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Barriers to Effective Implementation of Mobile Learning

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Abstract

The focus of the present research was to identify some of the major barriers to the successful integration of mobile learning (mLearning) in public senior secondary schools in Botswana. An integrated approach involving surveys completed by 252 students from Form Five, along with qualitative data from students, teachers, information technology officers, school managers, and one qualitative key informant from the Botswana Ministry of Education, was utilized, along with focus group discussions and classroom observations. The analysis was informed by the Technology Acceptance Model (TAM), the FRAME model, and Social Constructivist Theory (SCT). Findings described four barrier domains integrated along multiple levels. Students mentioned unreliable Internet (72%), power outages (68%), and insufficient charging stations (63%). Teachers' responses indicated large disparities in support and preparation: 40% said that training support was adequate, 36% said that institutional support was adequate, and 40% said that monitoring and supportive policies were adequate. Qualitative data highlighted unexpected use of devices for off-task activities, along with plagiarism and procurement, maintenance, storage, and supplier issues. mLearning integration requires investment beyond the provision of mobile devices. Integration of mLearning requires funding of a supporting infrastructure, ongoing development of teachers, digital citizenship, and supportive services.

Keywords: mobile learning, Botswana, educational technology, implementation barriers, TAM, FRAME, social constructivism

1. Introduction

In the last ten years, rapid growth of the information and communications technology sector (ICT) changed how education is delivered and how learners are able to engage with educational materials (Chasokela & Mpofu, 2025). One of the many phenomena is mobile learning (mLearning) which refers to the use of mobile devices to learn and provides learners with the opportunity to access educational materials at their convenience (Amaniampong, 2025; Hema & Gandhimathi, 2025). The use of mobile technology and digital learning platforms can stimulate learning in an interactive and student-centered fashion. It has gained popularity in educational settings at the secondary and tertiary levels as educators and policy makers have recognized the need to extend learning beyond the traditional classroom walls and to make educational opportunities mainstream and available (Piedade & Batista, 2025; Shruthi et al., 2025; Amaniampong, 2025; Sohan & Orpa, 2025; Xu et al., 2025). Research has documented a number of benefits including motivation, collaboration, and access to educational resources (Li et al., 2025). Insufficient infrastructure, coupled with a lack of policy and professional development of teaching staff, are major barriers to its implementation (Goyal et al., 2025; Ugwu et al., 2025).

Some previous reviews have demonstrated that mLearning outcomes depend on pedagogy and conditions of implementation rather than access to devices. Crompton and Burke (2018) researched mobile learning in higher education, wherein Crompton et al. (2019) studied elements of student cognition in PK-12 mobile learning. Burke and Crompton (2020) analyzed the potential of mobile technology to either transform or reproduce pedagogy. Sophonhiranrak (2021) analyzed the readiness and learning, management, and supporting systems as elements of implementation. Finally, Saikat et al. (2021) analyzed the positive and negative aspects of mobile learning during the COVID-19 pandemic.

In Botswana, the Laptop Form 5 Programme provides a context to analyze the level of school digitalization. Although the programme improved the accessibility of laptops to Form 5 learners and teachers of public senior secondary schools, the availability of laptops is not the sole determinant of how technology is integrated into learning and teaching. In line with the research on mLearning, the present study focuses on accessibility and the capacity of implementation and explores how power, connectivity, preparation, and support implored in the teaching practice and institutional arrangements shape the sustained use (Sophonhiranrak, 2021; Ugwu et al., 2025). The case of Botswana is analyzed as an implementation case rather than as a policy of the laptop programme. TAM, FRAME, and SCT were used to understand how the individual, social, and institutional factors interact to provide a rationale for learning, and to position the research within the barriers to mobile learning**.**

1.1 Problem Statement

While the Vision 2036 laptop initiative was generally accepted with positive sentiments in line with the government's vision, logistical challenges remain as evident as ever at the school level. It is common knowledge that large-scale digital interventions, regardless of their benefits, are usually pitted against the same challenges as Sub-Saharan Africa grapples with in ongoing initiatives such as inadequate infrastructure, a supply gap of prepared teachers, and fragile governance systems (Cuadros et al., 2025; Matlala, 2025). Given the large digital divide that exists in most developing countries, people are asking what workable conditions enable the successful integration of technology into teaching praxis.

