Assessing Infrastructure, Resources, Policies, and Faculty Preparedness for Open, Distance, and Technology-Enabled Learning at Tamale College of Education to Support In-Service Teachers: A Baseline Study

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Abstract

The study evaluated the infrastructure, resources, policies, and faculty preparedness at Tamale College of Education (TACE) regarding open, distance, and technology-enabled learning. It analysed the college's existing systems and examined administrators' and teaching staff's perceptions of incorporating technology into professional development programs. A survey of 490 in-service teachers revealed a majority were male (344, 70.2%) and a smaller proportion female (146, 29.8%). Findings indicate that TACE has made progress in integrating technology, possessing basic infrastructure like computer labs and internet connectivity, and developing a digital learning platform. However, challenges remain in computer availability and internet access, especially in remote areas. Faculty preparedness varied; some educators demonstrated high digital literacy and enthusiasm, while others required further training to effectively use technology. Additionally, TACE lacks a comprehensive policy framework for open, distance, and technology-enabled learning. Establishing clear guidelines, support mechanisms, and incentives could promote innovation and technology adoption in professional development programs.

Keywords: Open, Distance, and Technology-Enabled Learning (ODL), Faculty Preparedness, Professional Development, Technology Integration, Digital Literacy.

Introduction

In recent years, the educational landscape has transformed due to advancements in digital technologies and the demand for flexible learning opportunities. Open, Distance, and Technology-Enabled Learning (ODL) aims to democratise education by breaking down barriers related to time, geography, and accessibility (Anderson, 2011; UNESCO, 2020). ODL combines open educational resources (OERs), distance education models, and digital technologies to create inclusive and personalised learning experiences.

Open learning emphasises accessibility and flexibility, allowing learners to choose how, when, and where they engage with educational content (Commonwealth of Learning, 2015). Distance education supports learners separated from instructors through correspondence, broadcast media, or internet-based platforms. Technology-Enabled Learning (TEL) enhances these models with digital tools like Learning Management Systems (LMS), mobile learning apps, video conferencing tools, and AI-driven educational software, facilitating interactive and adaptive learning (Ally & Samaka, 2013).

The significance of ODL was highlighted during the COVID-19 pandemic, which disrupted traditional education and necessitated a shift to remote learning (Bozkurt et al., 2020). Institutions that had invested in ODL frameworks showed greater resilience, emphasising the need for robust infrastructure, policy support, faculty training, and learner readiness for success.

For in-service teacher professional development, ODL offers opportunities for continuous learning and pedagogical innovation without requiring physical displacement.

Effective implementation of ODL depends on technological infrastructure, digital literacy, motivation, and supportive institutional policies (Anderson, 2011; UNESCO, 2020). Therefore, assessing the readiness and capacity of educational institutions and stakeholders is essential for integrating ODL strategies into professional development programs.

This study aims to explore the infrastructure, resources, policies, and faculty preparedness necessary for adopting ODL at Tamale College of Education, providing evidence-based insights for future educational innovations and reforms. The study is guided by the following research questions:

1. What is the current level of awareness and understanding among in-service teachers regarding open, distance, and technology-enabled learning methods for professional development and training?

2. What are the existing infrastructure, resources, and technological tools available for implementing open, distance, and technology-enabled learning for in-service teachers' professional development and training?
3. To what extent are in-service teachers' readiness in terms of their technological proficiency, digital literacy skills, and adaptability to new learning environments?

Literature Review

This literature review evaluates faculty preparedness, institutional policies, resource allocation, and infrastructure essential for Open, Distance, and Technology-Enabled Learning (ODL). It synthesises recent studies on institutional readiness, regulatory frameworks, resource distribution, and educators' capabilities to employ online learning methodologies, especially given rapid technological advancements and the shift to online education. A critical component of effective ODL is the institutional framework. Benke and Widger (2023) analyse how support systems, such as reliable IT infrastructure, digital libraries, and adaptable student support services, have evolved for various delivery models. Gungadeen and Rajnee (2023) emphasise that infrastructure readiness is crucial for a seamless transition to online modalities, identifying strengths and deficiencies in technology-enabled learning across institutions. Banawis et al. (2023) argue that a robust digital education strategy requires thorough assessments of academic resources, learning tools, and collaboration among stakeholders.

Successful open and distance learning relies on the quality and accessibility of learning materials. Huang et al. (2020) underscore the significance of Open Educational Resources (OER) in overcoming educational barriers during crises, particularly through Open Educational Practices (OEP) that enhance instructional quality. Okonkwo (2012) highlights OER's essential role in improving instructional delivery in distance learning environments reliant on robust ICT infrastructures. Topping et al. (2022) note that significant improvements in both school and non-school services are necessary to support innovative digital methodologies and ensure students receive consistent assistance during and after transitions to online learning.

