



Digital Strategies for Diverse Learner Engagement in Ugandan Higher Education: A UDL-Informed Qualitative Case Study

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Abstract: This qualitative instrumental case study examined how faculty in the Department of Foundations and Curriculum Studies at Makerere University, Uganda, used digital technologies to foster diverse learner engagement during instructional delivery. Guided by Universal Design for Learning Guidelines 3.0, specifically the Engagement principle, the study collected data through 12 semi-structured interviews, 6 focus group discussions with 47 pre-service teacher trainees, 11 lesson observations (10 face-to-face, 1 virtual), and document analysis of teaching-learning artefacts and institutional policy documents. Data from 59 participants were analysed. Reflexive thematic analysis revealed five sub-themes: institutional conditions and equity gaps; accessible design and low-bandwidth adaptations; welcoming interests, identities, and authentic engagement; sustaining effort, persistence, and emotional capacity; and affective engagement and equity in inclusion strategies. Findings indicate that faculty engagement strategies were ingenious but fragile, dependent on individual resourcefulness rather than systematic institutional support. A two-tier system of exclusion emerged wherein students with disabilities received inconsistent accommodations while faculty with disabilities were rendered almost invisible by inaccessible digital infrastructure. Sustainable digitally mediated engagement requires simultaneous attention to faculty capacity, accessible design, and institutional resourcing. Recommendations include embedding UDL-aligned engagement strategies in faculty development, establishing clear accessibility protocols, and ensuring institutional resourcing for low-bandwidth and assistive technologies.

Keywords: Universal Design for Learning, inclusive digital pedagogy, learner engagement, pedagogical practices, Uganda, higher education

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1. Introduction

Higher education institutions worldwide have embraced digital technologies to transform pedagogy, yet inclusive technology-mediated learning remains uneven (UNESCO, 2023). In Sub-Saharan Africa, unreliable electricity supply, limited connectivity, and inadequate faculty

preparation constrain the potential of digital tools (Muñoz-Najar et al., 2021). Uganda exemplifies these challenges: 75.4% of Ugandans remain offline (DataReportal, 2023), while 12.4% of persons aged 5 years and older live with a functional disability (Uganda Bureau of Statistics, 2019).

The Universal Design for Learning (UDL) framework offers a structured approach to inclusive learning design.

CAST (2024) articulates three principles: designing multiple means of Engagement, Representation, and Action and Expression. The Engagement principle, operationalised through three guidelines (welcoming interests and identities, sustaining effort and persistence, and emotional capacity), directs attention toward pedagogical moves that make any tool effective for diverse learners (Rao et al., 2021; Zhang et al., 2024). This emphasis on pedagogy over technology is particularly relevant where access is uneven, and systematic reviews confirm that UDL implementation faces persistent challenges including limited faculty training and institutional barriers (Moriña et al., 2025).

Existing research documents pragmatic tool adoption in African higher education. Simelane-Mnisi (2023) found South African academics combined LMS features with Microsoft Teams and WhatsApp when institutional systems proved insufficient. Akpa (2025) reported Nigerian students valued WhatsApp for its immediacy and accessibility. Namatende-Sakwa et al. (2023) documented how Ugandan design-based research used Google Docs to scaffold collaborative tasks. However, much of this evidence remains single-institution or tool-specific, and few studies provide thick qualitative accounts of how faculty orchestrate multiple tools under constrained conditions. A critical gap persists in understanding how faculty capacity deficits shape digital engagement strategies in real classrooms. Sikoyo et al. (2023) found many Ugandan academic staff lacked awareness of learners with visual impairments and the capacity to adapt their teaching. Yet how faculty with disabilities navigate digital teaching infrastructure remains largely unexamined. This study addresses these gaps through observational and interview evidence from a Ugandan teacher education department.

1.2 Statement of the Problem

Ugandan policy commitments to digital transformation in higher education, including the Third National Development Plan (NDP III) and the Digital Education Standards and Guidelines (MoES, 2021; NPA, 2020), have not consistently translated into inclusive pedagogical practice. The National Council for Higher Education (2020) reported a student-to-computer ratio of 14:1, while bandwidth remained inadequate for online delivery. Sikoyo et al. (2023) further established that most academic staff across three Ugandan public universities lacked awareness of learners with disabilities and the technical capacity to adapt their teaching and assessment practices.

