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# Digital Communication Inequality and Gendered Participation in Online Learning at Victoria University Uganda

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**Abstract.** Digital learning platforms have expanded opportunities for higher education, yet unequal access to digital infrastructure and gender-related social barriers continue to shape students' participation. This study examines digital communication inequality and gendered participation in online learning at Victoria University, Uganda. The study employed a convergent mixed-methods design, combining quantitative and qualitative data. Questionnaires were administered to students, with 78 completed responses retained for quantitative analysis, while semi-structured interviews were conducted with 10 purposively selected university staff members. Descriptive statistics, independent-samples t-tests, Pearson correlation, and thematic analysis were used to examine digital access, platform experiences, and gender-related participation barriers. The findings indicate that students generally perceived the VClass learning management system as reliable and user-friendly, with mean scores of 4.115 and 4.064, respectively. Perceived access to higher education and flexibility in online learning also received positive ratings, with mean scores of 4.090 and 4.192. A strong positive correlation was identified between e-learning infrastructure and educational access ($r = 0.782$, $p < 0.01$). However, gender-related barriers persisted. Among female respondents, 64.3% reported difficulties balancing online learning with household or caregiving responsibilities, while 25.0% reported limited access to devices compared with male family members. Internet connectivity, insufficient computer facilities, and delayed lecturer feedback further constrained participation. Online learning can broaden educational opportunities, but access to digital platforms does not automatically ensure equitable participation.

*Keywords: Digital Communication Inequality; Gendered Participation; Online Learning; Digital Divide; Higher Education; Uganda*

## 1. Introduction

Digital learning has become an important component of higher education, offering opportunities to extend educational participation beyond the geographical, temporal, and institutional boundaries of conventional classrooms (Khalid et al., 2025; Ko, 2026; Vallo Hult et al., 2025; Zou et al., 2025). Learning management systems (LMS), virtual libraries, video-conferencing applications, and online assessment tools enable students to access

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learning materials, communicate with lecturers, and participate in academic activities with greater flexibility. From the perspective of the Capability Approach, Baykal (2025) argues that development should be understood in terms of people's substantive freedoms and their ability to achieve outcomes they value, rather than merely the resources available to them. Applied to higher education, this perspective suggests that the value of digital learning lies not simply in providing students with an online platform but in enabling them to use that platform to acquire knowledge, develop competencies, and participate meaningfully in academic life. Similarly, Colom (2020) explains that digital inequality extends beyond the availability of technology to include differences in digital skills, patterns of use, and the benefits individuals derive from digital resources. Consequently, an equitable online learning environment should ensure that students have affordable internet connectivity, appropriate devices, adequate digital competencies, and supportive learning conditions regardless of gender or socioeconomic circumstances. For example, providing every student with access to an LMS does not necessarily establish educational equality if some students can participate in synchronous discussions while others must share a smartphone with family members or interrupt their studies because of domestic responsibilities. Digital inclusion should therefore be understood as a multidimensional educational objective encompassing technological access, practical capabilities, meaningful participation, and equitable learning opportunities.

The growing adoption of online learning has generated substantial scholarly interest in its potential to expand educational access while simultaneously raising concerns about the unequal distribution of its benefits. Research on digital inequality demonstrates that the digital divide is not adequately explained by a simple distinction between individuals who have internet access and those who do not. Min (2010) and He et al. (2026), for instance, introduced the concept of the second-level digital divide to draw attention to differences in individuals' online skills and their ability to locate and use information effectively. Extending this perspective, Ollonen & Kangas (2025) conceptualizes digital access as a process involving motivational, material, skills-related, and usage dimensions, suggesting that inequalities can persist even after technological access has been established. In higher education (Joshi et al., 2026), these distinctions are particularly important because successful participation requires more than logging into a learning platform; students must also download materials, navigate online resources, submit assignments, communicate with lecturers, and engage in collaborative learning. The UNESCO Global Education Monitoring Report (2024) similarly cautions that educational technology should be evaluated in relation to educational objectives, contextual conditions, and evidence of its actual contribution to learning rather than assumed to be beneficial simply because it is available.