Institutional policies provide the framework for adopting and sustaining ODL. Nkuyubwatsi (2016) critiques traditional higher education policy documents for inadequately addressing components of open learning, including openly licensed content and rigorous assessment methodologies. Rani (2025) explores digitisation and knowledge conversion in higher education, advocating for policy reforms that promote infrastructure investments and foster environments conducive to ongoing knowledge advancement. Dirienzo and Wang (2022) underscore the necessity of policy-driven strategies to cultivate interdisciplinary competencies and integrate technology into educational practices.

The transition to and sustainability of technology-enabled learning depend heavily on faculty preparedness and professional development. Cutri and Mena (2020) reveal that many educators felt unprepared for the digital transition, with the abrupt shift to online instruction during the COVID-19 pandemic exposing gaps in faculty readiness. Ramlo (2022) documents faculty scepticism regarding online instruction efficacy, highlighting the need for training and support initiatives. Szilagyi et al. (2022) emphasise that disparities in educators' digital proficiency lead to uneven student outcomes, reinforcing the importance of continuous professional development. Implementing digital teaching methodologies enhances faculty preparedness and mitigates skill gaps (De Juana-Espinosa et al., 2023; Siregar & Siregar, 2024).

Integrating technology into the classroom requires a comprehensive transformation in pedagogical approaches beyond infrastructure and faculty readiness. Educators and students need training and supportive policies to cultivate digital skills, as effective technology use is essential for successful distance learning (Alenezi, 2023; Roddy et al., 2017). To ensure immediate adaptation and long-term sustainability, Forkosh-Baruch and Avidov-Ungar (2019) propose frameworks for ICT implementation that emphasise systematic training and progressive technological integration.

The literature indicates that several interrelated factors must converge for the successful implementation of ODL. Policymaking must adapt to the demands of digital education, institutions must invest in digital infrastructures and learning materials, and faculty members must engage in ongoing professional development. Numerous studies demonstrate that addressing these interconnected domains concurrently is the most effective strategy for developing successful digital learning environments.

The successful integration of ODL fundamentally depends on robust infrastructure and technological resources, including high-speed internet, Learning Management Systems (LMS), mobile-compatible platforms, and access to digital devices (Anderson, 2011; UNESCO, 2020). Without these components, institutions face limitations in delivering flexible, high-quality educational experiences.

In Sub-Saharan Africa, infrastructural inadequacies are a major barrier to effective distance education. The Commonwealth of Learning (2015) reports that many developing countries struggle with unstable internet connectivity, outdated hardware, and limited access to e-resources, undermining ODL implementation. Bozkurt et al. (2020) argue that disparities in access to electricity, broadband networks, and digital tools exacerbate educational inequalities.

Research indicates that institutions that invested early in robust digital infrastructures, including scalable cloud-based LMS and mobile learning support, were more resilient during the COVID-19 pandemic (Bond et al., 2021). A comprehensive evaluation of current infrastructure and resources at Tamale College of Education (TACE) is essential for understanding existing assets and planning targeted investments to address deficiencies.

Faculty preparedness is a critical determinant of ODL's success, encompassing technical proficiency and pedagogical competence in delivering instruction through digital platforms. Ally and Samaka (2013) emphasise that many educators lack the skills to design and deliver content online, especially in contexts traditionally dominated by face-to-face instruction.

Digital literacy, defined as the ability to effectively find, evaluate, create, and communicate information using digital technologies, is vital for faculty engaged in ODL (UNESCO, 2020). However, a study by Czerniewicz et al. (2019) found that many faculty members in emerging economies possess only moderate familiarity with digital teaching tools and lack confidence in utilising them creatively.

Faculty attitudes towards technology significantly influence ODL adoption. The willingness of in-service teachers to adapt to new technologies and engage in professional development is crucial (Kirkwood & Price, 2014). Without targeted training programs focusing on ICT skills, online pedagogy, collaborative digital learning environments, and adaptive assessment methods, institutions risk low engagement and suboptimal use of ODL platforms.

Baseline studies, such as the one at TACE, are essential for mapping faculty competencies, identifying training needs, and designing tailored interventions.

Institutional frameworks comprising policies, administrative support, incentives, and strategic plans play a pivotal role in sustaining ODL. Bates (2015) notes that without coherent institutional policies outlining expectations, support mechanisms, and quality assurance standards, technology integration in education tends to be fragmented and unsustainable.

