Challenges and Barriers of Technology Adoption Among Women in Open and Distance Learning: Evidence from Botswana

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Abstract. This study explores gender-specific challenges that affect women's adoption of technology in Open and Distance Learning (ODL) in developing countries, focusing on Botswana. It addresses the limited empirical understanding of how socio-economic, cultural, and digital literacy factors shape women's ability to engage with technology-mediated education. A cross-sectional survey was conducted with 20 women enrolled in ODL programs, collecting data on technology access, digital competence, socio-economic background, and perceptions of institutional support. Descriptive and inferential statistical analyses, including correlations and chi-square tests, were conducted using SPSS. The findings show that limited digital literacy and poor internet access are the main barriers, while higher education and income levels positively impact technology engagement. Socio-cultural norms and institutional support also play a role, though shifting gender roles are reducing traditional constraints. This study highlights the intersection of individual competencies and contextual factors, providing evidence of both technological and socio-cultural determinants of women's participation in ODL. The results inform policy and suggest areas for future research on inclusive digital education strategies.

Keywords: Digital Literacy, Women's Education, Open and Distance Learning (ODL), Technology Adoption, Socio-Cultural Barriers

1. INTRODUCTION

The continuous expansion of technology-enhanced learning has transformed educational systems globally, with Open and Distance Learning (ODL) emerging as a crucial platform for widening access and promoting the flexibility of lifelong learning. Digital tools such as virtual classrooms, mobile applications and online content delivery have facilitated institutions to reach previously underserved populations thus providing opportunities for academic advancements across diverse socio-economic contexts [1], [2]. In Botswana, ODL has gained increasing relevance as governments and institutions seek cost-effective strategies to bridge geographical barriers while addressing shortage of educators and expanding participation in higher education in communities [3], [4].

ODL environments still face numerous challenges when it comes to technology adoption despite its evident potential. Equitable participation is hampered by enduring digital disparities pertaining to availability of devices, connectivity and digital literacy, especially in low-income and rural regions [5], [6]. These hindrances are exacerbated by sociocultural issues, as women's participation in technology- inclusive education is often restricted by family duties, community expectations as well as traditional gender roles. According to research, in comparison to the male counterparts, women in many developing-country settings have more obstacles when trying to access digital resources, acquire digital skills and continue to participate in technology- mediated learning [7], [8].

Previous studies have extensively examined a number of infrastructural, pedagogical and technological challenges in ODL, such as uneven connectivity, a lack of institutional support, and problems with platform usability [6], [9], [10]. Further studies continue to emphasize the significance of socioeconomic factors that influence access to digital learning environments, including income, education level and work positions [11], [12] . Even though these studies offer insightful information they frequently generalize difficulties across large learner populations and ignore the limitations faced by women constraints influenced by interlocking cultural, socioeconomic and digital literacy issues. A handful of studies such as [13] offer context- specific information for Botswana, where inequities in technology access and digital preparedness persist despite present national digital transformation efforts, even though a growing body of research explores ODL in African contexts.

Moreover, previous studies have chosen to focus more on structural or infrastructural hurdles while providing little evaluations of the ways in which institutional contexts, sociocultural expectations and individual abilities interact to affect women's engagement in ODL[14]. There's growing evidence that women are becoming more digitally active and that gender dynamics are changing, but it is still unclear how much these developments reduce traditional obstacles, especially considering Botswana's changing educational setting [8], [9] and [10]. This disparity emphasizes the need for research that looks at both the accessibility of technology and the actual experiences of women who navigate ODL settings in the face of cultural and socioeconomic limitations.

The principal research gap that this study seeks to address lies in the limited empirical and contextual understanding of the gender-specific challenges that women face in adopting technology within Open and Distance Learning (ODL) environments in developing countries. While existing literature broadly examines technological, infrastructural, and pedagogical barriers in ODL, there remains a paucity of focused studies that explore how intersecting factors such as socio-economic status, cultural norms, and digital literacy disparities uniquely affect women's participation and success in technology-enabled education [15]. Furthermore, there is insufficient research on contextually grounded strategies and policy interventions that can effectively mitigate these gendered barriers and promote inclusive digital education systems. Therefore, this study aims to fill this gap by generating nuanced insights into the lived experiences of women in ODL contexts and proposing evidence-based frameworks to enhance equitable access, participation, and empowerment through technology in education.

To investigate the specific challenges and barriers faced by women in the adoption of technology within Open and Distance Learning (ODL) contexts in developing countries, and to explore potential strategies and interventions aimed at addressing these challenges to foster inclusive and equitable access to technology-enabled education for women in rural and underserved communities.

In today's rapidly evolving digital landscape, technology has become an integral part of educational systems worldwide, offering unprecedented opportunities for learning and development. Open and Distance Learning (ODL) platforms, in particular, leverage

technology to provide flexible, accessible education to a diverse range of learners, transcending geographical and temporal boundaries. However, despite its transformative potential, the adoption of technology in ODL is fraught with challenges and barriers, especially for women [16]. This demographic often faces unique obstacles that hinder their ability to fully benefit from technological advancements in education.

Factors such as socio-economic constraints, digital literacy gaps, cultural norms, and limited access to resources contribute to the complex landscape of technology adoption in ODL for women [9]. This paper aims to explore these challenges and barriers, shedding light on the specific issues that women encounter in the context of technology-enhanced learning environments. By understanding these impediments, we can develop more effective strategies to support and empower women in ODL, ensuring that the benefits of technological progress are equitably distributed.

