education policy analysis archives

A peer-reviewed, independent,
open access, multilingual journal

epaa aape
Arizona State University

Volume 33 Number 34 May 27, 2025 ISSN 1068-2341

Challenges of Implementing E-Learning in African Universities: Experiences from Ethiopia and Rwanda

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Citation: Abera, M., Bimenyimana, P. C., Abebe, S. M., Byungura, J. C., Ndikumana, R., & Jemal, M. W. (2025). Challenges of implementing e-learning in African universities: Experiences from Ethiopia and Rwanda. *Education Policy Analysis Archives, 33*(34). https://doi.org/10.14507/epaa.33.8772

Journal website: http://epaa.asu.edu/ojs/
Facebook: /EPAAA
Twitter: @epaa_aape

Manuscript received: 31/5/2024
Revisions received: 31/3/2025
Accepted: 1/4/2025

Abstract: The COVID-19 pandemic significantly disrupted society, the economy, and education. The University of Gondar (UoG) and the University of Rwanda (UR) were similarly affected. Both closed their campuses, suspended face-to-face learning, and embraced internet-based resources and tools. However, successful transitions from class-based learning to e-learning require embedding e-learning in their culture, structure, policy, and processes. In this paper, we explored their challenges in this process. We used the ecological systems perspective and viewed the universities as interrelated units capable of fulfilling institutional functions and responding or adjusting to ecological factors. We collected data through document review, key informant interview (KII), and focus group discussion (FGD). We audio-recorded and transcribed all KIIs and FGDs. We used Atlas.ti(9) to iteratively code, re-code, and categorize results under four themes: (a) technology/infrastructure, (b) pedagogy/devices, (c) policy/leadership, and (d) culture/skills. The two universities were relatively similar in technology and pedagogy challenges, but the UR reportedly had a better e-learning policy environment, leadership, culture, and skills. We concluded with remarks on how these two African public universities could address these challenges, create institutional resilience, and ensure their e-learning embraces and promotes accessibility, equity, and inclusion.
Keywords: e-learning; PPCT; challenges; university; Ethiopia; Rwanda

Desafíos de la implementación del aprendizaje en línea en universidades africanas: Experiencias de Etiopía y Ruanda

Resumen: La pandemia de COVID-19 interrumpió significativamente la sociedad, la economía y la educación. La Universidad de Gondar (UoG) y la Universidad de Ruanda (UR) se vieron afectadas de manera similar. Ambas cerraron sus campus, suspendieron la enseñanza presencial y adoptaron recursos y herramientas basadas en internet. Sin embargo, una transición exitosa del aprendizaje en el aula al aprendizaje en línea requiere integrar este último en la cultura, estructura, políticas y procesos institucionales. En este artículo, exploramos los desafíos que enfrentaron en este proceso. Utilizamos la perspectiva de los sistemas ecológicos, considerando a las universidades como unidades interrelacionadas capaces de cumplir funciones institucionales y de responder o ajustarse a factores ecológicos. Recopilamos datos mediante revisión documental, entrevistas con informantes clave (EIC) y grupos focales (GF). Todas las EIC y GF fueron grabadas y transcritas. Utilizamos Atlas.ti(9) para codificar, recodificar y categorizar los resultados de manera iterativa bajo cuatro temas: (a) tecnología/infraestructura, (b) pedagogía/dispositivos, (c) políticas/liderazgo, y (d) cultura/habilidades. Las dos universidades enfrentaron desafíos relativamente similares en cuanto a tecnología y pedagogía, pero la UR presentó un entorno más favorable en políticas de aprendizaje en línea, liderazgo, cultura y habilidades. Concluimos con observaciones sobre cómo estas dos universidades públicas africanas pueden abordar estos desafíos, crear resiliencia institucional y asegurar que su aprendizaje en línea promueva el acceso, la equidad y la inclusión.
Palabras clave: aprendizaje en línea; PPCT; desafíos; universidad; Etiopía; Ruanda

Desafios na implementação do ensino a distância em universidades africanas: Experiências da Etiópia e de Ruanda

Resumo: A pandemia da COVID-19 causou profundas interrupções na sociedade, na economia e na educação. A Universidade de Gondar (UoG) e a Universidade de Ruanda (UR) foram igualmente afetadas. Ambas fecharam seus campi, suspenderam o ensino presencial e passaram a utilizar recursos e ferramentas baseados na internet. No entanto, a transição bem-sucedida do ensino presencial para o ensino a distância requer a incorporação deste na cultura, estrutura, políticas e processos institucionais. Neste artigo, investigamos os desafios enfrentados por essas universidades nesse processo. Utilizamos a perspectiva dos sistemas ecológicos e consideramos as universidades

como unidades inter-relacionadas, capazes de cumprir funções institucionais e responder ou se ajustar a fatores ecológicos. Os dados foram coletados por meio de análise documental, entrevistas com informantes-chave (EIC) e grupos focais (GF). Todas as EIC e GF foram gravadas e transcritas. Utilizamos o software Atlas.ti(9) para codificar, recodificar e categorizar os resultados de forma iterativa em quatro temas: (a) tecnologia/infraestrutura, (b) pedagogia/dispositivos, (c) políticas/liderança e (d) cultura/habilidades. As duas universidades apresentaram desafios semelhantes quanto à tecnologia e pedagogia, mas a UR demonstrou um ambiente mais favorável em termos de políticas de EAD, liderança, cultura e habilidades. Concluímos com observações sobre como essas duas universidades públicas africanas podem enfrentar esses desafios, fortalecer sua resiliência institucional e garantir que o ensino a distância promova acessibilidade, equidade e inclusão.
Palavras-chave: ensino a distância; PPCT; desafios; universidade; Etiópia; Ruanda