Effective ODL policies should address areas such as intellectual property rights for online content, standards for digital course design, faculty workload allocations for online teaching, and access to technical support (Anderson, 2011). Additionally, incentive structures that reward faculty involvement in online teaching significantly influence adoption rates (Huang et al., 2020).

A study by Sangrà et al. (2012) highlighted that institutions with clear strategic visions for e-learning successfully embedded technology-enabled practices across departments. Conversely, a lack of leadership commitment, budgetary allocations, and long-term planning often results in ODL initiative failures post-pilot phases.

Examining current policies, managerial support, and resource distribution at TACE will facilitate understanding of the institution's readiness and assist in developing effective implementation plans.

Literature Review

This review examines faculty preparedness, institutional policies, resource allocation, and infrastructure as critical enablers of Open, Distance, and Technology-Enabled Learning (ODL). Rather than cataloguing studies, the focus is on synthesizing evidence that highlights institutional readiness, regulatory frameworks, and the capacity of educators to integrate technology into teaching. The review is particularly relevant given rapid technological change and the increasing reliance on digital modalities to support teacher education.

Infrastructure and Resources

Robust infrastructure and adequate resources are consistently identified as the foundation of successful ODL. Benke and Widger (2023) highlight the role of support systems such as reliable IT infrastructure, digital libraries, and student services in sustaining diverse delivery models. Similarly, Gungadeen and Rajnee (2023) show that infrastructural readiness enables smooth transitions to online modalities, whereas weaknesses in connectivity or platform reliability disrupt learning. Banawis et al. (2023) further argue that strategic investment in learning tools and collaborative stakeholder engagement is essential for building resilient digital education systems.

A key dimension of infrastructure is the quality and accessibility of learning materials. Open Educational Resources (OER) have emerged as a cost-effective means of reducing barriers to education while enhancing instructional quality (Huang et al., 2020; Okonkwo, 2012). However, the effectiveness of OER depends on stable ICT infrastructures and institutional commitment to adoption. Topping et al. (2022) caution that without simultaneous investment in both learning materials and support services, students are likely to experience inconsistent educational outcomes during transitions to online learning.

Institutional Policies and Frameworks

Institutional policies shape the sustainability of ODL initiatives by setting expectations, allocating resources, and ensuring quality. Nkuyubwatsi (2016) critiques many higher education policy documents for neglecting components

such as openly licensed content and robust assessment practices. More recent analyses emphasize the importance of policies that support digitisation, knowledge conversion, and ongoing professional development (Rani, 2025; Dirienzo & Wang, 2022). Policies that incentivize technology integration and interdisciplinary collaboration provide an enabling environment for long-term success.

Clear strategic visions also matter. Sangrà et al. (2012) show that institutions with explicit policies and leadership commitment embed technology more effectively across departments. By contrast, fragmented initiatives without long-term planning or budgetary support often fail after pilot phases. Bates (2015) adds that policies should address practical issues such as intellectual property rights, workload for online teaching, and technical support. At Tamale College of Education (TACE), examining existing policy frameworks is therefore central to understanding readiness for ODL.

Faculty Preparedness and Professional Development

Faculty preparedness is a decisive factor in ODL adoption. Research shows that many educators entered the digital era with limited readiness, a challenge exposed during the COVID-19 pandemic (Cutri & Mena, 2020; Ramlo, 2022). Uneven levels of digital proficiency among faculty members often result in inconsistent student outcomes, underscoring the importance of continuous training and development (Szilagyi et al., 2022). Recent studies confirm that professional development initiatives enhance digital competencies and improve the quality of online instruction (De Juana-Espinosa et al., 2023; Siregar & Siregar, 2024).

Beyond technical skills, faculty attitudes toward technology strongly influence adoption. Kirkwood and Price (2014) note that willingness to engage in professional learning and adapt pedagogical practices is essential for success. Without targeted support in areas such as ICT skills, online pedagogy, and digital assessment methods, educators are unlikely to maximize the potential of ODL platforms. Baseline studies in institutions like TACE therefore play a vital role in identifying current competencies and tailoring interventions to faculty needs.

Regional and Contextual Challenges

In Sub-Saharan Africa, infrastructural and resource limitations remain significant barriers to effective ODL. The Commonwealth of Learning (2015) documents persistent challenges such as unstable internet, outdated hardware, and limited e-resources. Bozkurt et al. (2020) add that disparities in access to electricity and broadband exacerbate inequalities in digital education. Yet, institutions that invested early in scalable infrastructures, such as cloud-based Learning Management Systems (LMS) and mobile learning platforms, proved more resilient during the COVID-19 pandemic (Bond et al., 2021). These findings highlight the urgency of context-specific evaluations to inform targeted improvements in ODL systems.