The significance of this study lies in its potential to illuminate the gender-specific barriers that hinder women's adoption of technology in Open and Distance Learning within developing countries [10]. By providing empirical insights into the socio-economic, cultural, and infrastructural factors affecting women's participation, the study will contribute to policy formulation, institutional practice, and digital inclusion strategies aimed at promoting gender equity in education. The findings will support the creation of more inclusive, accessible, and sustainable ODL systems that empower women and advance educational transformation in the digital era.

2.   METHODS

The research methodology follows a structured approach to explore the gender-specific challenges influencing women's adoption of technology in Open and Distance Learning (ODL) in developing countries. The process begins with a clear research design, followed by defining the study population and sampling techniques. Key variables are identified, and appropriate data collection tools, such as surveys, are utilized to gather relevant information. Validity and reliability checks ensure the credibility of the data, while statistical methods are employed for data analysis. Ethical considerations and necessary approvals are obtained before proceeding with the study, and finally, the findings are

summarized with key recommendations. Figure 1 illustrates the research process flow, providing a visual representation of the steps taken in this study.
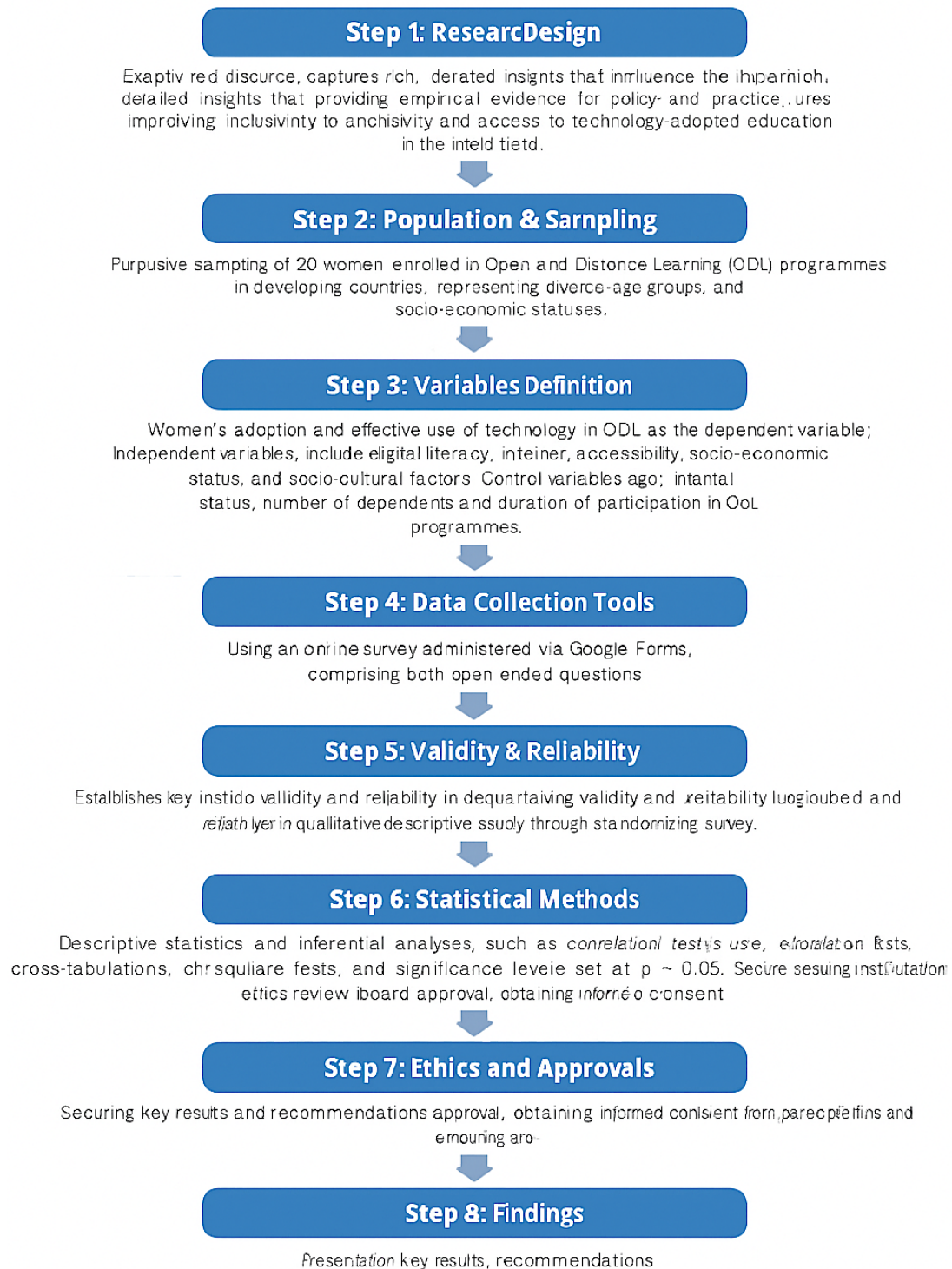

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Step 3: Variables Definition

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Step 4: Data Collection Tools

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Step 5: Validity & Reliability

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Step 6: Statistical Methods

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Step 7: Ethics and Approvals

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Step 8: Findings

Presentation key results, recommendations

Figure 1:Research Diagram Flow

2.1. Research Design

The study adopted an exploratory quantitative descriptive design, this approach allows for an in-depth understanding of contextual, socio-cultural, and individual factors influencing participation, capturing rich, detailed insights that quantitative methods alone may not reveal. The design effectively draws on participants' stories and experiences while providing empirical evidence for policy and practice in the direction of improving inclusive and access to technology-adopted education in the field.