Though a number of challenges reducing the effectiveness and efficiency of mLearning have been documented, there are still gaps in the integrated research needed to address them. This research is an attempt to analyze the barriers to the implementation of mLearning, particularly in Botswana's public senior high schools, considering challenges with the devices, infrastructure, pedagogy, behavior, and institutional problems.

1.2 Research Questions

This research is premised on the following research questions:

1. What are the infrastructural challenges that impede the active implementation of mLearning in Botswana's senior secondary schools?
2. What are the pedagogical and institutional challenges that limit teacher preparation and policy implementation?
3. What are the behavioural and ethical challenges arising from the use of laptops for learning?
4. What are the procurement and technical support challenges that hinder the sustainability of mLearning initiatives?

1.3 Significance of the Study

This study has three main contributions. First, it is an early contribution to the literature on large-scale digital transformations in the Sub-Saharan region. Most work in this field looks more generally at the potential or the readiness for these transformations. By shifting focus to barriers, my study looks at an important gap in the literature. Second, my study integrates three theories to better understand how technology works in classrooms. This study also contributes by showing how different barriers, in combination with the Technology Acceptance Model, the FRAME model, and Social Constructivist Theory, can be used to understand social interactions, the usefulness of a technology, and the barriers to collaborative learning. Third, this study will provide specific policy recommendations for government officials, school administrators, and the ICT regulators in Botswana and similar countries. The study includes recommendations for infrastructure, teacher development, digital ethics, and refining the procurement and purchasing systems. These recommendations may also be helpful for other countries in order to better align their digitalization policies and practices for greater integration in the classroom.

2. Theoretical Framework

Davis (1989) proposes Technology Acceptance Model (TAM) to describe the acceptance of a technology as a combination of factors of perceived usefulness (PU) and perceived ease of use (PEOU). This model can be applied to schools in Botswana. The unreliable electricity and poor Internet can negatively impact PEOU, and the limited curriculum integration can negatively impact PU and act as a barrier to technology adoption by both learners and educators.

Koole (2009) proposes the FRAME model to explain mobile learning as the interaction between the device, the learner, and the social context. It can be adapted to describe the barriers of limited or broken technology, poor support, and

adverse institutional conditions. FRAME indicates the interplay between technology and social and cultural barriers to the use of technology in learning and teaching.

Vygotsky's (1978) Social Constructivist Theory (SCT) complements the other theories by considering learning as socially constructed as a result of interaction and scaffolding. It asks about the negative outcomes of insufficient participation in scaffolding, such as plagiarism, cyberbullying and technology misuse, on social learning. These combined theories bring a constructive outlook to understand the challenges of implementing mobile learning in the secondary schools in Botswana.