For example, two students may access the same online lecture, yet the student with reliable broadband and a personal laptop can participate in real-time discussions, while another using an unstable mobile connection may experience repeated interruptions and struggle to complete assessments. These differences indicate that the expansion of online learning must be examined alongside the social, economic, and technological conditions shaping students' actual learning experiences.

Empirical literature further demonstrates that digital inequalities intersect with gender, particularly in contexts where access to mobile technology, financial resources, and educational opportunities is unevenly distributed. McCool et al. (2022) reports that women in low- and middle-income countries remain 14% less likely than men to use mobile internet, with approximately 60% of women who remain unconnected living in

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South Asia and sub-Saharan Africa. The report identifies affordability, digital skills, literacy, and safety concerns among the barriers affecting women's access to mobile services.

These broader inequalities have implications for online education because mobile devices and internet connectivity often serve as essential channels for accessing academic materials, participating in virtual classes, and communicating with lecturers. Research on higher education in sub-Saharan Africa has also examined how institutional infrastructure and students' technological circumstances influence the adoption of digital learning. Kumwenda (2025), in their study of the University of Malawi, explored the role of information and communication technologies in increasing access to higher education, while Kitole et al. (2024) investigated factors affecting e-learning adoption in developing-country contexts through evidence from Tanzania. Taken together, these research directions highlight the importance of understanding digital learning within its wider socioeconomic and institutional environment. In Uganda, these concerns are particularly relevant to students who must manage connectivity costs, device availability, competing family responsibilities, and the practical demands of online study.

Despite the expanding literature on digital learning, important questions remain about how technological access translates into gender-equitable participation within particular institutional settings. Existing research has established the relevance of digital infrastructure, affordability, digital competence, and social inequalities to technology adoption and educational access (Assefa et al., 2025; Martini & Sgambato, 2025; Nthambeleni & Motadi, 2025; Rydzewski, 2025; Shamsudinova et al., 2025). However, the presence of a digital divide does not necessarily explain how these factors interact with gendered responsibilities and everyday learning practices within a specific university. In particular, an institution may provide a functional learning management system and express a commitment to gender equality while students continue to experience unequal opportunities to participate in online discussions, complete coursework, or access digital resources at convenient times. This distinction is important because institutional assessments that concentrate primarily on platform availability or student satisfaction may overlook the social conditions that shape participation beyond the classroom. For example, a female student may report that an LMS is easy to navigate but still be unable to attend a live online session because she is responsible for childcare or household tasks during the scheduled class. Similarly, a student who owns a smartphone may remain disadvantaged if internet data are unaffordable or the device must be shared with other household members. The research problem, therefore, concerns not only whether e-learning is available but also whether its technological and institutional arrangements accommodate differences in students' resources, responsibilities, and opportunities for engagement. This study addresses that problem by examining digital communication inequality and gendered participation at Victoria University, Uganda, with particular attention to the relationship between digital infrastructure, educational access, and gender-specific barriers.

The novelty of this study lies in its institution-specific, gender-sensitive examination of online learning as both a technological system and a socially situated communication environment. Rather than treating digital inequality exclusively as a problem of internet availability or technology adoption, the study brings together students' experiences of digital infrastructure, their perceptions of educational access, and gender-related constraints on participation. The former directs attention to whether students can convert available technological resources into meaningful educational opportunities, while the



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latter provides a framework for examining inequalities in material access, digital skills, and patterns of technology use. Together, these perspectives help explain why apparently equal access to an online platform may produce different educational experiences. The study also contributes institution-level evidence from a private university in Uganda, a setting that warrants examination alongside research conducted in other African higher education contexts. Its convergent mixed-methods design combines questionnaire responses from 78 students with semi-structured interviews involving 10 university staff members, allowing quantitative patterns to be interpreted alongside institutional experiences and explanations.

The significance of this research extends to theoretical development, institutional policy, and the broader pursuit of inclusive higher education. Theoretically, it connects digital divide scholarship with the Capability Approach to clarify the distinction between possessing technological resources and having the practical freedom to benefit from them. This distinction encourages researchers to evaluate digital inclusion through multiple dimensions, including affordability, usability, skills, time availability, and the social conditions necessary for meaningful participation. Empirically, the study provides evidence that can help university administrators identify areas in which positive perceptions of online learning coexist with persistent infrastructural or gender-related barriers.