Challenges of Implementing E-Learning in African Universities: Experiences from Ethiopia and Rwanda

In the 21st century, higher education has embraced e-learning, delivered synchronously, asynchronously, or blended, for its better accessibility, inclusivity, and efficiency (Chandra & Sharma, 2018; Muhie et al., 2020; Pittard, 2004; Seale, 2014). E-learning offers great flexibility for self-paced, self-directed, and personalized learning and facilitates peer feedback and mentoring, which improve learning outcomes for all learners, including those with disabilities (Abdelaziz, 2022; Fayram et al., 2018; Van-Popta et al., 2017; Waight & Oldreive, 2020). E-learners can also effectively collaborate and work across institutions and geography by accessing high-quality course resources from international sources such as open educational resources (OERs) and massive open online courses (MOOCs) that would improve their academic and educational experiences (Gardner & Brooks, 2018; Littlejohn et al., 2016; Reddy et al., 2020).

The COVID-19 pandemic significantly accelerated e-learning innovation and adoption worldwide (Bao, 2020; El-Sabagh, 2021; Nicoleta & Maria-Loredana, 2012; Picciano, 2017; Yavuzalp & Bahcivan, 2021). However, educational institutions in the global South were less prepared for this transition and faced considerable challenges (Kabir et al., 2022). As schools and universities closed to address public health concerns, educators in these regions turned to technology, including the Internet, to facilitate remote learning (Chen & Aytenew, 2021). The integration of digital tools encountered numerous obstacles, especially in Africa, including limited technical skills, lack of awareness, insufficient access to devices, unaffordability, poor internet connectivity, and a general lack of readiness for such a swift shift to e-learning (Eke, 2011; Johnson et al., 2021; Kabir et al., 2022).

Africa experiences barriers to internet access, including unreliable connectivity, high expenses, and frequent power outages (Almahasees et al., 2021; Bao, 2020; Chen & Aytenew, 2021). Many universities are reluctant to embrace technology in education due to challenges such as the high costs of implementation, insufficient infrastructure, a lack of awareness, policy, and resources, and cultural fears surrounding innovation (Atanga et al., 2020; Balaraman et al., 2018; Osubor & Chiemeke, 2015; Tallvid, 2016). Consequently, most transitions from class-based teaching to e-learning are poorly designed, quick fixes. For instance, in Ethiopia, e-learning became synonymous with using any internet-based communication media, and many Ethiopian universities resorted to using emails, websites, etc., to share course content with students (Luele et al., 2023; Mengistie, 2021). Most content was not customized for e-learning. Teachers used Zoom and Microsoft Teams to conduct lectures or thesis defence sessions (Balaraman et al., 2018; Luele et al., 2023). More

importantly, relevant policies on e-learning were either non-existent or in development (Bekele, 2021).

Despite criticism, e-learning could improve both access to and the quality of education (Bhuasiri et al., 2012; Graham, 2019). However, studies identified numerous obstacles to adopting e-learning in developing countries, including a general lack of awareness, low rates of acceptance, limitations in bandwidth and connectivity, low levels of computer literacy, insufficient quality e-learning resources, challenges in maintaining learner online engagement, and language barriers (Balaraman et al., 2018; Osubor & Chiemeke, 2015). Scholars also raised concerns regarding its fairness, particularly in low-resource settings where digital divides are prominent, leading to unequal access to technology and resources among various social groups (Lim et al., 2020; Reddy et al., 2020; Yang et al., 2018). Additionally, educators often overlook the importance of e-learning quality and student experience, which require new content and teaching methods that the existing educational systems and institutional frameworks may not adequately support (Atanga et al., 2020; Kebritchi et al., 2017; Pham et al., 2019; Smith & Northcote, 2017).

A successful e-learning program requires an adequate policy framework, a supportive institutional environment, and robust, flexible communication and administration policies that govern intellectual property and online interactions (Ali, 2021; Bekele, 2021). These elements are crucial for embedding e-learning into the institutional culture, structures, processes, and daily operations (Babeley, 2016; Eke, 2011). Additionally, it is important to consider the societal aspect, ensuring that e-learning does not exacerbate the existing digital divide and exclusion affecting various communities (Catalano et al., 2021; Mengistie, 2021; Tonks et al., 2021). For example, students from rural or remote areas often encounter connectivity issues, while faculty and students with disabilities face unique accessibility challenges (Mengistie, 2021). These disadvantaged groups typically lack access to necessary resources for effective e-learning and sufficient support from mentors, teachers, and administrators, and may not possess adequate e-learning skills. In other words, a successful e-learning program must be calibrated internally and externally. Internally, it should tackle physical, institutional, infrastructural, normative, policy, and perceptual barriers. Externally, it must ensure that it does not create or worsen disadvantages for specific social groups.