This study addresses the persistent gap between policy aspirations for inclusive digital learning and the pedagogical practices faculty use to engage diverse learners. While digital tools are embedded in higher education worldwide, evidence on how faculty use them

to enhance diverse learner engagement in Ugandan public universities remains scarce. The absence of deliberate, consistent institutional interventions, including UDL-aligned strategies, assistive technologies, and targeted faculty training, may widen rather than bridge educational inequalities (DataReportal, 2023; MoES, 2021). This study therefore investigated how faculty use digital technologies to foster diverse learner engagement during the teaching-learning process.

1.3 Purpose of the Study

This study aimed to analyse how faculty use digital technologies to enhance diverse learner engagement during instructional delivery in the Department of Foundations and Curriculum Studies, School of Education, Makerere University.

1.4 Justification of the Study

Digital technologies have expanded rapidly in Uganda's higher education, yet this growth has sparked critical debate. Much focus has been tilted toward infrastructure and access rather than pedagogical and human aspects of inclusion, with institutions often prioritising technological innovation over inclusive pedagogical practices. Namazzi and Ssemphala (2024) found that many inclusive teaching initiatives are isolated individual efforts rather than cohesive institutional strategies. This study addresses these gaps through UDL Guidelines 3.0 (CAST, 2024), which offers a structured framework for designing multiple means of Engagement, Representation, and Action and Expression to create accessible, flexible, and inclusive learning experiences (Rao et al., 2021). Examining faculty practices through the UDL lens aims to contribute to a more equitable higher education landscape in Uganda and to global discussions on digital technologies and inclusive learning, moving beyond technological enthusiasm toward a pragmatic approach to genuinely inclusive digital learning in resource-constrained settings.

2. Literature Review

2.1 Theoretical Review

This study draws on two complementary frameworks: Social Constructivism and Universal Design for Learning (UDL) Guidelines 3.0. Social constructivism holds that knowledge emerges through social interaction rather than as fixed facts (Vygotsky, 1978). Learning occurs in the zone of proximal development (ZPD), where educators or peers scaffold cognitive growth. Constructivist classrooms position teachers as facilitators of inquiry, dialogue, and reflection rather than disseminators of information (Bruner, 1996). However, constructivist philosophy often

remains only symbolic at the policy level when teachers do not undergo epistemological change, thus creating discrepancies between theory and practice (Bardakci et al., 2021).

UDL translates universal design logic from the built environment into pedagogy, in which designers anticipate variability and proactively reduce barriers (Rose & Meyer, 2002). UDL Guidelines 3.0 reframes its principles as design goals: design multiple means of Engagement, Representation, and Action and Expression (CAST, 2024). This shift from "provide" to "design" asks educators to plan intentionally for variability rather than add options as afterthoughts. UDL is grounded in cognitive science, which identifies three brain networks: the affective network (the why of learning), the recognition network (the what of learning), and the strategic network (the how of learning).

This study focuses on the Engagement principle (the why of learning), organised around three guidelines: welcoming interests and identities, sustaining effort and persistence, and emotional capacity. Welcoming interests and identities involve optimising choice, relevance, and authenticity while addressing biases and distractions. Sustaining effort and persistence involves clarifying goals, optimising challenges, fostering collaboration and belonging, and offering action-oriented feedback. Emotional capacity involves recognising beliefs and motivations, developing self- and other-awareness, promoting reflection, and cultivating empathy (CAST, 2018; CAST, 2024). The Engagement principle fits well here because it shifts attention from tools to the pedagogical moves that make any tool effective for diverse learners, especially when digital access is uneven.

Reflexive thematic analysis (Braun & Clarke, 2021) served as the analytic framework, aligning with the study's social constructivist paradigm. Its six-phase process provided systematic yet flexible data organisation, supported by MAXQDA 24 (VERBI Software), while preserving researcher-led interpretation.

2.2 Empirical Review

Digital technologies enhance accessibility, expand resources, enable personalised pathways, and foster engagement (Mayer, 2009; UNESCO, 2023). Text-to-speech, screen readers, and captioning improve access for students with visual and hearing impairments, while adjustable fonts and colour-contrasts enhance usability (W3C, 2018; Baguma & Wolters, 2021). Simulations and collaborative platforms provide timely feedback (Hanus & Fox, 2015). Flexible pacing and data-informed feedback support diverse learners (Basham et al., 2016). Paired with instructional support, adaptive systems provide targeted practice aligned with individual progress (UNESCO,

2023). However, the digital divide persists where infrastructure and affordability limit access, requiring targeted investment and inclusive design (ITU, 2023). Faculty development is essential and requires sustained professional learning that combines technical training with pedagogical coaching and mentoring (Pomerantz & Brooks, 2017).