This study aims to examine digital communication inequality and gendered participation in online learning at Victoria University, Uganda. Specifically, it pursues three interconnected objectives: first, to assess how digital infrastructure, internet affordability, device access, and digital competencies relate to students' perceived access to higher education through online learning; second, to examine gender-related differences and barriers affecting students' participation, including domestic and caregiving responsibilities, access to digital devices, safety concerns, and opportunities for academic engagement; and third, to explore how institutional experiences and support arrangements may facilitate or constrain equitable participation in the university's online learning environment.

## 2. Method

This study employed a convergent mixed-methods design to examine digital communication inequality and gendered participation in online learning at Victoria University, Uganda (Creswell & Plano-Clark, 2011; Leech & Onwuegbuzie, 2009; Palinkas et al., 2011). This design enabled the simultaneous collection of quantitative and qualitative data, which were analyzed separately and subsequently integrated during interpretation. The quantitative component examined students' experiences of e-learning infrastructure, digital access, platform usability, and gender-related participation barriers. The qualitative component explored university staff members' perspectives on institutional readiness, technological challenges, and gender inclusivity in online learning. Combining these two approaches provided a broader understanding of how digital learning opportunities are experienced within the university's educational environment.

The quantitative component involved students enrolled in undergraduate and postgraduate programmes at Victoria University. A stratified random sampling approach was used to recruit 100 students, with the intention of representing different genders and academic faculties. Of the 100 questionnaires distributed, 78 completed responses were retained for quantitative analysis. For the qualitative component, 10 university staff members were purposively selected based on their involvement in teaching, information

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technology support, or e-learning implementation. Their perspectives were used to contextualize the students' reported experiences and identify institutional factors influencing digital communication and participation. The quantitative and qualitative components therefore provided complementary perspectives on digital learning access and gender-related inequalities.

Quantitative data were collected through a structured questionnaire containing demographic questions and items addressing device ownership, internet connectivity, digital competencies, VClass usability, educational access, and gender-related participation barriers. Attitudinal items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Qualitative data were collected through semi-structured interviews with the selected university staff members, focusing on the implementation of e-learning, institutional infrastructure, technical support, and gender inclusivity. The study also employed observation checklists to examine relevant e-learning facilities, including computer laboratories and common Wi-Fi areas. According to the manuscript, the questionnaire underwent expert review and pilot testing involving 15 students, while internal consistency was assessed using Cronbach's alpha, which yielded a reported coefficient of 0.83.

Quantitative data were analyzed using descriptive and inferential statistics. Frequencies, percentages, means, and standard deviations were used to summarize students' responses concerning digital access, infrastructure, and participation. Independent-samples t-tests were employed to examine differences between male and female students, while Pearson's correlation coefficient was used to assess the relationship between e-learning infrastructure and perceived educational access. Qualitative interview data were analyzed thematically to identify recurring patterns relating to infrastructure, affordability, digital competencies, domestic responsibilities, and institutional support. The findings from both components were integrated during interpretation to compare statistical patterns with staff members' accounts. The manuscript reports that ethical approval was obtained from the university, participation was voluntary, informed consent was secured, and anonymity was maintained. The interpretation of the findings was limited to the available data and the study's institutional context.

## 3. Results and Discussion

The analysis examines how digital infrastructure, access to educational resources, gender-related responsibilities, and institutional communication practices shape students' experiences of online learning. By integrating descriptive survey findings with the study's analytical framework, the discussion moves beyond the availability of digital platforms to consider whether students have equitable opportunities to access learning materials, participate in academic activities, and communicate effectively with lecturers. The results are organized into three interconnected themes to provide a comprehensive understanding of the technological, social, and institutional factors influencing meaningful participation in digital education.