This paper explored the challenges the University of Gondar (Ethiopia) and the University of Rwanda experienced in implementing collaborative e-learning programs involving the Mastercard Foundation and Arizona State University. Both institutions envisioned enhancing their e-learning capabilities and improving institutional resilience, particularly in light of challenges such as the COVID-19 pandemic, despite significant challenges. By highlighting these experiences, this study aimed to shed light on their obstacles and lessons, which would inform improved e-learning policymaking and programming in low-resource settings, especially in sub-Saharan Africa.

This study underscores the critical role that e-learning plays in expanding access to quality higher education, aligning with governmental goals to increase enrollment across all education levels (MoE, 2021). To guide this exploration, the study utilized Bronfenbrenner's bioecological theory, providing a comprehensive framework for understanding the systemic interactions that influence e-learning outcomes. It emphasizes the importance of collaboration among the academic community and the need for managing interactions at the institutional and national levels to overcome challenges and achieve effective e-learning implementations.

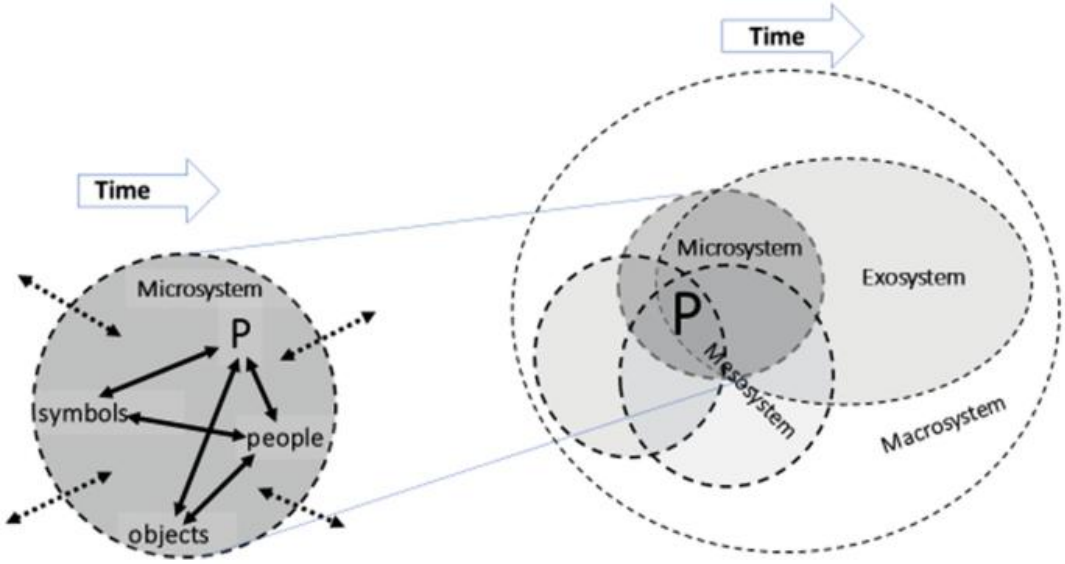
PPCT Model of Human Development: Analytical Framework

This study employs Bronfenbrenner's latest bioecological model – process-person-context-time (PPCT) – which builds on his ecological systems theory (Bronfenbrenner, 1977, 1979, 1989, 1993, 1995, 2005; Bronfenbrenner & Morris, 2006). Over several iterations, the theory has

increasingly highlighted individuals' bidirectional interactions with their environment across four systems: microsystem, mesosystem, exosystem, and macrosystem (see Figure 1; Hayes et al., 2017; Tudge et al., 2022; Tudge & Rosa, 2013). Human development, thus, involves understanding the dynamic relationships between an active individual and their evolving immediate settings (Bronfenbrenner, 1979). The PPCT centers on proximal processes to explain how process, person, context, and time interact in development (Hayes et al., 2017; Tudge & Rosa, 2013).

Figure 1

Analytical Framework: PPCT Model of Human Development



Process, the PPCT model's first component, encompasses all proximal and distal interactions between developing individuals and their environments (Krishnan, 2010). Distal interactions (macrosystem, exosystem, mesosystem) indirectly influence development, while proximal interactions occur within the microsystem through sustained, reciprocal engagements, directly impacting individuals (Bronfenbrenner, 1993; Krishnan, 2010).

The second component, Person, emphasizes the active role of individuals in shaping their development, focusing on biological influences (Hayes et al., 2017). People are not passive recipients but engage dynamically with their environments, influenced by three key traits: active behavioral disposition (e.g., curiosity, aggression), resource characteristics (e.g., education, health), and demand characteristics (e.g., age, gender; Bronfenbrenner & Morris, 2006; Hayes et al., 2017). These traits impact how individuals interact and are perceived, necessitating adaptable learning environments to meet developmental needs (Hayes et al., 2017; Krishnan, 2010). In educational technology, studies show that motivated teachers and students embrace and engage in e-learning better, improving their outcomes in terms of participation and performance (Cabero et al., 2013).