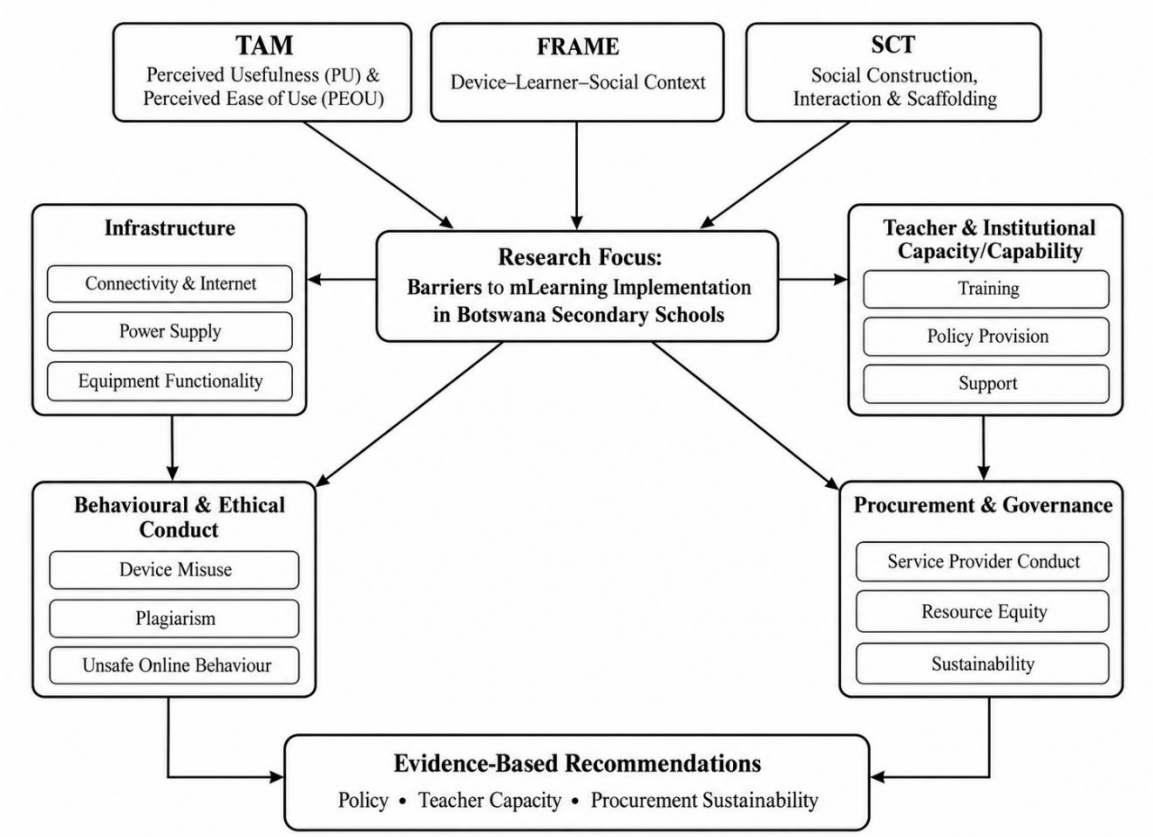


Figure 1. Integrated Theoretical Framework, Barrier Domains, and Evidence-Based Recommendations for mLearning Implementation

Note. This integrated framework combines the elements of the Technology Acceptance Model (TAM), FRAME, and Social Constructivist Theory (SCT). TAM speaks to the issues of perceived usefulness and ease of use, while FRAME describes the capabilities and social context of the device and the learner, and SCT describes the social context and the nature of collaboration and the creation of knowledge. The frameworks are adapted to cover four barrier domains: infrastructure (adequate connectivity and power, functionality of equipment); teacher and institutional capacity/capability (training, provision of necessary policy, and support); behavioral and ethical conduct (misuse of devices, plagiarism, and unsafe behavior online); and procurement and governance (conduct of service providers, equity and sustainability of the resources). Together, these domains offer informed evidence for policy, teacher capacity, and sustainability of procurement.

3. Methodology

A pragmatic mixed-methods approach was chosen to explore the implementation challenges of mLearning in public senior secondary schools in Botswana.

3.1 Research Design

A concurrent multilevel mixed-methods research design was used. Broadly, stakeholders across different levels were involved in the same process of collecting data. The quantitative arm of the research design involved a firm survey instrument to assess device provision, connectivity, and the active participation of learners in the process of learning.

The qualitative component comprised interviews, open-ended questionnaires, focus group discussions, and classroom observations of learners, teachers, IT support staff, school administrators, and one person from the Ministry of Education.

3.2 Research Population

The target population of this study was Form Five learners, teachers, IT support staff, school administrators, and staff from the Ministry of Education involved in the provision of senior secondary education in Botswana.