Inclusive learning should integrate technology in ways that recognise diversity and support equitable experiences (CAST, 2018). Inclusive higher education rejects one-size-fits-all approaches by anticipating variability and removing barriers proactively (Moriña, 2017). Institutions should design environments that adapt to diverse cognitive, sensory, and socio-emotional profiles. UDL offers principles for doing so through multiple means of Engagement, Representation, and Action and Expression (CAST, 2024). Discipline-specific guides help faculty translate principles into practice (Israel et al., 2020). Belonging is also essential, and collaborative designs strengthen community. Faculty shape norms that foreground equity and mutual respect (Dewsbury & Brame, 2019; Tai et al., 2023). Aligning inclusive pedagogy with diversity and inclusion strategies sustains practice rather than making it episodic (Brancaccio-Taras et al., 2022).

Ugandan policy provides a foundation for technology-enabled inclusion, yet practice requires context-sensitive planning (MoES, 2021; NPA, 2020). Infrastructure remains a constraint: unreliable electricity, intermittent connectivity, limited bandwidth, and ageing hardware restrict pedagogical affordances (EPRC, 2021). The 2019/20 State of Higher Education report documented 20,147 functional computers, a 14:1 student-to-computer ratio, with bandwidth inadequate for online delivery (NCHE, 2020). Socio-cultural dynamics also shape who benefits: language, stigma, and socioeconomic disparities require strategies combining technology with awareness-raising and culturally responsive pedagogy (UNESCO, 2021). Technology cannot be a neutral fix; it must attend to context and equity.

Digital engagement strategies encompass pedagogical choices that welcome interests and identities, sustain effort and persistence, and support emotional capacity. Systematic reviews show that instructor behaviours such as clear goal setting, scaffolded tasks, and timely feedback improve participation (Hu & Xiao, 2025). Qualitative work confirms that deliberate course structure and sequenced tasks sustain engagement better than technology alone (Heilporn et al., 2021). However, evidence remains skewed toward high-resource settings. African research highlights hybrid practices: South African academics combined LMS features with Microsoft Teams and WhatsApp when systems proved insufficient (Simelane-Mnisi, 2023). Nigerian students valued WhatsApp for immediacy and accessibility (Akpa,

2025). Ugandan design-based research used Google Docs to scaffold collaborative tasks, yielding principles including feedback loops and recognition of diverse learner styles (Namatende-Sakwa et al., 2023). Ethiopian flipped classroom experiments improved engagement but revealed a caveat: they assumed reliable out-of-class access, which is quite next to impossible, especially where data is expensive and connectivity is intermittent (Faro et al., 2024). A 2023 study across three Ugandan universities found most staff lacked awareness of students with visual impairments' needs and technical capacity to adapt teaching, due to absent prior information, poor coordination, and near-total lack of formal orientation (Sikoyo et al., 2023). This reflects an absence of emotional capacity, particularly developing awareness of self and others and recognising expectations, beliefs, and motivations.

3. Methodology

3.1 Research Approach and Design

This study adopted a qualitative approach situated within a social constructivist, interpretivist paradigm. The study employed a qualitative instrumental case study design to examine Makerere University's School of Education as a bounded system that illuminated broader phenomena related to UDL Guidelines 3.0 and digital inclusion (Yin, 2018). The case study design enabled intensive, multi-sourced data collection during the field period, including classroom observations in physical and online settings, semi-structured interviews, focus group discussions, and document analysis. The researcher produced a rich, descriptive account that explained how faculty designed and negotiated inclusive practices with digital technologies within the Department of Foundations and Curriculum Studies.

3.2 Population

The primary unit of analysis comprised faculty from the Department of Foundations and Curriculum Studies at Makerere University's School of Education. The study purposively selected these facilitators because they design and deliver mandatory professional courses that shape pedagogical norms, assessment practices, and curriculum decisions relevant to inclusive, technology-mediated teaching. The faculty target included instructors of Curriculum Studies, Comparative Education, Philosophy of Education, Educational, Social and Organisational Psychology, and Educational Administration. To triangulate faculty perspectives, the study also captured learner experiences from pre-service teacher trainees enrolled in the Bachelor of Arts with Education (B.A.Ed.) and Bachelor of Science with Education (B.Sc.Ed.) programmes across first, second, and third years. In addition, the study targeted institutional actors, including programme coordinators, learning-technology support staff, policymakers, and leaders, chosen for their roles in policy implementation, infrastructure management, capacity building, and leadership.