Context, the third component, encompasses ecological systems: microsystem (immediate settings), mesosystem (connections between microsystems), exosystem (indirect influences like parental workplaces), and macrosystem (cultural/national influences; Bronfenbrenner, 1979, 1993; Krishnan, 2010). Activities, roles, and relationships happening at all system levels are crucial for understanding human development.

The final component, Time, accounts for chronological age and significant life events (e.g., schooling, marriage), shaping future experiences, self-efficacy, and motivation (Bronfenbrenner,

1993; Hayes et al., 2017; Krishnan, 2010; Shelton, 2019). Time influences individuals, relationships, and their environment (Shelton, 2019).

The PPCT model provides a structured framework for analyzing the systems influencing e-learning adoption in two African universities, highlighting the role of environmental, cultural, and historical factors. It positions academic community members within layered environments that shape their development and psychosocial change, offering a unified yet nuanced way to examine how immediate and broader contexts affect human development (Bronfenbrenner, 1979, 1995).

Specifically, this study applied the PPCT model to investigate how environmental, institutional, cultural, and historical factors influence teachers' and students' access to technology, motivation, attitudes, and e-learning adoption. Students, teachers, and educational leaders were portrayed as key actors engaging in bidirectional interactions within their institutional settings, national priorities, and the global environment. Given ICT's prominence in society, economy, and education, integrating e-learning is essential. When universities fail to align with this purpose, the benefits of new learning technologies are diminished (Babeley, 2016; Powell & Barbour, 2011). The study examined institutional realities, policies, and structural contexts to assess their impact on resilience, relevance, normative frameworks, leadership, and stakeholder perceptions of e-learning (Ilgaz & Gülbahar, 2015; Judit, 2018; Maina & Nzuki, 2015).

Methods and Procedures

This study employs a cross-sectional, qualitative-exploratory design to collect empirical data and critically review documents to understand e-learning initiatives' development, implementation, and updates during and after COVID-19. Utilizing multiple qualitative methods—including key informant interviews (KIIs), focus group discussions (FGDs), and systematic document analysis—the study compares two universities, the University of Gondar (UoG) in Ethiopia and the University of Rwanda (UoR) in Rwanda, to examine their e-learning development in the context of institutional and policy changes.

Research Design

The study employed a cross-sectional design to collect data between August and September 2022. Empirical data were collected through interviews, FGDs, and a thorough review of institutional documents such as e-learning policies, strategic plans, program reports, and ICT-related documents. A structured framework guided the document review, ensuring a systematic assessment based on clearly defined criteria: policy relevance (alignment with national or institutional eLearning strategies) and institutional impact (measured by policy adoption, funding allocation, or integration into university curricula). These criteria were chosen to align with the study's objective and applied consistently through a coding scheme to enhance reliability. This design enabled the capture of institutional realities at the UoG and UoR.

Study Participants

Study participants included faculty, students, administrators, and national education ministry executives directly involved in e-learning initiatives. The study used purposive sampling to select 37 participants based on their expertise and roles. Specifically, UoG contributed 21 participants—8 faculty members, 6 students, and 7 administrators—and UoR contributed 14 participants—7 faculty members, 4 students, and 3 administrators. Additionally, 2 executive representatives from the national education ministries of Ethiopia were included. These details ensure that the sample represents diverse perspectives across the institutions and educational system.

Data Collection

Data were gathered using qualitative methods and document analysis. All interviews and FGDs were conducted face-to-face in Amharic (the working language in Ethiopia) at UoG and in English at UoR; translation into English was carried out by a certified translator, with back-translation procedures to ensure accuracy. The data collection instruments—semi-structured interview guides and FGD protocols—were piloted and validated through expert review before use.

Document Review

The document review involved a systematic search and a critical appraisal of key institutional and policy documents relevant to higher education policies, distance education, e-learning policies, strategic plans, and documents related to ICT and access to higher education.

Key Informant Interview

We conducted key informant interviews with policymakers, top leadership, deans, directors, and ICT or e-learning experts. Nine interviews were conducted in Ethiopia and 14 in Rwanda, focusing on senior managers and administrators involved in e-learning development. In both sites, interviews were conducted individually, with each session lasting between 45 and 90 minutes, ensuring consistency.

Focus Group Discussion

Furthermore, we organized two FGDs to explore Ethiopia's national and UoG's institutional e-learning contexts. The findings from these FGDs offered valuable insights into the diverse and unique experiences with e-learning. The first FGD included faculty and staff from various academic and administrative units, such as ICT and the registrar's office. The second FGD comprised students from several study programs, including those with disabilities and female students. Each FGD had 6 to 8 participants, was conducted in Amharic, and lasted between 60 and 90 minutes.

Data Analysis

All KIIs and FGDs were audio recorded, transcribed verbatim, and then imported into Atlas.ti for coding. We adhered to rigorous ethical research procedures to collect and analyse empirical data, utilizing a critical document review alongside an iterative coding and thematization process for KIIs and FGDs with the assistance of Atlas.ti (v.9). The data analysis process began with open coding, which we subsequently refined and organized based on conceptual affinities and empirical findings. To ensure reliability, we conducted regular team discussions to address discrepancies, refine code definitions, and maintain consistency in our coding practices.