Form Five students were included because they received laptops directly. Teachers were classified as primary implementers because they work in classrooms. IT officers and school managers were included to cover the technical and administrative perspectives, respectively. Since only one official from the Ministry of Education participated (n = 1), this participant was identified exclusively as a qualitative key informant and a policy-level perspective. No Statistical Representativeness is claimed for the Ministry's contribution.

3.3 Sampling Procedures

There are 34 public senior secondary schools in Botswana with varying collections of administrative regions. Five schools were purposively selected from the Southeast, South, Kgatleng, and Kweneng regions in an attempt to provide geographical coverage and make detailed fieldwork feasible. Within these schools, stratified random sampling was used to select students from Form Five (4,778). Gender and academic streams were the stratification variables.

Using Cochran's (1977) sampling techniques for finite populations, an initial sample estimate was set at 355. The final achieved quantitative sample included 252 students. For the qualitative strand, purposive and snowball sampling were employed to recruit 50 students, 25 teachers, five IT officers, five school managers, and one Ministry of Education official involved in mLearning. The Ministry official (n = 1) was not included for Statistical Inference. In addition, 10 classroom observations (two per school) and 10 focus-group discussions (one student group and one teacher group per school) were conducted. Using probability sampling in the quantitative strand with purposive and snowball sampling in the qualitative strand added balance to the study's level of quantitative coverage and contextual depth.

3.4 Data Collection Instruments

Data were gathered using different tools appropriate to the various research questions (table 1):

Table 1. Data Collection Instruments

Instrument	Purpose	Focus Areas
Student survey	Quantify student perceptions	Infrastructure, teacher support, curriculum integration, behavioural issues
Semi-structured interviews and focus groups	Explore stakeholder experiences	Institutional barriers, procurement, ethics, classroom practices
Open-ended questionnaires	Extend structured responses	Explanations, examples, emerging concerns
Classroom observations	Examine enacted practice	Teacher-student interaction, laptop integration, device use during lessons

3.5 Validity and Reliability of Instruments

Pilot study and expert review were undertaken to assess instrument quality. For the quantitative strand, stability was evaluated using test-retest. Coefficients of Cronbach's Alpha higher than 0.70 were interpreted as evidence of reliability; however, it should not be confused with internal validity. For the qualitative strand, credibility and dependability were enhanced via member checking, triangulation of data sources, and peer debriefing.

3.6 Data Analysis

Quantitative data were analyzed using SPSS 29. To compare gender-based differences in access and use, independent t-tests were employed on selected variables, and descriptive statistics were used on the rest of the data. The four research questions were primarily descriptive and asked for a comparison of three or more groups, which was not the case. Thus, ANOVA and multiple regression were not applicable. This was explicitly stated as a limitation of the analysis. Qualitative data were analyzed using Braun and Clarke's (2006) thematic analysis in ATLAS.ti. Credibility and dependability were enhanced through triangulation of data collection methods and sources. Participants from institutions were sent formal requests for participation.

4. Results

4.1 Infrastructure Challenges

Infrastructure was the leading challenge. Table 2 summarizes that 72% of students reported agreement or strong agreement to express concerns about unstable internet connectivity, 68% reported frequent blackouts while using their laptops, and 63% reported insufficient charging facilities. Classroom observations noted instances that limited use of laptops due to a lack of charging deficiencies during blackouts. A student said, “Sometimes the laptop is useless because there is no electricity or Wi-Fi for the whole day.” An IT officer said, “We do not have backup systems so when power goes off, everything stops.”

In these situations, ease of use (TAM) is impacted, and the interaction between the device and the learner (FRAME) is weakened.

Table 2. Student Perceptions of Infrastructure Challenges (N = 252)

Challenge	% Agree/Strongly Agree	M (SD)
Internet connectivity is unreliable	72%	3.91 (.82)
Frequent power cuts affect laptop usage	68%	3.85 (.95)
Lack of charging facilities in classrooms	63%	3.70 (.88)

Note. “% Agree/Strongly Agree” represents the proportion of students who selected 4 = Agree or 5 = Strongly Agree on the Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Full Likert distributions are provided in Appendix Table A1.