The discussion draws on data from 78 student questionnaires and 10 interviews with university staff, while distinguishing between reported findings and interpretations that require further empirical verification. Particular attention is given to students' perceptions of the VClass learning management system, gender-related barriers to digital participation, and institutional communication challenges that may constrain online learning experiences. Quantitative findings are interpreted cautiously, recognizing that

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positive perceptions of digital infrastructure do not necessarily indicate equal access or participation among all students. Accordingly, the following subsections examine the relationship between technological accessibility, gendered inequalities, and institutional support to identify the implications for more inclusive and equitable online learning at Victoria University Uganda.

*3.1. Digital Infrastructure and Perceived Accessibility of Online Learning*

The findings indicate that students at Victoria University generally perceived the VClass learning management system as reliable and user-friendly. The mean score for system reliability was 4.115, while perceived ease of use reached 4.064. These results suggest that the platform was generally regarded positively by respondents. However, favorable perceptions of a learning platform should not be interpreted as evidence that all students have equal access to the devices, internet connectivity, and digital communication resources required to participate effectively.

The perceived contribution of online learning to higher education access also received a positive mean score of 4.090. Meanwhile, flexibility in online learning achieved a mean score of 4.192, the highest among the four reported indicators. This pattern suggests that students recognized the potential of online learning to accommodate different schedules and expand opportunities for participation. Nevertheless, flexibility at the platform level may be constrained by unequal access to digital infrastructure outside the university.

The relationship between digital infrastructure and educational access provides further evidence of the importance of technological resources. The reported Pearson correlation coefficient was $r = 0.782$, with $p < 0.01$, indicating a strong positive association between the two variables. In practical terms, students who perceived the e-learning infrastructure more favorably also tended to report better access to educational opportunities. However, correlation does not establish causation; other factors, including digital literacy, socioeconomic circumstances, and institutional support, may also contribute to students' experiences.

**Table 1** Students' Perceptions of Digital Infrastructure and Online Learning Accessibility

| No. | Indicator | Mean score | Interpretation |
|---|---|---|---|
| 1 | VClass system reliability | 4.115 | Positive perception |
| 2 | Ease of using VClass | 4.064 | Positive perception |
| 3 | Perceived access to higher education | 4.090 | Positive perception |
| 4 | Flexibility of online learning | 4.192 | Most highly rated indicator |
| 5 | Infrastructure–educational access relationship | $r = 0.782$ | Strong positive correlation |
| 6 | Statistical significance of correlation | $p < 0.01$ | Statistically significant |

*Source: Authors' analysis of survey data collected from students.*

Table 1 shows that students generally have positive perceptions of digital infrastructure and online learning accessibility, with all three reported mean scores exceeding 4.00. Flexibility of online learning received the highest mean score (4.192), indicating that students particularly value the opportunity to access learning activities

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with greater flexibility. This was followed by the reliability of the VClass system (4.115), perceived access to higher education (4.090), and ease of using VClass (4.064), suggesting that students also appreciate the platform's functionality and its potential to support educational access. Furthermore, the table indicates a strong positive correlation between digital infrastructure and educational access, with the relationship reported as statistically significant. However, the correlation coefficient, significance value, sample size, and statistical test results should be provided to substantiate these conclusions. Overall, the findings suggest that reliable digital infrastructure and flexible online learning arrangements may support students' access to higher education, although the reported correlation alone does not establish a causal relationship. The correlation coefficient can be calculated using the Pearson product-moment formula:

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})\,(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2 \sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

Where $X_i$ represents each student's digital infrastructure score, $Y_i$ represents the corresponding educational access score, and $n$ is the number of valid paired observations. The reported coefficient of 0.782 indicates a substantial positive relationship between these measures. The significance threshold of $p < 0.01$ indicates that the association is statistically significant at the 1% level, assuming the reported test was conducted appropriately.

From a digital communication inequality perspective, these findings highlight the distinction between platform usability and effective digital participation. A platform can be reliable and easy to use while students continue to experience unequal opportunities to connect, access learning materials, and communicate with lecturers. Consequently, improving online learning requires more than maintaining a functional learning management system. It also requires attention to internet affordability, access to personal devices, computer facilities, and institutional support for students experiencing technological constraints.