Furthermore, reflexivity underpinned the overall process, with coders documenting their interpretations and potential biases to enhance transparency. Our shared codebook was continually revised through collaborative reviews, ensuring its comprehensiveness and validity. Grouping related codes created themes that facilitated thematic and narrative analysis, enabling us to extract insights relevant to the research questions. Following the Clarke & Braun (2017) methodological framework, we employed an inductive approach to analysis enhanced by thematic analysis techniques, allowing us to explore the complex contextual and cultural dimensions. We also applied content analysis to critically evaluate and assess key policy and institutional documents integral to the e-learning agenda. Finally, we reported our findings through narratives to ensure clarity and effectiveness in presentation.

Ethical Considerations

We obtained ethical clearance for the study from the institutional research ethics boards of both UoG and UR. Before data collection, all participants provided verbal informed consent, and we used codes and secure data storage to maintain confidentiality and anonymity.

Challenges in E-Learning Implementation

E-learning's popularity as an alternative to conventional classroom-based learning has grown tremendously, especially since the COVID-19 pandemic. However, its design and implementation in the global South have faced many challenges. While exploring two African public universities and their experiences with e-learning, we identified their key challenges as related to technology and infrastructure, pedagogy and content, policy and leadership, and culture and skills. Table 1 provides a summary of these challenges.

Table 1

Summary of Challenges, Indicators, and Sample Quotations

Challenges	Indicators	Quotation
Technology and infrastructure	Inadequate facilities	"Many universities … do not have a well-developed digital center, advanced LMS, or other resources necessary to start e-learning" (P1, FGD-1, UoG)
		"Network and connectivity are a few of the several e-learning challenges at UR" (KII-9, UR)
	Low ICT capacity	"The ICT system capacity is a challenge. It gets slow when a large number of students log on to register online" (KII-3, UoG)
		"Challenges … include limited access to technology and poor internet connectivity" (KII-12, UR).
Lack of skills and gadgets		"UoG has not bought laptops and computer accessories in the past 3 years" (P1, FGD-1, UoG)
		"There is a limited number of computers" (KII-9, UR)
		"Faculty have poor IT skills and [did not have] … ample opportunities to develop their ICT skills related to e-learning content development or pedagogy" (KII-2, UR)
Policy and leadership	Limited coverage of e-learning in current trends	"E-learning is not well explored as a new educational trend. There are only a few guidelines on e-learning without necessary detail" (KII-14, UR)
	Lack of incentives	"Copyright and incentives for content creation may hinder effective e-learning implementation" (P1, FGD-1, UoG).
Culture and skills	Resistance to e-learning adoption	"Some [faculty] were hesitant or resistant to using e-learning, while others were eager to adopt it" (KII-12, UR).
		"There could be resistance from the old guard … due to lack of capacity, skills, or awareness of its benefits" (KII-1, E-MoE).
	Inadequate digital literacy and staff willingness to adopt e-learning	"Many faculty lack the digital skills required to develop multimedia course content … for e-learning (P1, FGD-1, UoG)
		UR needs to "mobilize lecturers and equip them with enough skills in interactive digital content" (KII-13, UR).

Technology and Infrastructure

Many participants reported that both universities lack adequate ICT infrastructure and personnel to support successful and sustainable e-learning implementation. Participants referred to damaged or poorly maintained equipment or devices retained and developed for human resources as "inadequate." For instance, a participant at UoG commented that though many universities have invested in ICT infrastructure, they "do not have a well-developed digital center, advanced LMS, or other resources necessary to start e-learning" (P1, FGD-1, UoG). Another participant at UoG added that "technological infrastructure is also a significant concern for UoG leadership, including data center capacity, processing and storage capabilities, reliable wireless and wired network systems, and support systems" (KII-3, UoG). For this participant, it is doubtful whether UoG's ICT infrastructure would handle the online activities that e-learning entails: "The ICT system capacity is a challenge. [Let alone e-learning], it gets slow when many students log on to register online" (KII-3, UoG). Still other participants were concerns with ICT's manpower to run or manage a full-fledged e-learning platform, stating the existing staff "need further training to calibrate their e-learning skills and competencies" (KII-2, UoG).

Furthermore, FGD participants lamented that unreliable electricity and connectivity have affected e-learning delivery: "Connectivity will be a major challenge to e-learning [at the UoG]. Power interruptions and outages are frequent" (P5, FGD-2, UoG). This challenge is critical, forcing faculty to "submit students' grades online and in print … since we are not confident in internet connectivity" (P6, FGD-1, UoG). The participant added, "We struggle to maintain stable connectivity to complete simple administrative procedures like registering students, uploading students' performance reports, etc." (P6, FGD-1, UoG). Accordingly, many faculty members utilize traditional communication channels with learners.