4.2 Teacher Preparation and Institutional Gaps

Teachers noted inconsistent preparation and support by their institutions. Out of the 25 teachers, 10 (40%) agreed or strongly agreed that they had received sufficient training, 9 (36%) disagreed or strongly disagreed, and 6 (24%) were neutral. As the item was worded positively, the 36% represents disagreement with the statement that the training was sufficient; neutral responses were left as a separate category. A school manager noted that “Teachers still are not confident; many of them do not even touch the laptops because they are afraid of getting stuck with a technical problem during the lesson.” A teacher said, “We have no support after one workshop.” These results indicate insufficient perceived usefulness (TAM) and the support required for technology-supported learning (SCT).

Table 3. Teachers' Perceptions of Training and Institutional Support (N = 25)

Item	% Agree/Strongly Agree	M (SD)
Teachers received adequate training	40%	3.00 (1.29)
Institutional support structures are strong	36%	2.96 (1.17)
Monitoring and policy enforcement are adequate	24%	3.00 (1.29)

Note. All percentages use n = 25 as the denominator. For the training item, 10/25 (40%) agreed or strongly agreed, 9/25 (36%) disagreed or strongly disagreed, and 6/25 (24%) were neutral. Neutral responses were retained as a separate category. The M (SD) values are calculated from the 1–5 frequency distributions reported in Appendix Table A2.

4.3 Behavioural and Ethical Challenges

Some respondents reported behavioural and ethical challenges. Sixty-one percent of respondents reported off-task behaviour such as social media and gaming, while 57 percent reported plagiarism and other forms of academic dishonesty. Cyber bullying and other forms of inappropriate use of technology were reported by 41 percent of respondents. One student noted, “We use the laptops for Facebook and YouTube when teachers aren’t watching.” Plagiarism and inappropriate use of generative AI technology was noted by both teachers and IT representatives. One teacher said, “students just copy from the internet and submit it as their work.” An IT representative noted that, “AI tools are being used for assignments. Some simply paste answers from ChatGPT.” These behaviours may conflict with the collaborative learning principles of Social Constructivist Theory (SCT) and the social aspect of the FRAME model.

Table 4. Behavioural and Ethical Challenges Reported by Students and Teachers

Challenge	Students (N = 252)	Teachers (n = 25)
Off-task use (gaming, social media)	61%	72%
Plagiarism / academic dishonesty	57%	68%
Cyberbullying / misuse of devices	41%	52%

Note. Student percentages correspond to the proportions reported in Appendix Table A3. Teacher percentages represent the proportion of the 25 teachers identifying each challenge. IT-officer perspectives are reported qualitatively in the accompanying text and are not expressed as percentages.

4.4 Procurement and Governance Challenges

Qualitative data from five school managers and one ministry key informant provided insights on procurement and governance. Although the ministry only provided one official (n=1) for the purpose, this data has only been used as contextual evidence and has not been used to fill a statistical gap. This official remarked saying, "The supplier contract was not well monitored and now we struggle with maintenance and servicing." Separately, school managers described challenges with maintenance and in secure storage. These accounts may demonstrate that the procurement and governance arrangements create uncertainty about the sustainability of mLearning and the overall institutional commitment (FRAME).

Table 5. Qualitative Evidence from School Managers on Procurement and Governance Challenges

Challenge	School managers (n = 5) – illustrative qualitative evidence
Delays in device delivery	"We received the laptops late, and some even came without chargers."
Poor maintenance/servicing arrangements	"When laptops break down, it takes months to get them repaired because servicing is not covered in the contract."
Inadequate storage and inventory systems	"The storage rooms are not secure; we fear theft because there are no proper facilities."

Note. Table 5 summarises school-manager qualitative evidence only. The Ministry official (n = 1) is reported as a qualitative main informant in the surrounding text and it is not included in the summary table or used for statistical inference.

