear institutional policies (M = 3.72, SD = 0.93) and resistance to using digital platforms (M = 3.65, SD = 0.95) underscore the cultural and organizational barriers that hinder seamless adoption of digital practices.

Descriptive statistics were computed for the four major constructs: peer interaction, digital tools use, active listening, institutional support, and academic performance. The mean scores were interpreted as: 1.0 - 2.4=Low, 2.4-3.4=Moderate, 3.5-5.0=high. This is illustrated in Table 2.

**Table 2**

*Analysis of Key Variables*

Variable	N	Mean	Std. Deviation	Interpretation
Peer Interaction	325	4.02	0.71	High
Use of Digital Tools	325	3.88	0.69	High
Active Listening	325	3.76	0.73	High
Institution Support	325	3.42	0.82	Moderate
Academic	325	3.91	0.68	High

Source: Researcher (2026)

Most students reported frequently engaging in digital collaborative learning (DCL) through online platforms. However, institutional support was rated only moderate, indicating gaps in infrastructure and digital training.

The regression model was statistically significant ( $p < 0.001$ ), confirming that DCL variables significantly influence academic performance. This is illustrated in Table 3.

**Table 3**

*Regression Model*

Variable	B	Std. Error	Beta ( $\beta$ )	t	Sig.
Constant	0.74	0.211	—	3.52	.001
Peer Interaction	0.312	0.067	0.341	4.66	.000
Use of Digital Tools	0.275	0.064	0.298	4.30	.000
Active Listening	0.224	0.058	0.253	3.86	.000
Institutional Support	0.182	0.052	0.214	3.47	.001

Source: Researcher, 2026

All predictors were statistically significant ( $p = 0.05$ ) and positively associated with academic performance. Peer interaction contributed the most ( $\beta = 0.341$ ), followed by digital tool usage ( $\beta = 0.298$ ), active listening ( $\beta = 0.253$ ), and institutional support ( $\beta = 0.214$ ). The study rejected the null hypothesis that there is no statistically significant relationship between peer interaction through digital collaborative learning and students' academic performance at the Catholic University of Eastern Africa.

## 5.1 Conclusions and Recommendations

Based on the findings, the following conclusions were drawn. Peer interaction plays a crucial role in academic success. Students who engage actively with their peers in online environments tend to have a better grasp of the material, increased motivation, and greater confidence in their academic abilities. The study showed that working together not only holds students accountable but also helps them collectively build knowledge.

Digital tools like Moodle, Google Docs, and Microsoft Teams really boost coordination, provide timely feedback, and encourage interactive learning. These tools help break down physical barriers, allowing students to collaborate on academic tasks more easily.

Active listening is another key factor; it promotes reflection, empathy, and understanding. Students who pay close attention during online sessions are better equipped to interpret information and apply what they've learned in real-world situations.

Even though students generally have a positive attitude toward digital collaboration, institutional challenges hinder its full implementation. For sustainable Digital Collaborative Learning (DCL), the university needs strong infrastructure, digital literacy programs, and supportive policies that align technology with teaching goals.

Institutional readiness is complex, involving leadership commitment, investment in ICT, and a cultural shift towards digital teaching methods. When universities offer sufficient technical support and training, both students and faculty can fully harness the benefits of DCL.

Based on the insights from the study, here are some suggestions for educational institutions, policymakers, and stakeholders:

CUEA needs to take some thoughtful steps to boost its ICT infrastructure by increasing internet bandwidth and ensuring that systems are reliable enough to support effective digital learning. The administration should allocate sufficient resources to improve digital learning environments, including upgrading Learning Management Systems (LMS) and providing consistent technical support for both faculty and students.

The university should focus on ongoing digital literacy training for students and faculty alike, helping them become proficient with collaborative tools such as Moodle, Google Classroom, and Microsoft Teams. By developing these skills, we can enhance the quality of digital interactions and create a more engaging and inclusive learning experience.

Investing in reliable internet access, sufficient bandwidth, and enough devices is crucial to ensure that everyone can participate equally across all faculties. These infrastructural upgrades would help reduce disparities in access to online learning tools and foster a more equitable digital learning environment.

Additionally, CUEA should create a comprehensive Digital Collaborative Learning Policy that formalizes group work in digital spaces, weaves digital collaboration into the curriculum, and encourages assessment methods that value teamwork, problem-solving, and critical thinking. This policy would offer a structured framework to help both instructors and students adopt effective digital learning practices.

Faculty members should also receive support through regular professional development workshops that focus on digital pedagogy and collaborative learning techniques. To promote adoption, the university could introduce incentives that recognize and reward faculty who successfully integrate digital collaboration into their teaching. These initiatives would help cultivate a culture of innovation and continuous improvement in teaching and learning throughout the institution.