3.3 Participant Sample and Sampling Procedure

The study employed purposive sampling with a maximum-variation strategy to select participants who could best illuminate how inclusive, digitally mediated pedagogy is designed and enacted. Maximum variation sampling enabled the researcher to identify common patterns across diversity while also capturing divergent perspectives (Rana et al., 2023). Sample decisions were guided by principles of information richness and saturation and by practical constraints of time and access (Guest et al., 2006).

Table 1 Participant Demographics and Distribution

Category	Sub-Category	Number	Gender Distribution
Faculty	Department of Foundations and Curriculum Studies, including 1 with SEN (visual)	7	2 females, 5 males
Pre-service Teacher Trainees	B.A.Ed. and B.Sc.Ed. (Years 1–3), including 7 with SEN (4 physical, 2 speech & hearing, 1 visual)	47	23 females, 24 males
Key Informants	Makerere University teaching and non-teaching units, including 1 with SEN (visual)	4	2 females, 2 males
	National Council for Higher Education	1	female
Total analysed		59	

Table 1 presents participant demographics and distribution. Seven faculty members from the Department of Foundations and Curriculum Studies participated: 2 females and 5 males. One female faculty member had a visual impairment. Their ages ranged from approximately 30 to 55 years, with 3 to 21 years of teaching experience.

Forty-seven pre-service teacher trainees, including 7 with special educational needs, participated in 6 focus group discussions and were aged 19 to 25 years. Five key informants provided institutional and policy perspectives: 4 from Makerere University's teaching and non-teaching units and 1 from the National Council for Higher

Education. Although 63 participants were recruited, data from 59 were analysed. The researchers excluded data from 4 key informants because their responses did not address the research question, leaving 5 whose data were analysed, interpreted, and discussed.

Each participant was assigned a unique code to maintain confidentiality. Faculty members were labelled F1 to F8, with the suffix SEN where a special educational need was relevant and KI where a faculty member also served as a key informant. Students were coded by year (Y1, Y2, Y3), programme (A for Arts, S for Science), and individual

number, with SEN where applicable. Key informants were designated with the suffix KI and identified by their institutional roles: NCHE-KI, IODEL-KI, CISO-KI, F3-KI, and Y2A3(SEN)-KI. F3-KI held a faculty position but entered the study through his SEN coordination role and was counted once under key informants. Y2A3(SEN)-KI, a Year 2 B.A.Ed. student leader who represented students with special educational needs, was likewise counted once under key informants.

3.4 Data Collection Tools

Table 2. Summary of Data Collection Instruments and Sources

Instrument	Number	Participants/Sources	Focus
Semi-structured interviews	12	7 faculty, 5 key informants	Attitudes, experiences, and reflections on engagement strategies
Focus group discussions	6	47 pre-service teacher trainees	Learner experiences, accessibility barriers, affective dimensions
Lesson observations	11	10 face-to-face, 1 online via Google Meet	Instructional delivery, student responses
Document analysis	Approx. 23	Institutional policies, manuals, course outlines, coursework templates, etc.	Structural context for engagement design

Table 2 summarises the four instruments used. Semi-structured interviews explored attitudes, experiences, and reflections on digital engagement strategies. Focus group discussions captured learner experiences of faculty engagement practices, accessibility barriers, and affective dimensions of participation. Lesson observations documented faculty actions during instruction and students' responses. Document analysis provided the structural context within which engagement strategies were designed, mandated, or constrained.

3.5 Data Collection Procedure

Following institutional authorisation from the Dean, School of Education, Moi University, the researcher submitted the protocol and instruments to Uganda Christian University's Research Ethics Committee (UCU-REC) for ethical review. Upon clearance, the researcher obtained national approval from the Uganda National Council for Science and Technology (UNCST) and finalised site-level arrangements with the Dean, School of Education, Makerere University. The researcher then recruited and briefed research assistants and coordinated participant recruitment and scheduling for lesson observations, interviews, focus group discussions, and document analysis in line with the approved protocol (Leavy, 2017).

3.6 Data Analysis Procedure

The study adopted reflexive thematic analysis following the six-phase process outlined by Braun and Clarke (2021). This approach was chosen because it aligns with

the study's social constructivist paradigm and emphasises the researcher's active role in interpreting meaning. MAXQDA 24 (VERBI Software) supported the analysis by facilitating data organisation and code management while preserving researcher-led interpretation. The UDL principle of Engagement guided the analysis, with its three guidelines providing the analytical lens through which engagement practices were examined.