5. Discussion

The first research question focused on infrastructural constraints. 72% of students in the survey stated that they had unreliable internet. 68% of students stated that they had experienced power outages and 63% of students stated that they had inadequate charging facilities. In addition, from classroom observation, students' laptops remained unused during power outages and during times that charging facilities were not available. From the interviews, participants suggested that their device use stopped because there was no backup power. These constraints on ICT resources have been well documented by Nsyengula et al. (2025) in their studies of schools in Sub-Saharan Africa. In the context of the Technology Acceptance Model (TAM) inadequate infrastructural constraints would lead to a lower perceived ease of use of a system and in the FRAME model insufficient connections between devices, users and environment would lead to a less-integrated learning environment.

The second research question concerned preparation of teachers and the ability of the institution. Using a constant reference of n=25, 10 of the teachers (40%) responded that the training was adequate, while 9 (36%) of the teachers responded that the training was inadequate and 6 (24%) of the teachers responded that the training was neither adequate nor inadequate. Therefore, neutral responses were considered as a separate category. However, school-manager interviews noted that the teachers had insufficient confidence and ability to use laptops in their teaching. One participant stated, "Teachers are still not confident, many avoid laptops because they fear technical problems in the middle of lessons." This viewpoint is aligned with Muyambi and Ramorola (2025) who state that teacher training is a primary factor for successful mobile learning.

According to SCT, the absence of adequate scaffolds may make it difficult for teachers to implement technological design that improves their ability to set up collaborative digital learning spaces. The absence of institutional oversight may also lead to a lack of responsibility and superficial adoption, as Sprovieri (2025) argues.

The third research question was focused on behavioral and ethical challenges. The results showed that 61% of students reported off-task behavior such as social media and gaming. Plagiarism and other forms of academic dishonesty were also reported by teachers and IT officers. One student said, “We use the laptops mostly for Facebook and YouTube when the teachers are not keeping watch.” Along with the concerns expressed by teachers regarding the misuse of generative AI to complete schoolwork, these examples align with the concerns expressed by Kovari (2025) and Whalen et al. (2025) regarding the ethical and academic-integrity issues posed by digital and generative-AI technology.

The fourth research question addressed procurement and governance. Qualitative interviews with school managers and the Ministry key informant indicated concern for the delayed delivery of devices, unreliable maintenance, and vulnerable storage of devices, along with insufficient supplier oversight. Given the feedback from the Ministry came from a single respondent, it should be framed as contextual qualitative feedback rather than quantitative feedback. These findings support Nguyen and Le (2025), who argue that adverse supply-chain and weak regulations impact the ability to implement digital transformation.

Overall, the barriers to the implementation of mLearning in Botswana are integrated and span across the different factors of preparedness of learners, teachers, infrastructure, procurement, governance, and behavior of learners. Asuamah Yeboah et al., 2025; Shambare & Jita, 2025; Umbet et al., 2025 report other related contexts with comparable challenges. This study provides additional value to the literature by integrating procurement challenges and ethics under the same umbrella of implementation challenges. The Botswana case shows how reliance on technology for education would require adequate supplies of reliable electricity, trained teachers, and accountability in the procurement process.

On the limitations from analysis, the quantitative side was mostly descriptive, with some t-tests for two-group comparisons. Since the research questions did not seek to define central comparisons among three or more groups or propositional modelling, ANOVA and multiple regression were not used. Hence, there is no estimate of multi-group differences or the independent predictive contribution of each barrier. Therefore, the findings should be more understood as descriptive associations than causal or multi-variable effects.

6. Conclusion

This study covered barriers to effective mobile learning (mLearning) under the context of government-sponsored distribution of laptops for Senior Secondary School students in Botswana. Using a concurrent mixed-methods design, the study identified four interrelated barrier domains: infrastructure, teacher preparation and institutional support, behavior and ethics, and procurement and governance. Insufficient electricity and internet supply, together with limited charging facilities, constrained ease of use. Limited and inequitable training and institutional support undermined teachers’ confidence and ability to incorporate laptops pedagogically in the classroom, while misuse of devices, cyberbullying, plagiarism and distraction from the learning objective challenged the social learning environment.