## References

- [1]. Adedoyin, O. B., & Soykan, E. (2020). COVID-19 pandemic and online learning: The challenges and opportunities. *Interactive Learning Environments*, 1–13. <https://doi.org/10.1080/10494820.2020.1813180>.
- [2]. Alemayehu, Y. T., & Zeleke, W. (2022). Digital learning challenges and student engagement in Ethiopian universities. *Ethiopian Journal of Education and Sciences*, 17(1), 45–60.
- [3]. Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating E-learning systems' success: An empirical study. *Computers in Human Behavior*, 102, 67–86. <https://doi.org/10.1016/j.chb.2019.08.004>
- [4]. Algahtani, A. F. (2021). Digital learning in Kenyan universities: A comparative perspective. *Journal of E-Learning and Higher Education*, 2021, 1–10. <https://doi.org/10.5171/2021.345672>.
- [5]. Algahtani, M. (2021). The impact of digital learning on student performance in higher education institutions. *International Journal of Education and Practice*, 9(1), 35–48. <https://doi.org/10.18488/journal.61.2021.91.35.48>.
- [6]. Altowairiki, N. (2021). Facilitating collaboration in online learning. *International Journal of Educational Technology*.
- [7]. Alupe University. (2025). *Courses offered at Alupe University*. Retrieved from CAbera, M. (2023). Implementing e-learning in low-resourced university settings: Comparative institutional readiness in Rwanda and Ethiopia. [ampus.co.ke](https://ampus.co.ke).
- [8]. Bach, A. (2024). Collaborative online learning in higher education: quality of interaction and self-reported outcomes.
- [9]. Bashiri, M., & Kowsari, K. (2024). *Transformative influence of LLM and AI tools in student social media engagement: Analyzing personalization, communication efficiency, and collaborative learning*.
- [10]. Biasutti, M. (2020). A blended learning approach for teaching a music performance class in a higher education setting. *International Journal of Music Education*, 38(1), 66-81.
- [11]. Biasutti, M. (2020). A constructivist approach to STEM learning: The role of digital collaborative platforms. *European Journal of Education Research*, 9(3), 1103–1115. <https://doi.org/10.12973/eu-jer.9.3.1103>