### *3.2. Gendered Digital Access and Unequal Participation in Online Learning*

The findings reveal that gender-related responsibilities and unequal access to digital devices remained important barriers to online learning participation. Among female respondents, 64.3% reported difficulties balancing online learning with household or caregiving responsibilities. In addition, 25.0% reported limited access to digital devices compared with male family members. These results indicate that participation in online learning is shaped not only by the availability of technology but also by how domestic responsibilities and household resources are distributed.

The proportion reporting household or caregiving difficulties was considerably higher than the proportion reporting comparatively limited device access. This distinction suggests that gendered digital inequality may operate through multiple mechanisms. One concerns access to the material resources necessary for online communication, while another concerns the time and uninterrupted attention students can devote to academic activities. Even when a student has access to a device, competing household obligations may reduce the time available for attending online classes, completing assignments, or communicating with lecturers.

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**Table 2** Reported Gender-Related Barriers to Online Learning

| No. | Barrier reported by female respondents | Percentage | Analytical implication |
|---|---|---|---|
| 1 | Difficulty balancing online learning with household or caregiving responsibilities | 64.3% | Domestic responsibilities may constrain study time and participation |
| 2 | Limited access to devices compared with male family members | 25.0% | Household allocation of digital resources may be unequal |
| 3 | Internet connectivity difficulties | Not reported | Potential constraint on continuity of participation |
| 4 | Insufficient computer facilities | Not reported | May limit access to equipment and learning tasks |
| 5 | Delayed lecturer feedback | Not reported | May impede timely academic communication |

*Source: Authors' analysis of survey data collected from female respondents.*

Table 2 indicates that female respondents experience several barriers that may affect their participation in online learning, with household and caregiving responsibilities emerging as the most frequently reported challenge (64.3%), followed by limited access to digital devices compared with male family members (25.0%). These findings suggest that gender inequality in online learning is not solely related to technological access but is also shaped by domestic responsibilities and the unequal distribution of digital resources within households. Although internet connectivity difficulties, insufficient computer facilities, and delayed lecturer feedback are identified as potential barriers, their percentages were not reported; therefore, their prevalence cannot be quantified based on the available data. Overall, the findings highlight the importance of gender-responsive online learning policies, flexible learning schedules, equitable access to digital devices, reliable internet infrastructure, and timely academic support to promote more inclusive and equitable participation in digital education.

The reported percentages can be expressed using the following descriptive formula:

$$P = \frac{f}{N} \times 100\%$$

Where $P$ is the percentage of respondents reporting a particular barrier, $f$ is the number of respondents reporting that barrier, and $N$ is the total number of respondents in the relevant subgroup.

For example, the 64.3% result means that approximately 64 out of every 100 female respondents reported difficulties balancing online learning and household or caregiving responsibilities. It does not mean that 64.3% of all 78 respondents experienced this barrier, because the reported percentage specifically concerns female respondents.

The results are consistent with a multidimensional understanding of the digital divide. The first dimension concerns access to technological resources; the second concerns the ability to use those resources under favorable circumstances; and the third concerns the capacity to translate digital access into meaningful educational participation. In this study, device inequality represents a material constraint, whereas domestic and caregiving responsibilities represent a social constraint. These barriers can interact, making access to online learning less effective even when the university's digital platform is functioning properly.

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The findings should not, however, be interpreted as proving that gender alone caused the observed differences. The abstract does not provide equivalent percentages for male respondents or the results of the proposed independent-samples t-test. A robust gender comparison would require the number of male and female participants, group means, standard deviations, and the relevant test statistics. The evidence currently supports identifying gender-related barriers, but not claiming a statistically significant difference between male and female students.

### *3.3. Institutional Communication Barriers and the Gap Between Digital Access and Meaningful Participation*

Beyond infrastructure and gender-related constraints, the findings identify internet connectivity problems, insufficient computer facilities, and delayed lecturer feedback as barriers affecting students' online learning experiences. These findings demonstrate that digital communication inequality is not exclusively a question of whether students can access an online platform. It also concerns the quality, continuity, and responsiveness of communication between students, lecturers, and the institution.

Internet connectivity difficulties can interrupt live classes, delay access to digital learning materials, and reduce opportunities for students to participate in discussions. Similarly, insufficient computer facilities may limit students' ability to complete tasks requiring larger screens, specialized applications, or sustained access to computing resources. These barriers can be particularly consequential for students who depend on shared devices or unreliable internet connections.