At the system level, procurement inefficiencies, insecure storage and weak maintenance raised questions of sustainability. According to TAM, FRAME, and SCT, adoption challenges exist in the psychological, contextual, technological, and social dimensions. Therefore, the sustainable Botswana mLearning project will require the concerted effort of all actors involved to provide infrastructure, develop teachers, and foster learners' digital citizenship, among others, along with required technical support and appropriate institutional governance. This integrated approach is illustrated in Figure 2.

The four interdependent areas represented in the framework are technological infrastructure, professional capacity building, learner engagement and digital citizenship, and governance, accountability, and ethics. It is less about the provision of devices and more about the need to focus on these areas in a coordinated way. The framework incorporates procurement inefficiencies, accountability and ethics and, thus, integrates Botswana into the existing discourse on the challenges of educational technology and digital education reform in the Global South.

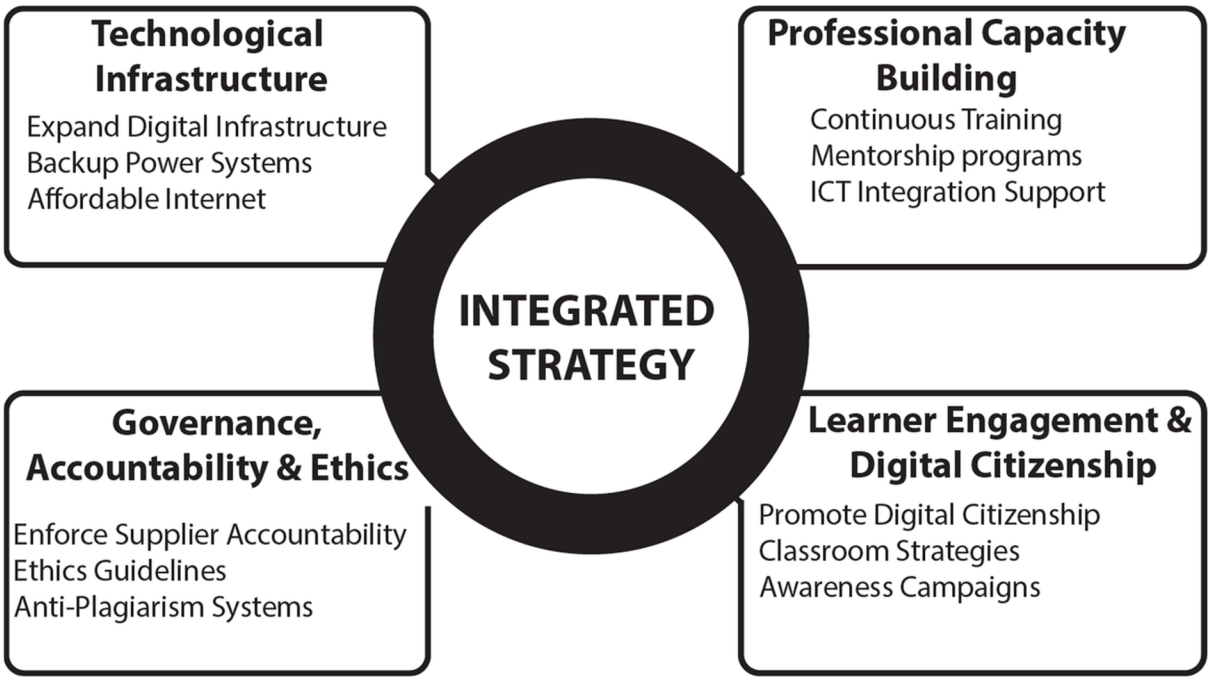


Figure 2. Integrated Framework for Addressing Barriers to Sustainable mLearning Implementation in Botswana's Senior Secondary Schools

Note: The framework connects infrastructure, professional and community capacity building, learner engagement and digital citizenship, and governance, accountability, and ethics as integrated areas for sustained mLearning.

7. Recommendations

Barriers have been identified and recommendations have been made at policy, practice and research levels.