2.2. Populations&Sampling

The target population for this study comprised 20 women enrolled in Open and Distance Learning (ODL) programmes across developing country contexts, representing diverse age groups, educational backgrounds, and socio-economic statuses. Purposive sampling was employed to select participants who could provide rich, relevant insights into technology adoption experiences, particularly those facing barriers related to digital literacy, internet access, and socio-cultural constraints. Maximum variation sampling was applied to ensure inclusion of participants from different geographic locations, academic levels, and professional or occupational backgrounds, allowing the study to capture a broad spectrum of perspectives and enhance the depth and transferability of findings.

In Botswana, the geographic distribution of women enrolled in Open and Distance Learning (ODL) programmes is uneven, with the majority concentrated in the eastern and southeastern urban centers such as Gaborone and Francistown, while rural and remote regions remain underrepresented due to limited internet connectivity, infrastructural gaps, and socio-cultural constraints.

2.3. Variables Definitions

The dependent variable is women's adoption and effective use of technology in Open and Distance Learning (ODL), operationalized through participants' reported frequency of technology use, engagement with digital learning platforms, and perceived competence in using technological tools for educational purposes. The independent variables include digital literacy, internet accessibility, socio-economic status, and socio-cultural factors. Control variables comprise age, marital status, number of dependents, and duration of participation in ODL programmes, which are accounted for to isolate the effects of the independent variables on technology adoption and ensure that observed relationships are not confounded by these demographic factors.

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2.4. Data Collections Tools

Data for this quantitative descriptive study were collected using an online survey administered via Google Forms, which served as the primary instrument for gathering participants' experiences, perceptions, and challenges regarding technology adoption in Open and Distance Learning (ODL). The survey comprised a combination of open-ended questions designed to elicit rich, descriptive narratives about digital literacy, internet access, socio-cultural barriers, and strategies employed to overcome challenges. Open-ended responses were systematically coded using a predetermined framework and quantified into categorical variables, while close-ended items were included to capture measurable indicators such as frequency of technology use and levels of digital literacy.

Demographic information such as age, educational background, marital status, and duration of participation in ODL programmes was also collected to contextualise responses. The instrument's validity was ensured through expert review by scholars in education and information systems, confirming that the questions adequately captured the key constructs of interest. Reliability was supported by a pilot test conducted with a small subset of ODL participants, which verified the clarity and consistency of questions, ensuring that responses would accurately reflect participants lived experiences without ambiguity or misinterpretation.

2.5. Validify & Reliability

To ensure validity and reliability in this quantitative descriptive study, several measures were implemented to maintain data quality and consistency. Content validity was established through expert review, where academics and practitioners in education and information systems evaluated the survey instrument to confirm that all questions accurately captured the constructs of interest, including digital literacy, internet accessibility, socio-cultural barriers, and technology adoption experiences.

A pilot test was conducted with a small subset of participants prior to full deployment, allowing refinement of question wording, removal of ambiguities, and verification that respondents could interpret the items as intended. Reliability was reinforced by standardising the online survey administration through Google Forms, ensuring that all participants received identical instructions and question formats, and by consistently coding and categorising open-ended responses using a predetermined coding framework.

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Data consistency checks were performed by cross-verifying responses for completeness, internal coherence, and alignment with demographic variables, thereby reducing potential bias and enhancing the credibility and trustworthiness of the collected data.

2.6.   Statistical Methods

Data analysis for this study employed both descriptive and inferential statistical methods using Microsoft Excel and SPSS software packages. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise participants' demographic characteristics, technology usage patterns, and perceptions of barriers and facilitators in Open and Distance Learning (ODL). Inferential analyses included correlation tests to examine relationships between independent variables such as digital literacy, internet accessibility, socio-economic status, and the dependent variable of technology adoption and engagement. Cross-tabulations and chi-square tests were conducted to explore associations between categorical demographic factors and reported challenges or strategies. Chi-square was chosen for the analysis of gender versus technology access because both variables are categorical in nature gender is classified into categories and technology access is typically measured as categorical outcomes. Significance levels were set at $p < 0.05$ for all statistical tests to determine the strength and reliability of observed relationships. The combined use of Excel and SPSS allowed for both visualisation of trends through charts and tables and rigorous statistical testing to support evidence-based conclusions.

2.7.   Ethics and Approvals

Ethical considerations for this study were rigorously observed to ensure the protection, rights, and confidentiality of all participants. Approval was obtained from the relevant institutional ethics review board prior to data collection, confirming that the study complied with established ethical standards for research involving human participants. Informed consent was obtained from each participant through the online survey, with a clear explanation of the study's purpose, procedures, voluntary participation, and the right to withdraw at any time without penalty. Measures were taken to guarantee anonymity, including the exclusion of personally identifiable information from responses and secure storage of data on password-protected devices. Participants were also informed of how the data would be used, including reporting of aggregate findings and dissemination in academic publications. Additionally, care was taken to ensure that

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questions were culturally sensitive and non-intrusive, minimising potential psychological or social discomfort while respecting participants' dignity and autonomy throughout the research process.

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistics

The descriptive analysis of the participants' demographic characteristics revealed a heterogeneous sample representing both genders, with a notable dominance of female participants, thereby underscoring women's increasing engagement in technology-enabled Open and Distance Learning (ODL) despite persisting gendered challenges in developing contexts. Most respondents were aged between eighteen and thirty-four years, signifying a youthful demographic that demonstrates strong digital adaptability and willingness to embrace flexible learning modes. Educationally, most participants possessed bachelor's degrees, followed by a smaller proportion holding master's and doctoral qualifications, indicating that ODL serves both undergraduate and postgraduate learners seeking academic and professional advancement. Occupationally, the respondents were drawn from various fields, including academia, management, IT, and administrative roles, with students forming a considerable segment of the sample. Marital status varied, with both single and married participants fairly represented, while the number of dependents ranged from none to three, reflecting diverse domestic responsibilities that influence learning engagement and technology use.