Synthesis and Gap

The literature converges on four interdependent factors—robust infrastructure, adequate resources, supportive policies, and faculty preparedness—as prerequisites for successful ODL. However, most studies consider these elements in isolation, with limited exploration of how they interact in teacher education institutions to support in-service teachers. In the African context, challenges of weak infrastructure, limited faculty digital literacy, and fragmented policy frameworks persist despite the global shift toward technology-enabled learning. This creates a pressing need for baseline institutional studies, such as the present investigation at Tamale College of Education, to assess readiness across these domains and design effective strategies for implementing ODL in support of in-service teacher development.

Methodology

Research Design, participants, and procedure

The baseline survey aimed to evaluate the current state of Open, Distance, and Technology-Enabled Learning (ODL) among in-service teachers and ensure that their perspectives were integral to the development of a contextually appropriate ODL framework. The study employed a mixed-methods design, integrating quantitative (descriptive cross-sectional survey) and qualitative (thematic analysis) data collection techniques. This approach provided both breadth and depth of insight, enhancing the richness and reliability of the findings.

Prior to data collection, the study secured approval letters from all headmasters of Tamale College of Education (TACE) partner schools. The headmasters reviewed the research design, survey instruments, consent procedures, and data protection protocols to ensure compliance with national and institutional ethical standards for research involving human participants. Participation in the study was strictly voluntary and anonymous. All in-service teachers were provided with comprehensive information outlining the study's objectives, the nature of their participation, their right to withdraw at any stage without penalty, and the measures implemented to ensure data confidentiality. Informed

consent was obtained both digitally and in writing prior to the commencement of participation, in accordance with best practices recommended by Creswell et al. (2007).

Study Design and Sampling

Data were collected in May 2023 from in-service teachers affiliated with schools participating in the TACE project. A convenience sampling method was employed, targeting a population of 1,200 in-service teachers. The survey was disseminated via WhatsApp, with a Google Forms link supported and shared by school headteachers. This digital method facilitated real-time response monitoring and automatic data storage. To address issues of digital exclusion, hard-copy versions were provided for respondents experiencing significant internet latency. Responses from these hard copies were subsequently manually entered into Google Forms to ensure a unified data format. Ultimately, 490 complete and valid responses were obtained.

Instrument Development and Piloting

The survey instrument was specifically designed for this study and aligned with the research objectives and terms of reference. The development process was informed by a comprehensive review of the literature on ODL readiness and capacity. To ensure clarity and contextual relevance, a pilot study was conducted among educators at three distinct institutions. Feedback concerning ambiguous items and usability informed subsequent revisions. The final instrument comprised six structured sections: Sociodemographic Characteristics; Access to Technology; Skills and Training of In-Service Teachers and Educators in ODL; Current Use of ODL; Perceptions and Preferences Regarding ODL; and Potential Challenges and Barriers to ODL.

Each section included both quantitative (Likert-scale and multiple-choice) and qualitative (open-ended) questions to elicit detailed responses.

Data Analysis

Quantitative data were computed using Google Sheets and Microsoft Excel 365, followed by statistical analysis using Jamovi 2.3.24 (The Jamovi Project, 2022; R Core Team, 2021). Descriptive statistics, including means, standard deviations, frequencies, and percentages, were employed to summarise responses.

Thematic analysis was applied to open-ended responses to identify recurring themes and issues. This process involved iterative coding and classification of data by two independent evaluators, who collaboratively refined and confirmed themes without substantial modifications. These qualitative insights provided a rich contextual interpretation of quantitative findings. The entire analytical approach underwent peer debriefing to enhance methodological rigour and credibility, consistent with qualitative best practices (Creswell et al., 2007).

Results

Sociodemographic Trait

As shown in Figure 1, Of the n= 490 in-service teachers, most were male (n = 344, 70.2%), while a smaller proportion were female (n = 146, 29.8%). Out of n = 490 in-service teachers, the age distribution was as follows: the most significant group was those aged 25-34 years (n = 215, 43.9%), followed by those aged 35-44 years (n = 178, 36.3%). Participants aged 45-54 years made up 17.3% (n = 85), while those aged 55 and above (n = 4, 0.8%) and under 24 years (n = 8, 1.7%) represented a smaller fraction of the in-service teachers. Figure 2 illustrates the frequency distribution.