3.7 Ethical Considerations

This study adhered to beneficence, non-maleficence, respect for autonomy, and justice, operationalised through approvals, transparent recruitment, secure data handling, and responsible dissemination (Creswell & Poth, 2016). The researcher secured institutional and regulatory permissions before fieldwork. Recruitment materials outlined the study's purpose, voluntary participation, confidentiality, and accommodations for participants with disabilities. Consent was documented through signatures, fingerprints for visually impaired participants, or, when needed, oral consent with a witness, ensuring it was genuine and freely given (Creswell & Creswell, 2018:2023). All identifying details were pseudonymised, including names, exact job titles, and precise ages. Age ranges replaced birth dates, and support persons were described generically. The team stored raw recordings securely with restricted access; transcripts were pseudonymised and redacted. The researcher locked all digital and physical records for five years post-study. The study minimised risks such as emotional discomfort through transparent briefing, the option to pause or withdraw, and referral to support services. Participation

was voluntary, and the study obtained informed consent before data collection.

3.8 Trustworthiness

The study treated trustworthiness as a coherent quality-assurance framework. The study ensured credibility through methodological triangulation, prolonged engagement, and participant validation. The study supported transferability through thick, contextualised descriptions of the institutional setting and participant characteristics, along with transparent sampling criteria. The audit trail recorded data collection timelines, coding iterations, analytic decisions, and peer debriefing supported dependability. To ensure confirmability, the researcher explicitly linked interpretations to source data, actively sought discrepant cases, and systematically preserved raw data, coded excerpts, and analytic memos (Stahl & King, 2020).

4. Results and Discussion

4.1 Institutional Conditions and Equity Gaps

The conditions shaping faculty digital engagement strategies were not neutral; they determined what engagement was possible, for whom, and how consistent it was. Professional development varied considerably. A faculty member in Educational, Social and Organisational Psychology acknowledged IODEL's training on online assessment and instruction, yet IODEL-KI described a champions-based cascade model that depended on early adopters to mentor colleagues, thus rendering its sustainability unpredictable. More pointedly, another faculty member critiqued, "The failure of organisers of CPDs to understand how adults learn...I don't have a laptop...the salary is little...I am demotivated." This misalignment between training and faculty realities was compounded by infrastructure that further constrained what faculty could attempt. A Year 2 Science student observed that "the most commonly used digital tool by lecturers is a projector," yet functionality could not be assumed. F3-KI, a faculty member and SEN coordinator, revealed a telling maintenance problem: "Those microphones use batteries...when they don't have, nobody uses...for them me...I buy my own and put there." Without batteries, lectures lacked amplification, narrowing participation to front-row seats. The burden fell disproportionately on faculty with disabilities. F7 (SEN), a visually impaired faculty member, could not use the projector because it required visual reference, so she taught from memory instead. Student responses corroborated these infrastructural challenges: a Year 1 Science student explained that campus Wi-Fi frequently showed "limited connection" or "connected without

Internet," while another summarised: "The overall challenge is costs. If you're to access MUELE, you need data because you won't rely on this Wi-Fi which is on and off."

Policy expectations further diverged from practice. Although each course was required to have at least two staff, several faculty taught large courses alone. A Year 3 Arts student observed that the Makerere University E-Learning Environment (MUELE) use declined sharply by third year: "In year one and two, notes were uploaded before every lecture...by year three, there was no content update." The university's accessibility provisions followed a similar pattern. The Disability Support Centre provided assistive technologies, but a student leader for students with special educational needs highlighted a monitoring challenge:

The good thing the main library has it but the problem we have, that closed-circuit television (CCTV) magnifier, I have never found it connected to electricity and I have tried to talk to them but they don't work on them. So, which means we have the gadgets, but the monitoring is not good (Y2A3(SEN)-KI).

Y2A4(SEN), a student with visual impairment, found the university's Learning Management System (LMS) incompatible with screen readers. CISO-KI confirmed that Mastercard-funded assistive technologies included ten screen readers and a Braille embosser, yet the student-to-desktop ratio was approximately 8:1. Accessibility policy existed; practical infrastructure remained stretched.

These findings align with Muñoz-Najar et al. (2021), who observed that infrastructural limitations constrain digital tools' pedagogical potential. The pattern of faculty absorbing maintenance costs echoes Kibuuka's (2025) identification of funding shortages as a core institutional challenge, while the misalignment between professional development and faculty realities corroborates Pomerantz and Brooks's (2017) argument that effective integration requires sustained learning combining technical training with pedagogical coaching. Furthermore, stretched access to resources confirms Sikoyo et al.'s (2023) finding that availability alone is insufficient without systematic monitoring and maintenance. Watuleke et al. (2026) similarly found that faculty resilience drove innovation despite institutional constraints, reinforcing this study's central observation that individual resourcefulness too often substitutes for systemic support.