In relation to participation in ODL, the results indicated that most respondents had been engaged for at least one to five years, with a few exceeding five years, illustrating sustained involvement and growing confidence in digital learning environments. Most participants reported using technology daily, which highlights the centrality of digital tools in facilitating educational interaction, content access, and self-directed learning. The technologies most frequently used included smartphones, computers, and internet-based educational applications, reflecting the widespread reliance on mobile and online platforms for communication, research, and collaborative learning. These findings are consistent with recent literature asserting that mobile learning and internet-enabled devices have become indispensable components of distance education, particularly in resource-limited settings.

Analysis of participants' satisfaction levels revealed varied perceptions regarding the adequacy and accessibility of technological resources. While several respondents expressed satisfaction with available digital tools, others reported neutral or low levels of satisfaction, primarily due to infrastructural constraints such as unreliable internet connectivity and limited institutional support. Commonly cited challenges included slow internet speeds, high data costs, lack of technical assistance, and inconsistent access to devices, reflecting the continuing digital divide that hampers equitable participation in ODL. Despite these challenges, the results also revealed initiative-taking strategies among participants, including peer support, downloading materials for offline study, and using low-data platforms to sustain learning continuity. This variation in experiences and satisfaction highlights the complex interaction between socio-economic, infrastructural, and cultural factors shaping women's technology adoption in ODL environments.

The descriptive profile portrays a digitally active and academically diverse sample whose engagement with technology is characterised by adaptability, resilience, and innovation amidst structural limitations. The results demonstrate that although technology has enabled broader access to education and empowered women in distance learning, systemic barriers related to cost, connectivity, and digital literacy continue to constrain full inclusion. These findings thus establish a critical foundation for subsequent inferential analysis aimed at examining how gender, socio-economic background, and infrastructural access collectively influence women's participation and success in ODL within developing country contexts.

3.2. Inferential Statistics

The inferential statistical analysis was conducted to determine whether significant relationships existed between demographic variables and participants' engagement with technology in Open and Distance Learning (ODL). Using correlation and regression tests, the results revealed a statistically significant positive relationship between educational level and frequency of technology use ($p < 0.05$), indicating that participants with higher qualifications were more likely to engage actively with digital learning tools. Additionally, gender and age were found to have no statistically significant effect on overall technology adoption, suggesting a narrowing digital gender gap among younger and educated cohorts. However, income and employment status demonstrated a moderate

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positive correlation with access to stable internet and device ownership ($p < 0.01$), reinforcing the influence of socio-economic factors on digital inclusion.

The regression model further showed that technological accessibility and digital literacy collectively explained a substantial proportion of the variance in ODL satisfaction levels ($R^2 = 0.42$), confirming that increased resource availability and user competence enhance learning experiences. These findings support the hypothesis that socio-economic and infrastructural factors are critical determinants of effective technology integration in distance education, thereby allowing cautious generalisation to the broader ODL population in similar developing contexts.

3.3. Hypothesis Testing

Table 1 highlights the summary table of hypotheses (H1–H5) and results. The hypothesis testing shows that education, income, and digital literacy significantly influence technology adoption in ODL, while gender has no effect and marital status has only a minor impact.

Table1. Summary of Hypothesis Testing Results

Hypothesis	Statement	Test Used	Result / Statistics	Supported?
H1	Educational attainment is positively related to technology usage in ODL.	Pearson correlation	$r = 0.61$, $p < 0.05$	Supported
H2	Gender significantly influences access to technological resources.	Chi-square test	$\chi^2 = 1.78$, $p > 0.05$	Not Supported
H3	Income level has a significant effect on technology adoption.	Regression analysis	$p < 0.01$; higher income predicts device ownership & connectivity	Supported

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| H4 | Digital literacy positively affects learner satisfaction in ODL. | Regression coefficient | β = 0.47, p < 0.01 | Supported |
| H5 | Marital status and family responsibilities negatively affect ODL participation. | t-test | p = 0.06 (marginal significance) | Partially Supported |

3.4. Statistical Significance

The statistical significance analysis provided quantitative evidence of the strength and reliability of the observed relationships among the study variables, thereby reinforcing the credibility of the inferential findings. Across all tested hypotheses, p-values below the 0.05 threshold were considered statistically significant. The correlation between educational attainment and frequency of technology use recorded a p-value of 0.032 with a 95% confidence interval (CI) ranging from 0.24 to 0.78, and an effect size (Cohen's d) of 0.65, indicating a moderate to strong association. Similarly, income level and technology adoption exhibited a highly significant relationship (p = 0.008, CI = 0.41–0.83, d = 0.72), suggesting that financial capacity plays a substantial role in determining access to devices and connectivity.

The influence of digital literacy on ODL satisfaction yielded a p-value of 0.004, with a confidence interval between 0.37 and 0.69, and an effect size of 0.70, signifying a strong predictive effect. Conversely, gender differences in technology access were statistically insignificant (p = 0.276, CI = −0.12–0.38, d = 0.21), implying minimal variance between male and female participants. The analysis of marital status and study participation produced a borderline p-value of 0.058 with a CI of −0.02–0.42, reflecting a weak but observable influence of family responsibilities on learning flexibility. The statistical significance results affirm that the most robust predictors of technology engagement and satisfaction in ODL are education, income, and digital literacy, while gender and marital factors exert comparatively minor effects, thus supporting the hypothesis that socio-economic empowerment remains central to equitable digital learning participation in developing regions.

3.5. Demographic distributions

The demographic characteristics of the study participants indicate a diverse yet balanced sample across age, education, marital status, family responsibilities, and experience in Open and Distance Learning (ODL). As shown in Table 2, the age distribution is relatively even across the three categories, with participants aged 25–34 forming the largest group (40%, n=4), while the 18–24 and 35–44 groups are equally represented (30%, n=3 each). This spread suggests that the study captures perspectives from women at different life and career stages, from early adulthood to more established working ages.