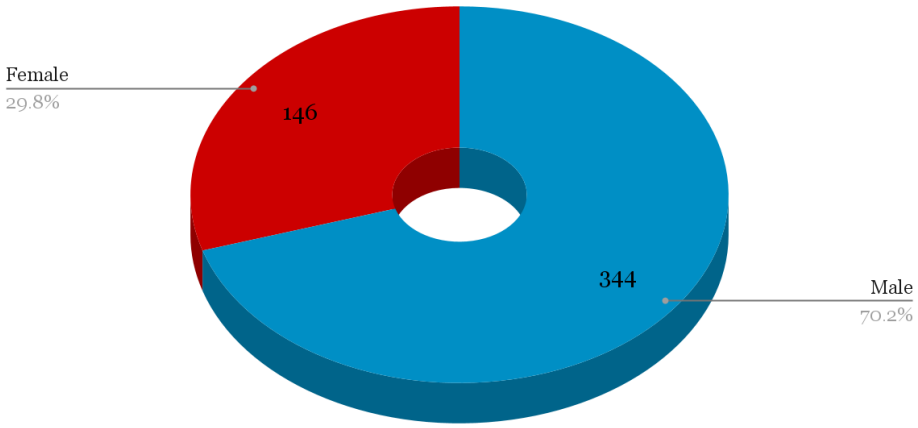

Figure 1: Frequency distribution of Gender

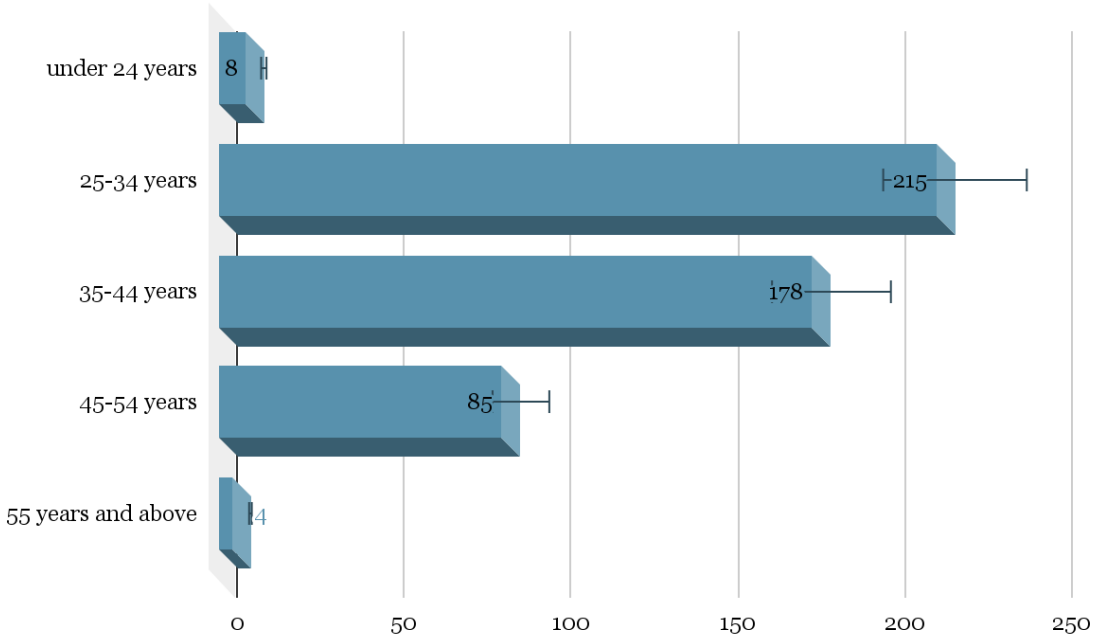

Figure 2: Frequency distribution of Age

In the total sample (n = 490), most (67.8%, n = 332) of in-service teachers held a Bachelor's degree (e.g., B.Ed., B.Sc., BA). The second most common qualification was a Master's degree (e.g., MA, M.Ed., M.Sc., MPhil) held by 15.7% of the sample (n = 77), and 14.0% (n = 69) of the teachers reported having a Diploma in Education. A minority of teachers (2.5%, n = 12) held other degrees. Figure 3 illustrates the frequency distribution and percentages of the educational qualification. Further, most in-service teachers (84.3%, n = 413) reported having over 3 years of teaching experience, while 11.6% (n = 57) had 1-3 years of experience, while a minority of the in-service teachers (4.1%, n = 20) had less than 1 year of teaching experience. Figure 4 demonstrates the frequency distribution and percentages of the teaching experience. Besides, most in-service teachers (80.2%, n = 393) resided in urban areas. Semi-urban areas were home to a fraction of in-service teachers (16.5%, n = 81), while only a small proportion were based in rural areas (3.3%, n = 16). Figure 5 demonstrates the frequency distribution and percentages of the geographical location.