4.2 Accessible Design and Low-Bandwidth Adaptations

Given infrastructural constraints, faculty adopted low-bandwidth strategies that shaped participation. A faculty member from Educational Psychology used phone-

recorded video assignments and flip charts to sustain lessons without reliable projectors or internet. WhatsApp became the connective tissue. She stated, "WhatsApp, for me, is easier and all my students are on WhatsApp." A Year 2 Science student confirmed WhatsApp groups handled announcements, PDFs, and lecturer communication. Yet WhatsApp was also a distraction, as a Year 1 Arts student explained:

We find there are over 1,000 messages and the lecturer has sent the work at midday and you have joined the group at 10:00 pm, meaning you find when the messages are too many and you cannot even see that work. You find yourself missing out.

Y2A3(SEN)-KI noted that MUELE "was good and it was educating us," suggesting the platforms served different functions. However, accessibility challenges extended to content. Y2A3(SEN)-KI's reflection document noted that "some course units are not accessible" for students with visual impairments, particularly those with graphs and tables, and called for "a lecturer who knows braille in Kiswahili department." The curriculum lacked alternative formats, and the university had not ensured Braille-competent staff.

These findings confirm Simelane-Mnisi (2023) and Akpa (2025) on hybrid tool adoption. However, this study reveals a trade-off: faculty traded pedagogical functionality for accessibility, as WhatsApp lacked LMS capabilities for organising materials and meeting accessibility standards. This confirms Namatende-Sakwa et al.'s (2023) emphasis on design principles that recognise diverse learner styles, while extending their work by showing that such principles require institutional support. Ayanwale and Molefi (2025) similarly affirm that sustaining engagement is challenging when infrastructure is unreliable.

4.3 Welcoming Interests, Identities, and Authentic Engagement

Faculty captured student attention through contextual hooks and local relevance. A Year 2 Science student noted that "some lecturers project videos from YouTube." A faculty member from Comparative Education used YouTube videos on the Finnish Education System, connecting them to Ugandan realities, and required students to create their own video content. A Year 2 Arts student explained that projection helped learning "by seeing," as examples from Ugandan news made content relatable. Another student in the same group noted that the projector "captivates the attention of the students." Y1A3 argued that projection with speakers benefited both visually and hearing-impaired learners, suggesting well-designed visual content paired with audio welcomes diverse identities across sensory modalities. Community-based tasks offered a second strategy. The same faculty

member required students to interview community stakeholders and upload video findings to YouTube. A Year 2 Science student described conducting experiments and recording videos. Y1A2(SEN) recounted that interviewing children and posting videos on YouTube helped build computer skills. These tasks attracted interest through authenticity and built valuable, professionally relevant digital skills. However, friction arose. A Year 2 Science student noted that "the letter of introduction wasn't effective in convincing school owners." An administrator dismissed him: "So you mean I have the time to respond to that questionnaire?" Without institutional support, the engagement potential was undermined.

Simulations offered another pathway. A Year 3 Science student praised Physics Education Technology (PhET) interactive simulations for exploring phenomena too dangerous or expensive to replicate. Yet a Year 2 Science student noted that simulations and virtual labs failed because students and lecturers lacked skills and the university lacked facilities.

The data align with Heilporn et al. (2021), who found that instructors sustain engagement through deliberate structure. The practices enacted the UDL guideline of welcoming interests and identities, specifically optimising relevance and authenticity. However, such practices were concentrated among a few faculty; for most, engagement remained tied to the projector with little student choice. This extends Hu and Xiao (2025) proving that instructor behaviours must be applied consistently to be effective. The friction with community tasks confirms Namatende-Sakwa et al.'s (2023) emphasis on institutional infrastructure for authentic learning.

4.4 Sustaining Effort, Persistence, and Emotional Capacity

Sustaining engagement over a semester required strategies that managed cognitive load and structured participation. Chunking, scheduled prompts, and pacing were central. A Year 2 Science student noted that quizzes, deadlines, and MUELE activities created a rhythm. The Teaching and Learning Policy required that "for courses to be online, at least three quarters of the content should be developed" (Makerere University Teaching and Learning Policy, 2022, p. 3). Y2A8(SEN), a student with special educational needs, explained that MUELE "allowed students who learn at different paces" to revisit materials. Another student noted that lecturers unlocked topics sequentially so as not to overwhelm them.