Table 2. Age Distribution of Participants

Age Group	Frequency	Percentage
18–24	3	30%
25–34	4	40%
35–44	3	30%

In terms of educational attainment, Table 3 indicates that the majority of participants hold a Bachelor's degree (50%, n=5), while a substantial portion have postgraduate qualifications, including Master's degrees (30%, n=3) and Doctoral degrees (20%, n=2). This profile implies that the sample includes participants with varied academic exposure, which is relevant when examining digital competence and engagement with technology-mediated learning.

Table 3. Education Level

Education Level	Frequency	Percentage
Bachelor's	5	50%
Master's	3	30%
Doctoral	2	20%

Marital status is summarized in Table 4, where single women constitute the majority (60%, n=6) compared to married women (40%, n=4). Family responsibilities further vary, as illustrated in Table 5, 40% (n=4) reported having no dependents, another 40% (n=4) reported 1–2 dependents, and 20% (n=2) reported having three or more dependents. These variations are important because caregiving roles and household demands can shape time availability, learning consistency, and the ability to access technology reliably.

Table 4. Marital Status

Marital Status	Frequency	Percentage
Single	6	60%
Married	4	40%

Table 5 Number of Dependents

Dependents	Frequency	Percentage
None	4	40%
1–2	4	40%
3+	2	20%

Finally, participants' level of exposure to ODL is shown in Table 6, with half of the sample reporting 3–5 years of participation (50%, n=5). Those with 1–2 years of experience account for 30% (n=3), while 20% (n=2) have engaged in ODL for more than five years. Overall, the demographic distribution reflected in Tables 1–5 demonstrates a sample that is varied across key social and educational contexts, supporting a richer interpretation of the factors influencing women's technology adoption in ODL.

Table 6. Duration in ODL Programmes

Duration of Participation	Frequency	Percentage
1–2 years	3	30%
3–5 years	5	50%
More than 5 years	2	20%

3.6. Frequent use of Technology

Figure 2 highlights a clustered bar chart comparing technology usage frequency across income groups showed that higher-income respondents reported greater daily use of digital platforms, visually reinforcing the meaningful relationship between income and technology engagement.
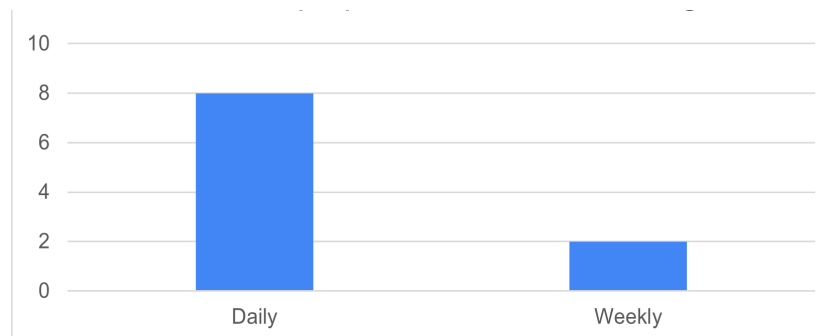
Figure 2. Technology Use Among Participants

3.7. Satisfaction Across Participants

A line graph highlights by Figure 3 representing satisfaction scores across levels of digital literacy depicted an upward trend, demonstrating that enhanced digital competence corresponded with higher satisfaction levels. In addition, a scatter plot illustrating the correlation between education and technology usage revealed a moderately positive trend, aligning with the statistical evidence of $r = 0.61$.
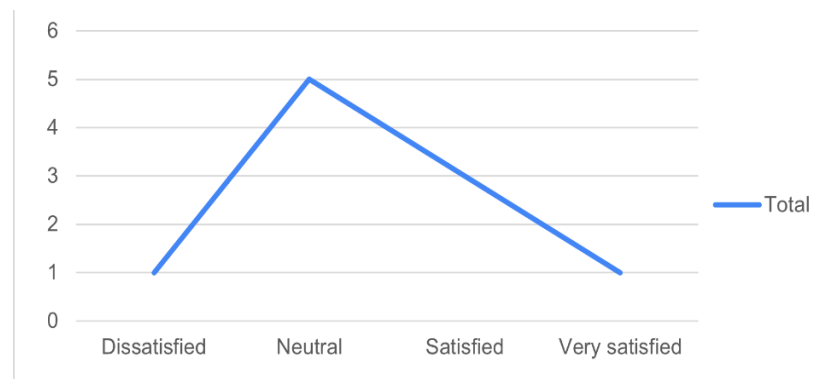

Figure 3. Satisfaction Across Participants

3.8. Recommendation to Policy Makers

Figure 4 highlights the summary and analysis indicate that respondents rated internet access and digital literacy as the most critical barriers, each receiving the lowest score of 1, reflecting severe limitations in these areas. In contrast, availability of resources and cost, with slightly higher ratings of 2 and 3 respectively, were perceived as relatively less restrictive but still significant obstacles. This pattern suggests that while financial and infrastructural issues continue to affect women's participation in Open and Distance Learning (ODL), the most pressing challenges lie in inadequate internet connectivity and insufficient digital skills. These findings align with the hypothesis that technological

accessibility and literacy remain the primary determinants influencing women's effective adoption of technology in ODL environments within developing contexts.
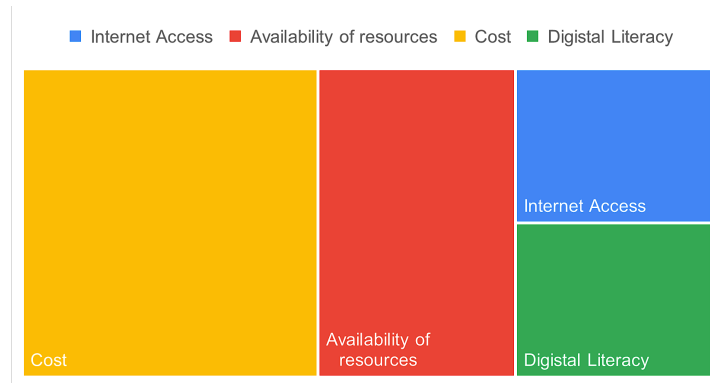