7.1 Policy-Level Recommendations

Clear procurement strategies should be developed. Maintenance and replacement service level agreements should be included when sourcing devices. Schools should have reliable and affordable internet with backup power supply and connected power infrastructure. Digital ethical frameworks should address plagiarism, use of generative AI and cyber-safety.

7.2 Practice-Level Recommendations

Continuous professional development should be provided through sustained professional development, mentoring and creation of peer support networks. Support should be provided through frequent school-level reporting and ICT coordination. Digital citizenship should be reinforced by engagement of learners, collaborative construction of Codes of Conduct, and practice which directs use of devices to support learning in the lesson.

7.3 Research-Level Recommendations

Longitudinal studies can assess the impact of mLearning in Botswana. Other Southern African countries can be used as case studies to assess the impact of procurement, governance, ethics and other mLearning frameworks. Where questions require multiple groups comparison or prediction, future studies should use appropriate methods such as ANOVA, multiple regression, or multilevel modelling. School-based action research can assess other interventions such as blended learning and gamified assessment to promote learning and reduce misuse of devices.

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Appendix

Table A1. Full Likert-Scale Distribution of Student Perceptions on Infrastructure Challenges (N = 252)

Challenge	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
Internet connectivity is unreliable	5%	10%	13%	44%	28%
Frequent power cuts affect laptop usage	6%	12%	14%	40%	28%
Lack of charging facilities in classrooms	7%	15%	15%	39%	24%

Table A2. Teacher and Institutional Challenges (Full Likert Distribution; N = 25)

Item	SD (1)	D (2)	N (3)	A (4)	SA (5)	% A/SA	M (SD)
Teachers received adequate training	4 (16%)	5 (20%)	6 (24%)	7 (28%)	3 (12%)	40%	3.00 (1.29)
Institutional support structures are strong	3 (12%)	6 (24%)	7 (28%)	7 (28%)	2 (8%)	36%	2.96 (1.17)
Monitoring and policy enforcement are adequate	4 (16%)	5 (20%)	6 (24%)	7 (28%)	3 (12%)	40%	3.00 (1.29)

Note. Each row is based on n = 25 teachers. SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, and SA = Strongly Agree. Percentages are calculated from the displayed frequencies using the same denominator. Neutral responses remain a separate category and are not added to disagreement. M (SD) values are calculated from the displayed 1–5 response frequencies.

Table A3. Behavioural and Ethical Challenges (Full Likert Distribution)

Item	SD (1)	D (2)	N (3)	A (4)	SA (5)	% A/SA	M (SD)
Off-task use (gaming/social media)	22 (9%)	30 (12%)	46 (18%)	96 (38%)	58 (23%)	61%	3.55 (1.21)
Plagiarism / academic dishonesty	18 (7%)	36 (14%)	54 (22%)	92 (37%)	52 (20%)	57%	3.48 (1.16)
Cyberbullying / misuse	28 (11%)	54 (21%)	66 (26%)	74 (29%)	30 (12%)	41%	3.11 (1.22)

Table A4. Qualitative Evidence on Procurement and Governance Challenges from School Managers

Challenge	School managers (n = 5) – illustrative qualitative evidence
Delays in device delivery	"We received the laptops late, and some even came without chargers."
Poor maintenance/servicing arrangements	"When laptops break down, it takes months to get them repaired because servicing is not covered in the contract."
Inadequate storage and inventory systems	"The storage rooms are not secure; we fear theft because there are no proper facilities."

Note. This appendix table contains school-manager evidence only. The single Ministry of Education official (n = 1) is treated as a qualitative key informant and is quoted only in Section 4.4; no statistical representativeness is claimed.

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Use of Artificial Intelligence

The authors reviewed and accepted all AI assisted changes. The authors take responsibility for the final manuscript. The authors confirm that the core academic content of this manuscript, including the research design, data collection, analysis, interpretation, findings, and conclusions, was entirely created by the authors and was not generated by any generative artificial intelligence model.

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