Peer scaffolding provided social support. WhatsApp groups functioned as spaces for questions, resource sharing, and deadline reminders. A Year 2 Arts student noted, "I managed to do all the quizzes on MUELE because I had friends." Where faculty deliberately

structured peer support, as one faculty member did by assigning peer mentors who posted weekly summaries, support was more systematic.

Digital scaffolds also helped learners plan and monitor progress. The Teaching and Learning Policy mandated that "for every course to be taught there shall be a course outline shared and explained to the learners at the commencement of teaching and learning" (Makerere University Teaching and Learning Policy, 2022, p. 3). When outlines were detailed and shared promptly, students had a clear roadmap. Where they were vague or late, students faced uncertainty and anxiety. A Year 2 Science student explained that MUELE shows the scope of coverage, content, and resources. Another noted that lecturers could customise the course flow, thus reducing cognitive load. Nonetheless, institutional constraints disrupted sustained engagement. A Year 2 Science student described how overlapping lectures caused seven- to twelve-minute delays when moving between colleges, making students miss lesson openings. A Year 3 Arts student noted that by third year, "there was minimal reference to MUELE," attributed to unresolved technical frustrations and the assumption that senior students needed less scaffolding.

This data affirm Hu and Xiao's (2025) conclusion that clear goal setting, scaffolded tasks, and timely feedback improve participation. Structured content release and formative quizzes enacted the UDL guideline of sustaining effort and persistence, specifically clarifying goals and offering action-oriented feedback. The decline in MUELE use by third year, however, complicates this picture: it suggests such behaviours must be sustained across semesters, not merely introduced. Faro et al.'s (2024) caution that scaffolds presuppose reliable access also holds. When students paid for data or travelled between halls, their capacity to persist was undermined. Meanwhile, the emotional capacity guideline was only partially enacted: where course outlines were vague or distributed late, students navigated without direction. Emotional capacity thus became an individual responsibility rather than an institutional scaffold.

4.5 Affective Engagement and Equity in Inclusion Strategies

Affective strategies built connection and reduced anxiety. A faculty member of Comparative Education, who taught online via Google Meet, read chat messages aloud, affirmed contributions, and invited students to build on each other's responses. A Year 2 Science student noted that "the lecturer often responded to our messages in the chat and thanked those who shared ideas." These small acts of recognition built a culture where students felt safe to contribute. Another Year 2 Science student observed that shy people were "catered for" in Google Meets because

"no one is looking at me." Y2A3(SEN)-KI, a student leader for learners with special educational needs, added that peer commenting built confidence: "you gain confidence in supplementing on someone's idea and opposing it." In addition, low-stakes formative activities further reduced evaluation anxiety. A faculty member used an online pre-test that "doesn't test their knowledge of content but their abilities in utilising the forums given." This safe entry point reduced fear associated with formal assessment.

However, the affective landscape was not uniformly supportive. Y2A3(SEN)-KI's document on challenges cited "discrimination by students" and instances where lecturers "chase away or discriminate some students." Some students with disabilities were actively excluded, not merely overlooked. Assistive technology provisions revealed similar gaps. The Disability Support Centre documented JAWS, Fusion, and a Braille display, and its utilisation report recorded 717 visits from 208 individuals, with visually impaired students comprising 45.6% of visits. Yet Y2A4(SEN), a student with visual impairment, found MUELE inaccessible: "when I remember the hardships I went through downloading something on MUELE, it was a real struggle, I didn't even do it myself, someone helped." Y2A3(SEN)-KI noted the specialised library at the School of Education was frequently closed: "I have tried to go there around four times; I have never found it open." Y3S6(SEN), a student with hearing impairment, described caption limitations: "sometimes the captions don't translate right things. I get confused." CISO-KI confirmed that accommodations policies were implemented "haphazardly."

The F7(SEN) lesson observation illustrated these gaps vividly. F7(SEN), a visually impaired faculty member, could not use the projector because she could not see the screen, and taught from Braille notes with a guide beside her. A male student with a visual impairment brought his own tablet to record the lecture because content was not otherwise accessible. Most UDL implementation research focuses on learner variability, but these data show faculty variability is equally consequential. The university had procured JAWS and Braille displays for students, but no equivalent provision existed for faculty. The burden of accessible content production fell on students or peer helpers, not the institution.