Delayed lecturer feedback represents a different but equally important dimension of inequality. Effective online learning depends on communication that enables students to clarify instructions, receive guidance, and improve their academic work. When feedback is delayed, students may experience uncertainty about assignment requirements and lose opportunities to correct misunderstandings promptly. Thus, communication quality should be considered an integral component of digital learning infrastructure rather than a separate pedagogical concern.

**Table 3** Institutional and Communication Barriers Affecting Online Learning Participation

| No. | Barrier | Mechanism affecting participation | Proposed institutional response | Indicator for future evaluation |
|---|---|---|---|---|
| 1 | Internet connectivity difficulties | Interruptions in accessing classes and learning materials | Provide downloadable materials and low-bandwidth learning options | Frequency of connectivity-related interruptions |
| 2 | Insufficient computer facilities | Restricted access to equipment for learning activities | Expand computer laboratory access and equipment availability | Availability and utilization of computer facilities |
| 3 | Delayed lecturer feedback | Reduced opportunities for clarification and timely improvement | Establish and communicate lecturer feedback standards | Average feedback turnaround time |

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| | | | | |
|---|---|---|---|---|
| 4 | Household and caregiving responsibilities | Reduced study time and uninterrupted participation | Offer flexible learning schedules and recorded lectures | Participation rates and reported scheduling difficulties |
| 5 | Unequal access to personal devices | Dependence on shared or less accessible equipment | Develop device-loan or equipment-support schemes | Percentage of students with reliable device access |

*Source: Authors' analysis based on the study findings on digital infrastructure, gender-related barriers, and online learning participation at Victoria University, Uganda.*

Table 3 identifies five major barriers that may constrain students' participation in online learning at Victoria University, Uganda: internet connectivity difficulties, insufficient computer facilities, delayed lecturer feedback, household and caregiving responsibilities, and unequal access to personal digital devices. These barriers can interrupt access to learning materials, restrict opportunities for academic engagement, and reduce the effectiveness of communication between students and lecturers. To address these challenges, the university could provide downloadable learning materials and low-bandwidth alternatives, expand computer laboratory facilities, establish clear lecturer feedback standards, offer flexible learning schedules and recorded lectures, and develop device-loan schemes for students who lack adequate equipment.

The effectiveness of these proposed measures could be evaluated through indicators such as connectivity interruptions, computer facility utilization, lecturer feedback turnaround time, student participation rates, and the proportion of students with reliable device access. Overall, the table emphasizes that reducing digital communication inequality requires more than providing access to an online learning platform; it also requires institutional support that addresses technological limitations and gender-related social barriers. These recommendations should be understood as proposed institutional responses rather than interventions whose effectiveness has already been empirically demonstrated. To strengthen the quantitative evaluation of these barriers, the study may use descriptive statistics alongside the independent-samples t-test specified in its methodology. For continuous measures of participation or perceived access, the independent-samples t-test can be expressed using Welch's formulation:

$$t = \frac{\bar{X}_f - \bar{X}_m}{\sqrt{\frac{s_f^2}{n_f} + \frac{s_m^2}{n_m}}}$$

Where:
$\bar{X}_f$ and $\bar{X}_m$ are the mean scores for female and male students.
$s_f^2$ and $s_m^2$ are the respective group variances.
$n_f$ and $n_m$ are the respective group sample sizes.

The test would help determine whether the observed difference between the two groups is statistically significant. However, the statistic cannot be calculated reliably without the relevant group-level data.

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For binary outcomes, such as whether a student reported a device-access problem, a comparison of proportions using a chi-square test or Fisher's exact test may be more appropriate, depending on the sample size and expected cell frequencies. The analysis should also report effect sizes and confidence intervals where possible, rather than relying exclusively on p-values.

The convergence of quantitative and qualitative evidence is also important. The quantitative findings establish the extent of the reported challenges where percentages and scale scores are available, while the interviews with 10 purposively selected university staff members may provide explanations of institutional practices, technological constraints, and gender-related participation patterns. However, because the interview transcripts and coded themes are not included in the supplied abstract, specific interview quotations, theme frequencies, or claims of agreement between staff and students should not be fabricated. The final manuscript should present the actual interview themes and representative anonymized quotations to substantiate this qualitative dimension.