These narratives show that the UoG is facing significant challenges with its ICT infrastructure, which is currently insufficient to meet the needs of its community. Users experience notable slowdowns, particularly during peak usage times, and the ICT staff lacks the necessary skills to manage the existing facilities effectively, resulting in suboptimal resource utilization. Furthermore, frequent electricity and connectivity problems disrupt routine communication, diminishing faculty confidence in the current systems. To address these issues, UoG must reassess its bandwidth capacity, ensure reliable access to electricity, and invest in staff development. This will be essential for creating an effective e-learning platform that serves its community effectively.

On the other hand, ICT and the internet also present significant challenges to implementing an e-learning initiative at UR. One participant stated, "Network and connectivity are among the primary e-learning challenges at UR" (KII-9, UR). Another participant noted that "limited access to technology and poor internet connectivity" are key obstacles to adopting e-learning at UR (KII-12, UR). Due to these challenges, a participant remarked that UR is "embarking on e-learning" and stressed that "all stakeholders should support it with increased budget and training for effective management" (KII-8, UR). These observations regarding UR's difficulties with internet connectivity and ICT reflect similar concerns voiced by participants from UoG about their university's ICT infrastructure and technology, highlighting the urgent need for decisive interventions in both institutions.

Devices and Pedagogy

Participants in both universities also raised concerns regarding accessing affordable and necessary tech devices such as laptops, tablets, and smartphones required for e-learning (e.g., P5, FGD-2). Many participants also noted the enormity of this challenge for most students and their families in the context of the rising cost of living. For instance, a participant reported that "most

students have phones with keypads. They use desktops at libraries to access digital content" (P1, FGD-2, UoG). A participant observed, "As it is known, not all students have access to smartphones, laptops, or computers" (KII-3, UoG). Only a handful of students, mostly in graduate programs and from well-to-do families, have laptops, tablets, or smartphones.

E-learning's technology-intensive nature is its main challenge at the UoG: "Each student should have a computer or smartphone" (P1, FGD-1, UoG). For a participant, "The main challenge of e-learning is access to resources" (KII-3, UoG). Teachers, too, need digital centers with necessary devices, including a computer, camera, editing equipment, or tools, etc., to prepare digitalized course content. Despite this, "the UoG has not bought laptops and computer accessories in the past 3 years [to maintain broken ones]" (P1, FGD-1, UoG).

Participants noted that the UoG faces a significant shortage of technology devices for faculty, hampering their ability to deliver quality education, and most students lack equipment for effective e-learning. To address these issues, the university needs to establish digital centers to enable faculty to create and access high-quality online course materials, enhancing the overall educational experience for teachers and students.

On the other hand, participants at the UR expressed concerns regarding the limitations in resources and skills that hinder effective e-learning. One noted the "insufficient number of computers available for users" (KII-9, UR); and another highlighted "the faculty's lack of computers and adequate IT skills," emphasizing that "they have not had sufficient opportunities to develop relevant ICT skills for e-learning content development or pedagogy throughout their educational journeys" (KII-2, UR). To address these issues, participants suggested establishing a specialized pedagogical unit to enhance faculty ICT and e-learning competencies. However, they also pointed out that "the heavy workloads of faculty members, stemming from an unfavorable staff-student ratio and the need to engage in additional teaching, research, and consultancy to maintain a decent income as well as publishing (KII-2, UR), detract from their focus on creating high-quality e-learning materials. As a result, "many e-learning platforms and content remain largely inaccessible to students" (KII-2, UR).

It is worth noting that, unlike UoG, UR has a guiding policy that facilitates the creation of "some ICT facilities that support e-learning and require both academic staff and students to embark on e-learning." Nonetheless, "the pedagogical skills for e-learning need to be taught to faculty" (KII-8, UR). Another participant agreed, "lecturers and students need to keep improving their blended teaching-learning skills" (UR, KII-13).

Moreover, participants have expressed concerns about UR's current e-learning approach, citing inadequate support in advising, tutoring, mentoring, and hands-on laboratory or technical learning (KII-12, UR). While UR has leveraged its policy on distance and open learning to develop online course content during and after COVID-19, the limited access to tech devices and ICT skills among students and faculty presents significant barriers. Participants suggested that to enhance its e-learning initiative, UR needs to invest in training faculty on ICT skills and effective student support in online environments.

Nonetheless, acknowledging its academic community's diversity is essential for an effective e-learning program at the UR. In other words, UR's initiative to improve access to devices and ICT skills within its academic community must address "the challenges many students face, particularly those in remote areas with unreliable internet access" (KII-9, UR) and those in difficult circumstances that demand their labor contributions in household chores, or engagement in generating income to support their poor families (KII-12, UR). Many students lack the necessary technology and connectivity for effective e-learning. Additionally, it is crucial for the initiative to foster an e-learning pedagogy that promotes social interaction and a sense of community among learners (KII-12, UR).

Policy and Leadership

Participants at the UR expressed concerns regarding the current policies surrounding e-learning. While there are "guidelines for conventional classroom learning, e-learning has not been sufficiently explored as an educational trend. This resulted in a lack of detailed policies" (KII-14, UR). Hence, to establish e-learning as a standard practice, there is a need for increased confidence and collaboration among leaders. A participant noted that designing an effective e-learning policy and implementing it "requires all partners to work together to minimize existing constraints (KII-3, UR). In this direction, "the university has initiated several measures to promote e-learning's future success, with institutional policymakers and managers showing support and understanding of the necessary steps for effective implementation" (KII-8, UR). Participants agreed that though UR has some e-learning guidelines, they require further detail and revision to facilitate effective governance and implementation. More importantly, UR also has wilful leadership to support e-learning, but engaging partners in the process will be essential to ensure the success of e-learning programs moving forward.