Data on affective strategies align with literature on instructor presence and emotional engagement. That shy students were "catered for" in Google Meets demonstrates that low-stakes digital participation can reduce social anxiety and broaden engagement, enacting the UDL consideration of developing awareness of self and others. Peer commenting built confidence and supported the emotional capacity guideline by showing that removing emotional barriers functions as a scaffold. However, active discrimination and lecturer hostility extend Sikoyo et al.'s

(2023) documentation of staff unawareness. Exclusion here was not only ignorance but active hostility. The parallel exclusion of faculty with disabilities, wherein F7(SEN) could not use the projector, represents a systemic failure of the UDL Engagement principle. If the teacher cannot engage with digital tools, the entire class's engagement is constrained. This study extends Sikoyo et al. by demonstrating that resource availability alone is insufficient; systematic training, proactive accommodations policies, and accessible design for faculty as well as students are necessary conditions for equitable digital engagement.

4.6 Integrated Discussion

The five sub-themes converge on a single insight: faculty digital engagement practices were patterned, not random, shaped by the interaction of institutional conditions, accessible design choices, and UDL-aligned pedagogical strategies. The data affirm Heilporn et al.'s (2021) finding that deliberate course structure sustains engagement, while extending Hu and Xiao (2025) by proving that such behaviours must remain consistent across semesters to be effective. Faro et al.'s (2024) caution that scaffolds presuppose reliable access also held, yet students paying for data or travelling between halls could not sustain effort.

The WhatsApp trade-off was a striking finding. Faculty chose it not for its pedagogical superiority but for accessibility, aligning with Akpa (2025) and Simelane-Mnisi (2023). Nevertheless, it lacked the LMS capabilities for organising materials and meeting accessibility standards, revealing a tension earlier studies had not adequately addressed.

Accessibility provisions followed a similar pattern. The Disability Support Centre had procured JAWS, Fusion, and Braille displays, yet resources were stretched and monitoring inconsistent. More significantly, the data reveal a parallel exclusion: F7(SEN), a visually impaired faculty member, could not use the projector because she could not see the screen. This extends Sikoyo et al.'s (2023) study by demonstrating that resource availability alone is insufficient; accessible design must include faculty as users, not only students. The community-based tasks designed by one faculty member further exposed this gap: without institutional backing, students shouldered the entire burden of authentic learning, extending Namatende-Sakwa et al.'s (2023) study.

The study thus contributes thick qualitative evidence of how faculty orchestrate digital tools under constraint. Engagement was ingenious but fragile, dependent on individual resourcefulness rather than systemic support. A two-tier exclusion system emerged: students with disabilities received inconsistent accommodations, while

faculty with disabilities were rendered almost invisible by visually biased infrastructure. The three conditions for durable engagement, namely a UDL-aligned repertoire, low-bandwidth adaptation, and institutional resourcing, were partially present but never systemically assured. Engagement remained vibrant only in isolated instances, uneven, and perpetually at risk of disruption.

5. Conclusion and Recommendations

5.1 Conclusions

Digital engagement strategies in this department were ingenious but fragile, dependent on individual faculty resourcefulness rather than institutional support. UDL-aligned practices remained signature moves of individual faculty, not a departmental norm, confirming Heilporn et al. (2021) while showing such practices were not systemic in low-resource contexts.

A two-tier exclusion system persisted: students with disabilities received inconsistent accommodations, while faculty with disabilities were rendered almost invisible by the system's inaccessible digital infrastructure. This extends Sikoyo et al. (2023) by demonstrating that resource availability alone is insufficient; systematic training, proactive accommodations policies, and accessible design for faculty and students are all necessary.

The three conditions for durable engagement; a UDL-aligned repertoire, low-bandwidth adaptation, and institutional resourcing were partially present but never systemically assured. Engagement remained vibrant only in isolated instances. This confirms Faro et al.'s (2024) caution and extends Hu and Xiao (2025) by requiring consistent instructor behaviours across semesters.

5.2 Recommendations

Faculty should design accessible materials from the outset, structure peer support, embed low-stakes formative assessments, and treat affective strategies as central to inclusive participation.

Institutional leaders should make inclusive digital pedagogy a strategic priority, protect budget lines for assistive technology, integrate UDL into quality assurance, and consult students and faculty with disabilities when designing digital environments.

Policymakers should enforce national accessibility standards aligned with WCAG 3.0 and mandate annual institutional reporting on digital accessibility.

Professional development providers should offer practice-embedded, discipline-specific programmes that combine technical training with pedagogical coaching and share

exemplars of UDL operationalised in low-bandwidth contexts.

5.3 Suggestions for Further Research

- Future research should prioritise comparative multi-institutional studies
- Longitudinal or intervention research on faculty practices and faculty with disabilities.

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