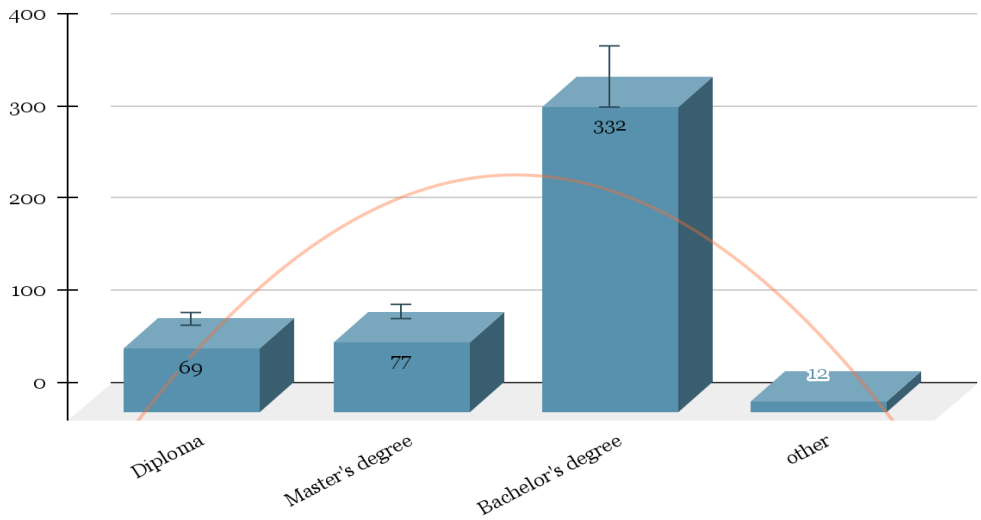

Figure 3: Educational qualification

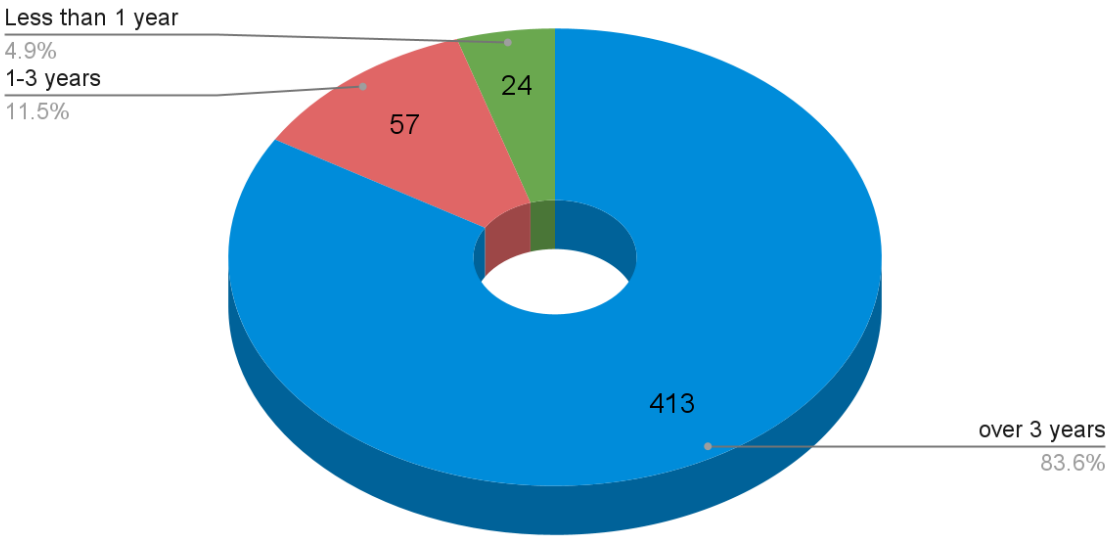

Figure 4: Teaching experience.

In-service Teacher's Access to Technology

Hardware device access

The in-service teachers were surveyed about their access to various hardware devices for teaching purposes. The survey included Desktop Computers, Laptops, Tablets, Smartphones, Digital Whiteboards, and a category labelled 'Other.' The data demonstrated that most in-service teachers have access to Smartphones, with 91.8% (n = 450/490) reporting access. Furthermore, 74.5% (n = 365/490) of the teachers reported having access to Laptops, while 35% (n = 171/490) reported access to Desktop Computers. The survey also showed that 14.3% (n = 69/490) of the teachers have access to Tablets, while Digital Whiteboards are the least accessed device, with only 7% (n = 34/490) reporting access. In addition, 12% (n = 59/490) of the teachers reported having access to devices categorised under 'Other.' Figure 13 visualises the results. The data also indicated that 28.1% (n = 138/490) of the in-service teachers have access to both Smartphones and Laptops, while 14.9% (n = 73/490) had access to Desktops, smartphones, and laptops.