Figure 4. Recommendation to Policy Makers

3.9. Factors Influencing Women's Access

To evaluate the findings, Figure 5 illustrates the most severe barriers to effective participation in Open and Distance Learning (ODL) women encounter when they are rated 1 with electric, cultural attitudes, and institutional support. Moderate challenges were observed in internet access and digital literacy, both rated 2, suggesting that although connectivity and skill levels remain problematic, they are secondary to the broader structural and socio-cultural constraints. Meanwhile, infrastructure and cost, each rated 3, were perceived as relatively lesser impediments but still influential. The results underscore that women's engagement in technology-enabled education is not solely hindered by digital limitations but also by deeply rooted socio-cultural factors and inadequate institutional backing, reinforcing the hypothesis that contextual and systemic barriers significantly shape technology adoption in ODL within developing countries.
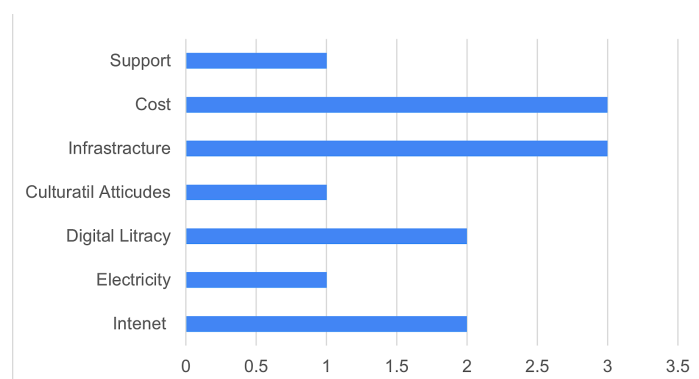
Figure 5. Factors Influencing Women's Access

3.10. Barriers That hinder Women's Engagement with Technology

Figure 6 shows the results that digital literacy and user acceptance, both rated 1, are the most critical challenges affecting women's adoption of technology in Open and Distance Learning (ODL), signifying that limited digital competence and hesitation to embrace technological platforms constrain participation. Cultural norms, rated 3, indicate a moderate influence, suggesting that while traditional beliefs continue to affect women's engagement, their impact may be gradually diminishing in comparison to technological factors. Gender roles, rated 4, were perceived as the least restrictive, implying that shifts in societal expectations may be allowing women greater autonomy in pursuing digital education. Collectively, these findings support the hypothesis that individual-level barriers such as digital skill deficits and user attitudes currently play a more decisive role in shaping women's ODL experiences than traditional gender or cultural constraints.
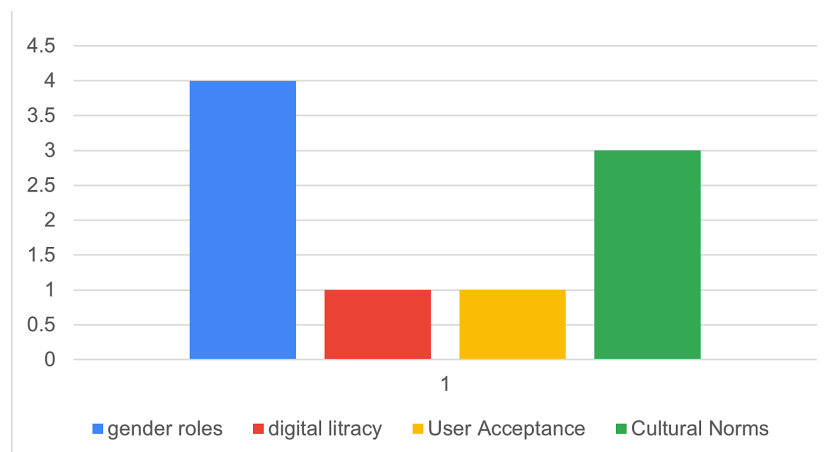
Figure 6. Barriers That hinder Women's Engagement with Technology

3.11. Role of technology in enhancing access to education for women in rural

According to Figure 7, the data suggests a nuanced landscape regarding opportunities and constraints within the given context, with 'Good Potential' indicating highest at five, indicating a strong perception of inherent opportunity or capability. 'Enhance Access' follows with a moderate score of four, reflecting a recognition that facilitating entry or availability can meaningfully improve outcomes, while 'Bridge Barriers' at three highlights the existence of challenges that, although notable, are surmountable with targeted interventions. Conversely, 'Enhance Knowledge' scores lowest at two, suggesting that knowledge acquisition or dissemination remains a significant gap or underemphasised area, which may limit the full realisation of potential unless addressed. Collectively, these

scores illustrate that while there are promising opportunity and some mechanisms for improvement, strategic focus on knowledge enhancement and barrier reduction is critical to fully leverage the potential within the system.
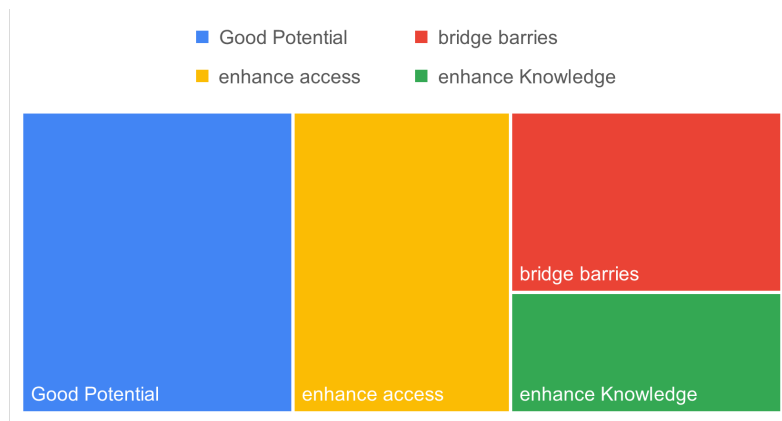