- [12]. Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education*, 18(1), 50. <https://doi.org/10.1186/s41239-021-00282-x>
- [13]. Candia, C., González-Bailón, S., & Underwood, W. (2022). Online peer collaboration and academic performance in digital forums. *Journal of Educational Computing Research*, 60(7), 1820–1842. <https://doi.org/10.1177/07356331221075089>.
- [14]. Candia, C., Maldonado-Trapp, A., Lobos, K., Peña, F., & Bruna, C. (2022). Disadvantaged students increase their academic performance through collective intelligence exposure in emergency remote learning due to covid 19. arXiv preprint arXiv:2203.05621.
- [15]. Carter, H. (2018). Impact of collaborative tools on higher education. *Journal of Educational Technology*, 45(3), 456–471.
- [16]. Carter, H. (2021). Institutional support in digital learning environments: Effects on student outcomes. *Educational Technology Research and Development*, 69(5), 2331–2349. <https://doi.org/10.1007/s11423-021-09952-7>.
- [17]. Carter, S. (2018). Collaborative learning in digital environments: Enhancing knowledge retention and application. *Journal of Educational Research and Practice*, 8(1), 45–59.
- [18]. Cheng, X., Wang, X., Huang, J., & Zarifis, A. (2023). *An experimental study of satisfaction response: Evaluation of online collaborative learning*.
- [19]. Cuban, L. (2021). *Teaching and Learning with Interactive Whiteboards: A Global Perspective*. *Educational Technology Research and Development*, 69(4), 223–238.
- [20]. Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology Systems*, 49(1), 5–22.
- [21]. Fiock, H. (2020). Designing a community of inquiry in online courses. *International Review of Research in Open and Distributed Learning*, 21(1), 134–152. <https://doi.org/10.19173/irrodl.v20i5.3985>.
- [22]. Gachago, D., Morkel, J., Hitge, L., Van Zyl, I., & Ivala, E. (2021). Developing eLearning champions in African universities. *International Journal of Educational Development*, 85, 102447. <https://doi.org/10.1016/j.ijedudev.2021.102447>.
- [23]. Garrison, D. R. (2021). Digital collaborative learning and student engagement in higher education. *Canadian Journal of Educational Technology*, 47(2), 101–115.
- [24]. Garrison, D. R. (2021). *E-Learning in the 21st Century: A Framework for Research and Practice*. *Educational Technology*, 61(1), 34–46.
- [25]. Garrison, D. R. (2021). *Online collaborative learning in underserved environments: Challenges to the Community of Inquiry framework*. *The Internet and Higher Education*, 49, 100805.
- [26]. Huang, R. H., Liu, D. J., Tlili, A., Yang, J. F., & Wang, H. H. (2022). *Handbook on facilitating flexible learning during educational disruption*. UNESCO.
- [27]. Huang, W., et al. (2022). *The Role of Virtual Reality in Educational Settings: An Overview of Current Research Trends*. *Virtual Reality & Intelligent Hardware*, 4(1), 19–32.
- [28]. Jeong, H., Hmelo-Silver, C. E., & Yu, Y. (2019). Ten years of computer-supported collaborative learning: A meta-analysis of CSCL in STEM education. *Educational Research Review*, 28, 100284. <https://doi.org/10.1016/j.edurev.2019.100284>.
- [29]. Johnson et al. (2021). *Impact of Digital Learning Tools in Education*.
- [30]. Kihoro, J. M., Muuro, M. E., & Oboko, R. (2023). The effect of digital collaborative learning on students' academic performance: A study of Kenyatta University. *Kenya Journal of Higher Education*, 7(2), 88–102
- [31]. Kiruma, J. W. (2023). *Diversity and participation in distance learning in Kenya: A study of institutional readiness at the University of Nairobi*.
- [32]. Lee, J., Lim, C., & Kim, H. (2021). Development of collaborative learning strategies for online environments: An experimental study in Korean universities. *Asia Pacific Education Review*, 22(3), 435–451. <https://doi.org/10.1007/s12564-021-09699-9>Local (Kenya).
- [33]. Liu, M., Kang, J., McKelroy, E., Harron, J., & Liu, S. (2020). Examining the use of Zoom and other video conferencing tools in online learning. *Online Learning*, 24(4), 1–18. <https://doi.org/10.24059/olj.v24i4.2322>.
- [34]. Wagacha, P. W., Oboko, R., & Kihoro, J. (2025). Students perceived challenges in an online collaborative learning environment: A case of higher learning institutions in Nairobi, Kenya. *International Review of Research in Open and Distributed Learning*,
- [35]. Maksum, A. (2025). Social presence in digital classrooms: Fostering collaborative learning through institutional support.
- [36]. Miller, C., O'Leary, S., & Reeves, J. (2021). Digital self-efficacy and peer modeling in online learning. *International Review of Research in Open and Distributed Learning*, 22(1), 89–106. <https://doi.org/10.19173/irrodl.v22i1.4886>
- [37]. Mitaani.co.ke. (n.d.). *Alupe University: location, courses offered and more*. Retrieved from mitaani.co.ke.
- [38]. Mnkandla, E., & Minnaar, A. (2023). *Frameworks for OCL using social media tools*. Tech Trends.
- [39]. Mutula, S. M. (2023). Assessing institutional support for collaborative digital platforms in Kenyan public universities. *Journal of Information Literacy and Society*, 17(1), 32–45.
- [40]. Muuro, M. E., Oboko, R., & Wagacha, P. W. (2019). Challenges affecting collaborative e-learning: Experiences from Kenyan universities. *International Journal of Education and Development using ICT*, 15(2), 45–63.
- [41]. Ng, W. (2022). *Digital literacy in a connected world: Rethinking student competencies*. Routledge.
- [42]. Otieno, P. O., Achieng, R., & Barasa, W. (2024). Infrastructure gaps and digital learning adoption in rural Kenyan universities: A case of Alupe University. *Busia Education Review*, 3(1), 13–27.
- [43]. Parmar, J. S., Mbeki, T., Adegoke, F., & Nyongesa, L. (2025). Peer support networks through digital platforms enhance engagement and academic outcomes: A multi-country African study. *African Journal of Educational Technology*.
- [44]. Parmar, J. S., Mbeki, T., Adegoke, F., & Nyongesa, L. (2025). Peer support networks through digital platforms enhance engagement and academic outcomes: A multi-country study across African universities.
- [45]. Sahoo, P., & Khuntia, U. (2024). Effectiveness of social media-based collaborative learning on student engagement and learning outcomes: A study of undergraduate colleges in Odisha, India.
- [46]. Simelane-Mnisi, S. (2023). *Effectiveness of LMS digital tools used by academics to foster students' engagement*. *Education Sciences*, 13(10), 980.
- [47]. Sirwan, H. (2024). *Fieldwork in qualitative studies: Principles and practices*. Academic Scholars Press.
- [48]. Tenya, A. N., Maina, J. C., & Awuor, F. M. (2023). *Digital Resource Platforms Available for Teaching and Research in Selected Public Universities in Kenya*.
- [49]. Uwamahoro, J., Twagirimukiza, J., & Ndayambaje, I. (2021). The impact of digital learning platforms on science education in Rwandan universities. *Rwanda Journal of Education*, 8(1), 1–15.
- [50]. Vygotsky, L. (1978). *Interaction between learning and development*. M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.), *Mind in Society: The Development of Higher Psychological Processes* (pp. 79–91). Harvard University Press.
- [51]. Wambua, M., & Mwololo, J. (2022). Examining student participation in digital collaborative learning at Masinde Muliro University. *Journal of Educational Technology in Kenya*, 6(1), 41–55.

- [53]. Wardhani, R., Pulungan, D. Z., Irawan, D., Gilaa, T., & Fawait, A. B. (2024). The impact of using collaborative learning platforms on increasing student creativity. *Journal of Computer Science Advancements*, 2(2), 73–9.
- [54]. Wasanga, M. M. (2022). The effectiveness of digital readiness strategies among university students in Kenya. *East African Journal of Education and Social Sciences*, 3(2), 54–6
- [55]. Zheng, L., Chen, N. S., & Huang, R. (2021). Effects of digital collaborative learning on students' critical thinking and problem-solving: A meta-analysis. *British Journal of Educational Technology*, 52(1), 25–47. <https://doi.org/10.1111/bjet.13051>