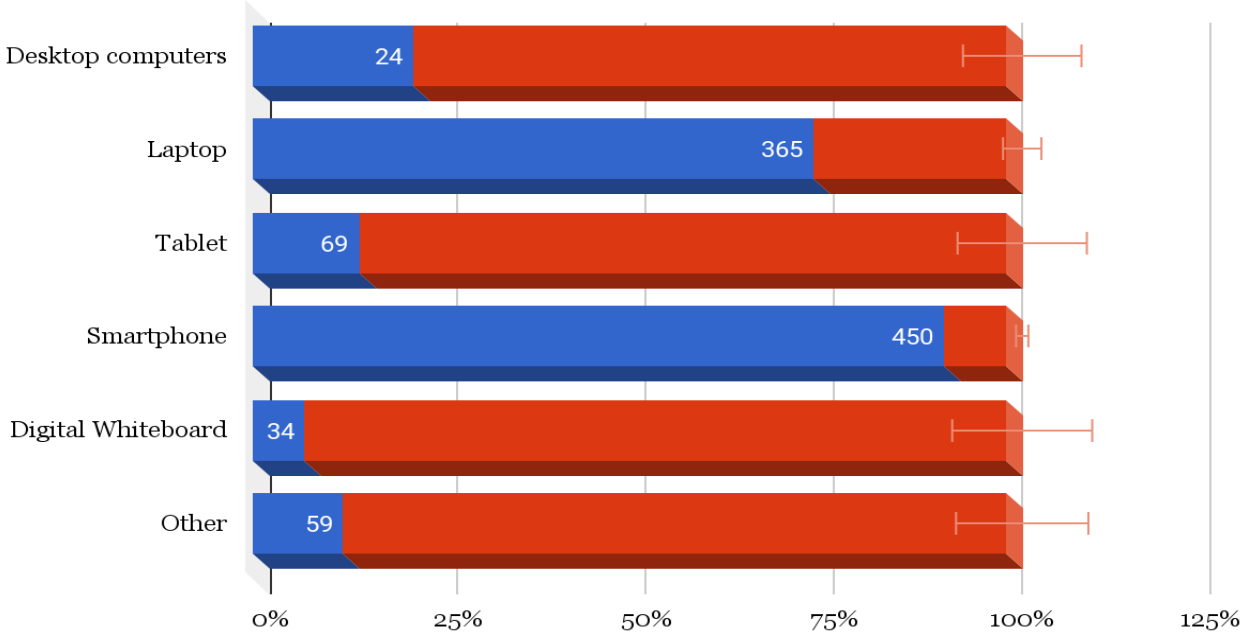

Figure 5: Access to devices

Table 1 presents the usage frequency of various hardware devices among in-service teachers. The mean usage frequency score is 2.32 (SD = 1.28), indicating that teachers typically use desktop computers between 'rarely' and 'sometimes'. Desktop computers are 'sometimes' used by the majority of teachers (35.5%, n = 105), although a significant proportion (34.7%, n = 170) never use them. In contrast, laptops are utilised more frequently, with most teachers (42.1%, n = 206) using them 'sometimes' and a substantial number (18.2%, n = 89) using them 'very often'. The average usage frequency score for laptops is higher at 3.06 (SD = 1.33), indicating a frequency between 'sometimes' and 'often'. Tablets are less popular than the previous devices, with nearly half of the teachers (46.3%, n = 227) never utilising them and 22.3% (n = 97) using them 'rarely'. The mean usage score of m = 1.67 (SD = .99) confirms the infrequent use of tablets. Smartphones are used frequently, with 34.7% (n = 170) of teachers using them 'sometimes' and almost as many (33.1%, n = 162) using them 'very often'. This result is reflected in the high average user score of m = 3.57 (SD = .10), implying usage between 'sometimes' and 'very often'. Lastly, utilising other hardware devices is relatively rare, with 48.8% (n = 239) of teachers never using them and 28.1% (n = 138) using them 'sometimes'. The mean usage score for these devices is 1.97 (SD = 1.18), signifying they are utilised 'rarely' on average.