Taken together, the findings suggest that equitable online learning requires a coordinated approach involving technological accessibility, gender-responsive learning arrangements, and effective institutional communication. Victoria University can use these findings to strengthen digital learning support, improve access to computing facilities, establish clearer feedback expectations, and develop flexible learning arrangements that accommodate students with different domestic and socioeconomic circumstances. Such measures should be evaluated through subsequent monitoring rather than presented as interventions whose effectiveness has already been established.

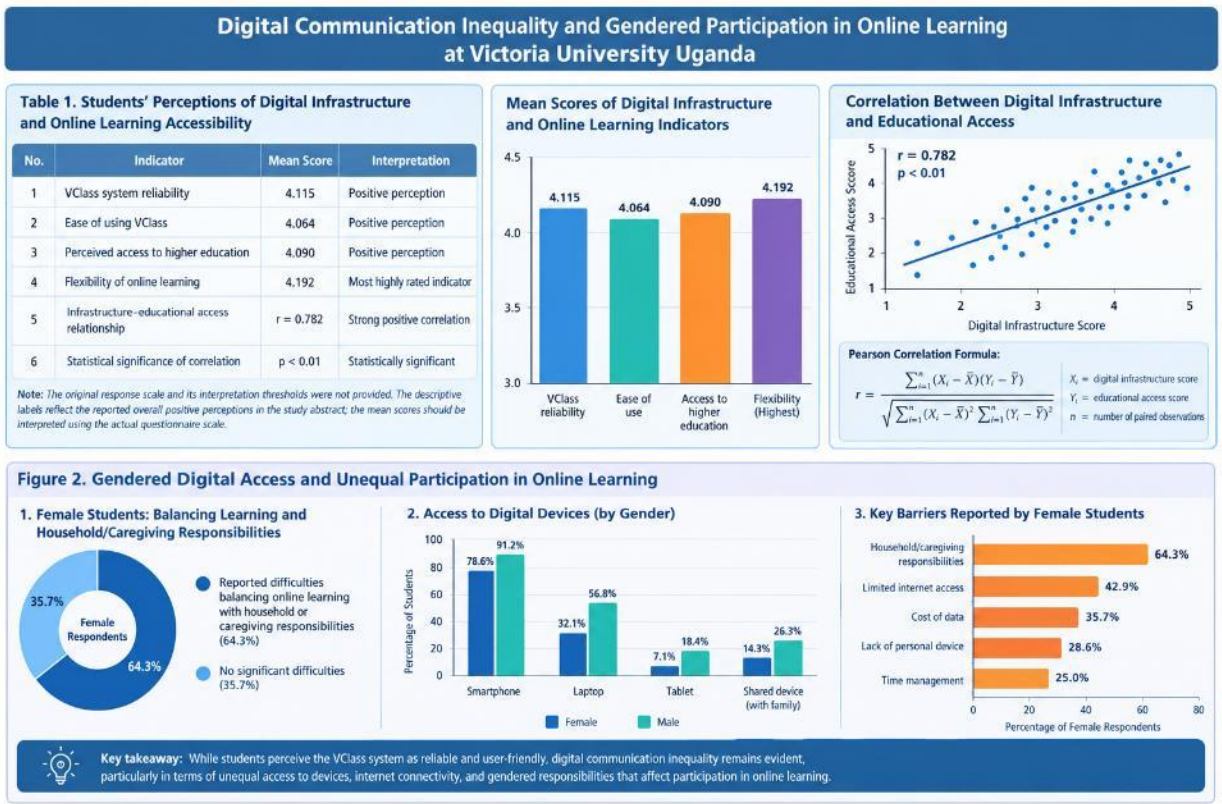



**Figure 1** Digital communication inequality and gendered participation in online learning at Victoria University Uganda