On the other hand, participants in Ethiopia have raised concerns about the absence of comprehensive policy and incentive mechanisms for academic and technical staff involved in e-learning. This issue requires significant attention from leadership, particularly regarding incentives for teachers creating digital content for courses. A participant at the Ethiopian Ministry of Education (E-MoE) acknowledged the necessity of addressing the lack of incentives, mentioning that "developing digital content is not currently viewed as part of teachers' responsibilities. Teachers express frustration over investing their time in these demanding tasks without adequate rewards" (KII-1, E-MoE). Although the E-MoE has attempted to offer incentives, "teachers have rejected the proposals, deeming them insufficient" (KII-1, E-MoE).

Further insights from the UoG suggest that "copyright issues and incentives for content creation could impede the successful implementation of e-learning initiatives" (P1, FGD-1, UoG). Some faculty members emphasize their demands for monetary compensation or reduced teaching loads as essential for continuing their e-learning contributions (KII-2, UoG). The UoG has received limited satisfaction from its leadership and the E-MoE regarding these demands, intensifying concerns that e-learning activities could stall (KII-2, UoG).

Recognizing the problem, the E-MoE is working on a policy and incentive scheme to foster content development while asserting that educational materials should be in the public domain (KII-1, E-MoE). A participant at UoG commented that "a clear e-learning policy is necessary to establish standards surrounding open-access publishing, the non-commercial use of online educational materials, and incentives" (P2, FGD-1, UoG). Overall, participants agreed that the UoG and E-MoE must develop policies and incentive structures to support digital content creators, ensuring faculty members are motivated and acknowledged for their contributions to e-learning.

Culture and Skills

Appropriate e-learning initiatives and their successful implementation depend significantly on academia's cultural and skills environment. Participants at UR were conscientious about their institution's circumstances: "The attitude of the faculty staff towards integrating technology into their teaching can vary. Some were hesitant or resistant to using e-learning, while others were eager to adopt it" (KII-12, UR). The participant explained,

> Factors that can influence a faculty member's attitude towards e-learning include their level of comfort and experience with e-learning, their perceptions of its effectiveness, and the resources and support they can avail. With time, the overall

> level of resistance to using e-learning has significantly decreased, and as of now, no one is resistant (KII-12, UR).

Another participant identified the skills gap among faculty and students in utilizing e-learning resources as impacting their perception and utilization of e-learning platforms. Accordingly, the participant commented, the UR needs to "mobilize lecturers and equip them with enough skills in interactive digital content" to reduce their resistance and improve their adoption of e-learning (KII-13, UR).

On the other hand, participants at UoG repeatedly underlined the academic community's inadequate digital literacy and willingness to adopt e-learning. Many faculty members lack the digital skills to develop multimedia course content, such as videos and images essential for e-learning (P1, FGD-1, UoG). Most students have gaps in their digital skills, and the university's technical staff in computer labs and libraries do not regularly update their ICT skills (P1, FGD-1, UoG). For a participant at the E-MoE, this "lack of capacity, skills, or awareness of its benefits" usually translates into "resistance" to e-learning, especially among "the old guard in universities" (KII-1, E-MoE).

In addition, "a small survey during COVID-19 found that teachers' language skills were below standard" (KII-1, E-MoE), which may affect, for instance, the quality of "online course contents they created" (KII-1, E-MoE). Accordingly, a participant noted that the academic community's technical and language skills must improve through "intensive and adaptive training and a dedicated budget for a time-bound e-learning program" (P1, FGD-1, UoG). Participants also argued that further training and orientation programs on "the importance of e-learning, the quality control features on the LMS, scenarios for e-learning application," (P4, FGD-1, UoG), "experiential learning" (UoG, KII-3, UoG), and "opportunities for online learning" (P2, FGD-1, UoG) should be organized to improve staff willingness and awareness to adopt e-learning.

Participants' reports show that the UR initially struggled with e-learning adoption due to widespread resistance and a lack of necessary skills, which has diminished over time, allowing for greater acceptance of e-learning within the institution. Conversely, the UoG continues to face challenges in implementing e-learning effectively. This situation is largely attributed to its members' inadequate digital skills and confidence to create, manage, and consume digital course content. To foster a cultural shift toward embracing e-learning at both institutions, it is crucial to enhance their capabilities, thereby building confidence and facilitating better integration of technology in education.

Discussion

This study employed a PPCT model and qualitative approach to identify individual, institutional, national, and cultural factors that interact and influence e-learning adoption at UoG and UR. Its findings reflected primarily on infrastructure, pedagogy, policy, and culture. Firstly, participants at UoG and UR noted that their universities adopted e-learning mainly after COVID-19 suspended in-person classes, mirroring trends in the global south (Bao, 2020; El-Sabagh, 2021; Yavuzalp & Bahcivan, 2021). Furthermore, the war in northern Ethiopia uniquely accelerated e-learning at UoG due to campus closures and safety risks. However, UoG's pre-pandemic ICT infrastructure was unready, lacking platforms, digital content, and awareness for a seamless shift.