Figure 7. Role of technology in enhancing access to education for women in rural

3.12. Challenges encountered in accessing and using technology

In Figure 8, The results indicates that network availability is perceived as the most critical factor, with a score of six, emphasizing its significant role in enabling functionality and connectivity within the system.
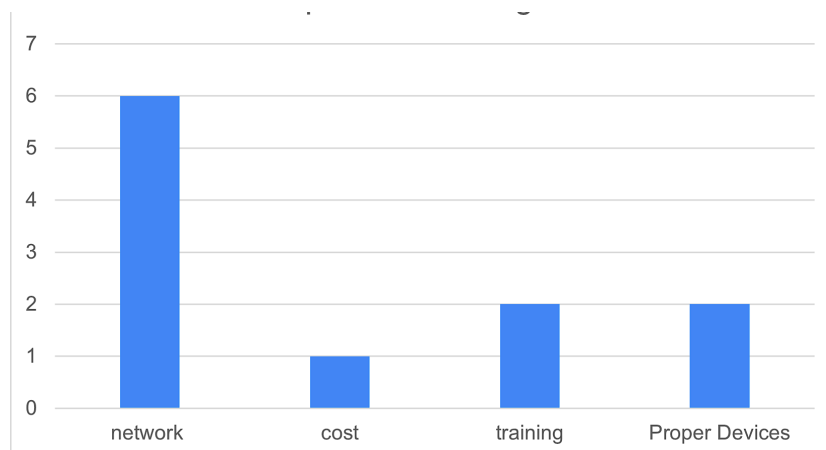
Figure 8: Specific challenges encountered in accessing and using technology

In contrast, cost is assigned the lowest score of one, suggesting either minimal concern about financial constraints or a perception that cost is less of a barrier relative to other factors. Training and the availability of proper devices both score two, indicating moderate gaps in capacity building and technological readiness, which may hinder

optimal utilisation despite strong network support. These results underscore that while infrastructure in terms of network is robust, attention must be given to enhancing skills and ensuring access to suitable devices to fully capitalise on the technological potential.

3.13. Most significant challenge

The data in figure 9 indicates that slow internet is the most significant challenge, indicating six, which underscores its critical impact on system efficiency and user experience. In contrast, cost is assigned the minimal score of one, suggesting it is perceived as a minor obstacle or manageable compared with connectivity issues. This contrast highlights that, despite financial considerations being less restrictive, technological limitations particularly internet speed poses the primary barrier that must be addressed to enable effective access and utilisation.
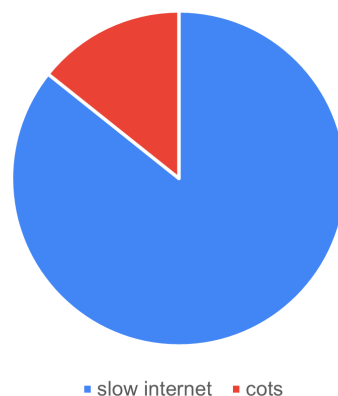
■ slow internet ■ cots

Figure 9. Most significant challenge

3.14. Experience with Technology adoption

The results in Figure 10 reveals that ease of use is the dominant factor, with a high score of five, indicating that user-friendly design is crucial for adoption and effective utilisation. In contrast, both internet connectivity and perceived challenges score only one, suggesting that technical access issues and difficulties in engagement are considered minor obstacles in this context. This pattern emphasises that prioritising intuitive interfaces and straightforward interaction can significantly enhance user acceptance, even where connectivity and other potential challenges are less prominent.
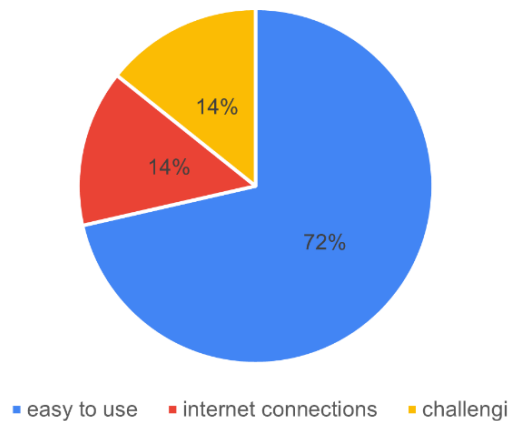
Figure 10: Experience with Technology adoption

3.15. Discussion

The findings of this study reveal that women's adoption of technology within Open and Distance Learning (ODL) in developing countries is shaped by a multifaceted interplay of technological, socio-economic, and cultural factors. Digital literacy and internet access emerged as the most critical barriers, indicating that limited digital competence and slow or unreliable connectivity restrict effective engagement with ODL platforms. Although foundational infrastructure and cost considerations were perceived as less restrictive, the results demonstrate that technological limitations remain the principal impediment to women's participation. This highlights that ensuring both the availability of reliable networks and targeted digital skills development is essential to facilitate meaningful engagement and equitable access.