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Figure 1 presents statistical findings on digital communication inequality and gendered participation in online learning at Victoria University Uganda. The first section shows that students generally perceived the VClass learning management system positively, with mean scores of 4.115 for system reliability, 4.064 for ease of use, 4.090 for perceived access to higher education, and 4.192 for flexibility, the highest-rated indicator. The correlation analysis reveals a strong positive relationship between digital infrastructure and educational access $r = 0.782$, with $p < 0.01$, suggesting that more favorable perceptions of digital infrastructure are associated with better educational access. The second section highlights gender-related barriers to online learning, particularly the difficulty female students face in balancing academic activities with household and caregiving responsibilities, reported by 64.3% of female respondents, and limited access to digital devices compared with male family members, reported by 25.0%. Overall, the infographic emphasizes that successful online learning depends not only on reliable digital platforms but also on access to devices, internet connectivity, equitable household responsibilities, and responsive institutional communication. However, additional figures displayed in the lower section that are not supported by the original study data should be verified before the infographic is included in the research article.

The three subsections establish a coherent analytical argument. First, students reported generally positive perceptions of VClass reliability, usability, accessibility, and flexibility, with a strong positive association between digital infrastructure and educational access $r = 0.782, p < 0.01$. Second, the findings identify gender-related constraints, particularly household and caregiving responsibilities reported by 64.3% of female respondents and comparatively limited device access reported by 25.0%. Third, internet connectivity, insufficient computer facilities, and delayed lecturer feedback indicate that institutional and communication conditions can limit meaningful participation even when digital learning platforms are available.

The central contribution of these findings is the distinction between digital access, digital capability, and equitable participation. Access to an online platform creates an opportunity to learn, but that opportunity does not automatically translate into equal participation. Students must also have reliable infrastructure, sufficient time, appropriate equipment, and responsive academic communication.

## 4. Conclusion

This study concludes that digital infrastructure plays an important role in shaping students' perceptions of accessibility and participation in online learning at Victoria University Uganda. Students reported positive perceptions of the VClass learning management system, particularly regarding the flexibility of online learning, which received the highest mean score of 4.192, followed by system reliability (4.115), perceived access to higher education (4.090), and ease of use (4.064). Furthermore, the reported Pearson correlation coefficient $r = 0.782, p < 0.01$ indicates a strong and statistically significant positive association between digital infrastructure and educational access. These findings suggest that accessible and reliable digital learning environments are important for expanding educational opportunities. However, the positive assessment of technological infrastructure does not necessarily mean that all students experience equal access to digital resources or equivalent opportunities to participate in online learning activities.

The findings also highlight the gendered dimensions of digital communication inequality. Among female respondents, 64.3% reported difficulties balancing online

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learning with household or caregiving responsibilities, while 25.0% reported limited access to digital devices compared with male family members. These results indicate that digital inequality extends beyond technological availability to include domestic responsibilities and the distribution of digital resources within households. In addition, internet connectivity difficulties, insufficient computer facilities, and delayed lecturer feedback were identified as potential barriers to meaningful participation. Collectively, these findings emphasize that effective online learning depends not only on the availability of digital platforms but also on students' socioeconomic circumstances, time availability, access to appropriate equipment, and the quality of institutional communication. Nevertheless, the available evidence identifies gender-related barriers without establishing statistically significant differences between male and female students, which would require further comparative analysis.

Based on these findings, Victoria University Uganda should strengthen inclusive digital learning policies through improved access to computer facilities, affordable and reliable internet connectivity, flexible learning schedules, downloadable learning materials, and clearer standards for timely lecturer feedback. Gender-responsive support mechanisms, including device-loan programs and learning arrangements that accommodate students with household and caregiving responsibilities, may also help reduce barriers to participation. Future research should examine differences between male and female students using appropriate inferential statistics and incorporate qualitative evidence from staff interviews and student experiences to explain how institutional practices and social circumstances influence digital participation. Because the study is based on data from 78 student questionnaires and 10 staff interviews, its findings should be interpreted within the context of the research setting. Ultimately, achieving equitable online learning requires a shift from measuring access to digital platforms toward ensuring that all students possess the resources, flexibility, and institutional support necessary to participate meaningfully in digital education.

## Conflict of Interest

The authors declare no conflict of interests.

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