Secondly, participants observed that Rwanda and Ethiopia's education ministries encouraged digital libraries and online courses. Rwanda mandated e-learning with support from UR, while Ethiopia's MoE worked with universities to compile course materials for online platforms. The UoG instructed undergraduate students to access e-learning resources independently and without adequate guidance. Its graduate students used tools like Microsoft Teams, but faculty often lacked

training to effectively use these resources, as reported for other African universities (Almahasees et al., 2021; Chen & Aytenew, 2021; Johnson et al., 2021; Kabir et al., 2022). Consequently, they relied on platforms like WhatsApp, Facebook, and Webex for communication. They also faced challenges, including poor connectivity, inadequate ICT infrastructure, and a lack of devices, that hindered e-learning at UR and UoG.

Thirdly, the COVID-19 pandemic intensified internet connectivity issues in non-urban areas, creating major challenges for students and faculty. Universities focused on timely graduations, often sacrificing educational quality and making poor investments. This impacted staff and students' views on e-learning adoption, raising concerns about institutional capacity, leadership commitment, and digital skills. Participants also suggested that infrastructure, capacity building, and awareness should have preceded e-learning implementation. However, they support e-learning and recognize the need for strategic investments in information and communication technology (ICT) to enhance educational access and quality.

Fourthly, at both universities, there is a significant confusion surrounding e-learning – its definition, benefits, risks, implementation, and requirements. Many individuals equate e-learning with sharing materials through internet platforms like Telegram or Facebook, highlighting a lack of understanding of its broader scope. This study found that cultural factors such as resistance to change, staff's levels of digital and language literacy, inadequate teacher training, and poorly designed courses that lack inclusivity may have contributed to negative perceptions and hinder the overall success of e-learning initiatives.

Fifthly, the study reported participants' concerns about the inadequate commitment from leadership regarding e-learning adoption. They highlighted that essential institutional investment was lacking in ICT infrastructure, capacity building, and awareness campaigns for a successful e-learning program. This insufficient commitment resulted in poor coordination, monitoring, and evaluation of ICT and e-learning initiatives. Furthermore, weak leadership and unclear strategies for e-learning constitute significant risks, affecting coordination initiatives and incentive mechanisms to motivate staff and students.

In conclusion, a few reflections on the study's use of the ecological systems model to explore e-learning initiatives at UoG and UR. The study's findings effectively highlighted how macro-structural factors, such as national education policies, government priorities, and socio-economic conditions, significantly influence the effectiveness of e-learning programs. These factors can either facilitate or hinder the adoption of e-learning based on their implementation. It also emphasized the importance of exosystemic and mesosystemic elements, including institutional policies, leadership styles, organizational culture, and investment capacity building, in establishing effective e-learning environments. The study found that the readiness to adopt e-learning is greatly influenced by institutional culture and leadership's openness to innovation. Inter-institutional collaboration was noted as vital for knowledge-sharing and resource mobilization.

Furthermore, central to the ecological systems model were various stakeholders—students, faculty, ICT support staff, and administrators—who play critical roles in the success of e-learning initiatives. Students require access to digital resources, while faculty need technical skills and adaptable teaching methods. ICT staff maintain the technological infrastructure, and administrators focus on policy and resource allocation. In light of these findings, this study advocates for a holistic approach to educational transformation that addresses infrastructural and cultural challenges while enhancing stakeholder engagement as implementers and beneficiaries whose skills, attitudes, and commitments are critical for advancing the process. It urges UoG and UR to ensure equitable access to e-learning for diverse student backgrounds. The findings suggest that UR should develop a sustainable e-learning ecosystem beyond temporary COVID-19 measures, focusing on online pedagogy training and inclusive strategies. Both universities must reinvest in e-learning to prevent a

decline in usage and ensure the sustainability of past investments. With these, both universities could effectively navigate the intricacies of digital transformation, aligning strategies with external conditions and internal dynamics, ultimately promoting equitable and high-quality educational outcomes.

Limitations

This study faced several challenges, including time constraints and limited financial support and availability of key informants. It required time to organize visits between both universities to understand the contextual realities and a series of workshops for validation. Addressing this issue, the research team organized virtual meetings to optimize the use of funds and time.

This study was an exploratory, qualitative study based on data collected from purposively selected individuals at the two universities and national leaders for higher education. It is limited in scope and representativeness. We recommend rigorous study on the subject utilizing a mixed-method approach and involving multiple and relevant stakeholders.

Acknowledgement

We extend our heartfelt gratitude to Arizona State University for its financial support, which was instrumental in facilitating our fieldwork and data collection for this article. Additionally, we thank the education administrators, university faculty, students, technical and support staff at the UoG and UR, and the relevant education authorities, for their valuable contributions as discussants and key informants in our study.

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Volume 33 Number 34 May 27, 2025 ISSN 1068-2341