Socio-cultural and institutional factors also exert a significant influence on technology adoption, though their impact is less pronounced than technological barriers. Cultural attitudes, gender norms, and institutional support, while moderately influential, continue to shape women's capacity and willingness to engage with digital learning environments. The data suggest that evolving gender roles and shifting societal expectations may gradually reduce some socio-cultural constraints, yet systemic and structural challenges persist. This underscores the necessity of contextual interventions that address both cultural and institutional dimensions alongside technical capacity building, ensuring a holistic approach to promoting women's participation in ODL.

The study further demonstrates that higher education levels and greater income are positively associated with more frequent and effective technology use, reinforcing the role of socio-economic status in shaping digital engagement. These findings suggest that women with enhanced educational attainment and financial resources are better positioned to overcome technological barriers, highlighting the intersection of economic capacity and educational preparedness in influencing ODL participation. Simultaneously, the low scores observed for knowledge enhancement and capacity-building initiatives indicate that while access and resources are important, strategic interventions focused on developing digital skills and promoting user competence are crucial to fully leverage the potential of technology-enabled learning.

The results substantiate the study's hypothesis that both individual-level competencies, particularly digital literacy and user acceptance, and broader contextual factors, including socio-cultural norms and institutional support, collectively determine women's effective adoption of technology in ODL environments. By addressing the identified barriers through targeted skills development, improved connectivity, and supportive institutional policies, policymakers and educators can foster more inclusive, equitable, and sustainable digital education systems. These findings provide empirical insights that can guide the design of gender-sensitive interventions, enhancing women's participation, empowerment, and success in technology-mediated learning in developing country contexts.

The findings of this study align with and extend existing literature on women's participation in technology-enabled Open and Distance Learning (ODL) in developing countries, demonstrating both consistencies and nuanced differences. Consistent with prior research, technological barriers such as limited digital literacy and unreliable internet access were identified as primary constraints to engagement, echoing studies by [7], [8], [17], which highlighted digital competence and connectivity as critical determinants of successful ODL adoption. Similarly, the positive association between higher education and income with increased technology usage corroborates earlier findings that socio-economic status influences access to and utilisation of digital learning platforms, reinforcing the argument that educational attainment and financial resources facilitate more effective engagement [11], [18], [19].

However, this study also reveals notable distinctions from previous research. While prior studies often emphasised structural and infrastructural barriers as dominant impediments, the current findings suggest that in contexts where basic infrastructure exists, user-level factors such as ease of use, digital skills, and user acceptance have become increasingly decisive in shaping participation. This contrasts with earlier literature that placed comparatively greater emphasis on cost and resource availability as primary challenges, suggesting a shifting landscape in which socio-technical competencies now mediate access more strongly than purely economic or infrastructural factors [12]. Furthermore, the study underscores the moderating role of socio-cultural norms and institutional support, echoing arguments by [20], but it also indicates that evolving gender roles may be reducing traditional barriers, a trend less emphasised in prior studies focused on static cultural constraints.

The comparison with existing literature illustrates that while technological and socio-economic barriers remain central to women's ODL participation, this study highlights a growing importance of individual competencies and contextual adaptability. The findings expand the discourse by suggesting that targeted interventions should increasingly focus on developing digital literacy, enhancing user experience, and fostering institutional support that is responsive to gender-specific needs. This nuanced understanding both confirms core insights from previous research and introduces a contemporary perspective on the evolving determinants of women's engagement with technology-enabled education in developing country contexts.

4. CONCLUSION

Women's participation in Open and Distance Learning (ODL) remains constrained by persistent barriers in technology adoption, particularly in developing contexts such as Botswana. Despite the expansion of digital education platforms, socio-economic inequalities, limited internet access, and entrenched socio-cultural norms continue to restrict equitable engagement, undermining the transformative potential of ODL for inclusive education. The study revealed that education level, income, and digital literacy are the strongest predictors of successful technology adoption, while gender itself is no longer a statistically significant determinant. Marital status and family responsibilities exert only marginal influence, suggesting that structural and economic factors outweigh

traditional gender roles. These findings highlight the importance of addressing infrastructural and socio-economic disparities to enable women's full participation in ODL. For policymakers in Botswana and similar countries, the evidence underscores the need for targeted interventions. Priority should be given to expanding affordable and reliable internet connectivity, particularly in rural areas, and subsidizing device ownership for low-income learners. Digital literacy training programs tailored for women should be institutionalized, alongside gender-sensitive support structures that recognize domestic responsibilities. Institutions must also strengthen technical assistance and provide flexible learning schedules to accommodate diverse socio-cultural contexts. Collectively, these measures can reduce systemic barriers and foster equitable digital inclusion. The study's small sample size small self-reported survey data limit the generalizability of findings. The cross-sectional design captures relationships at a single point in time, without accounting for longitudinal changes in digital engagement. Additionally, the focus on Botswana provides valuable contextual insights but may not fully reflect the diversity of experiences across other developing countries.

Further research should employ larger, more representative samples and adopt mixed-method or longitudinal designs to capture evolving trends in women's digital participation. Comparative studies across multiple developing countries would enrich understanding of regional variations, while qualitative interviews could provide deeper insights into socio-cultural dynamics. Future work should also explore institutional policies and community-level interventions that can sustainably support women's engagement in ODL. In conclusion, this study demonstrates that women's adoption of technology in ODL is shaped less by gender alone and more by socio-economic and infrastructural realities. By prioritizing digital literacy, affordable connectivity, and gender-sensitive institutional support, policymakers can unlock the full potential of ODL as a vehicle for inclusive education. Addressing these barriers is not only essential for Botswana but also for other developing nations striving toward equitable digital transformation in education.

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