Table 1: Frequency of Hardware Device Usage for Teaching Purposes

Hardware devices	N	Never	Rarely	Sometimes	Often	Very Often	m	(SD)
Desktop Computer	490	170	12	105	174	29	2.32	1.28
Laptop	490	53	97	206	45	89	3.06	1.33
Tablet	490	227	109	122	16	16	1.67	0.99
Smartphone	490	28	61	170	69	162	3.57	0.10
Digital Whiteboard	490	344	61	52	24	8	1.55	1.64
Other	490	239	52	138	32	28	1.97	1.18

M = mean; SD = Standard Deviation

The data indicates a diverse range of hardware devices used by in-service teachers, with laptops and smartphones being the most popular. This suggests that an ODL framework should be optimised for these devices to be effective. Conversely, desktop computers, tablets, and other hardware devices are used less frequently and may not be as integral in the digital teaching practices of most teachers. Therefore, ODL implementation strategies may focus less on these devices. The data also suggests that professional development in ODL should prioritise training on widely used devices before addressing less common technologies. These findings highlight the importance of aligning an ODL framework at TACE with the actual hardware usage habits of its intended users for successful implementation.

In-Service Teachers' skills and training in ODL

Training received in ODL

The survey results indicate in-service teachers' experiences with ODL methods in terms of formal training received and their self-rated skills and proficiency in using these methods. The teachers rated their agreement with the statement about their training in ODL methods on a scale of 1 (strongly disagree) to 5 (strongly agree). The results showed that most teachers disagreed or were neutral about receiving formal training in ODL methods, with 28.6% (n = 140)choosing 1, 15.3% (n = 75) choosing 2, and 27.6% (n = 135) choosing 3. The teachers agreed or strongly agreed that they had received formal training, with 23.5% (n = 115) choosing 4 and 5.1% (n = 25) choosing 5. The mean

rating for this statement was m = 2.69 (SD = 1.28). Figure X illustrates the frequencies and percentages of the responses.

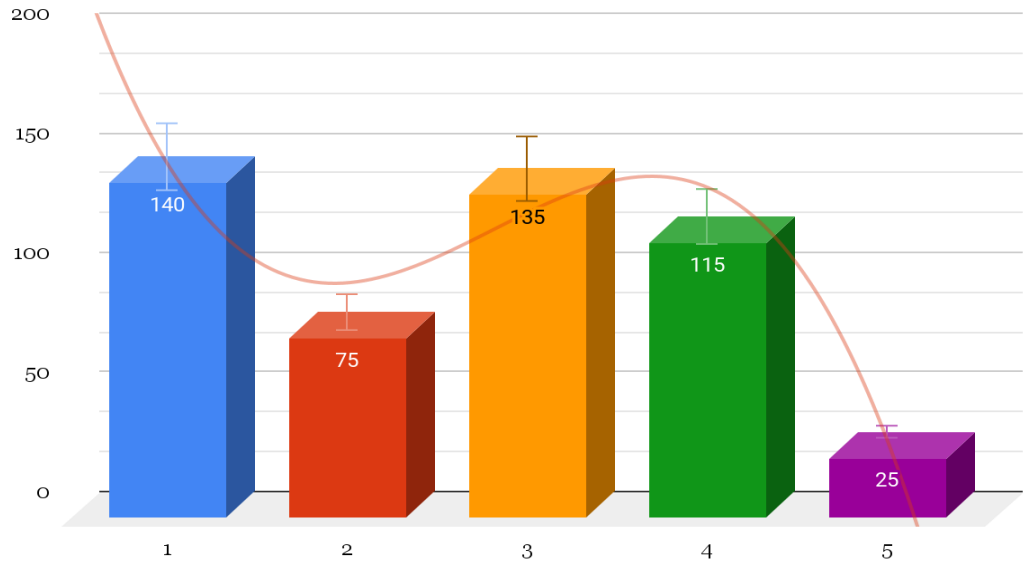

Figure 5: Formal training in ODL

Self-rated skills and proficiency in using methods

The survey results demonstrate in-service teachers' experiences with ODL regarding self-rated skills and proficiency in using these methods on a scale of 1 (strongly disagree) to 5 (strongly agree). The results demonstrated that most in-service teachers either were neutral or agreed about having overall skills and proficiency in using ODL methods for teaching, with 37.8% (n = 185) choosing 3, 23.5% (n =115) choosing 4, and 5.1% (n = 25) choosing 5. Only 16.3% (n = 80) of the teachers strongly disagreed that they had skills and proficiency in ODL methods by choosing 1, and 17.3% (n = 75) chose 2. The mean rating for this statement was m = 2.95 (SD = 1.12), meaning they neither disagree nor agree with their skills and proficiency in using ODL methods. Figure 25 visualises the results.

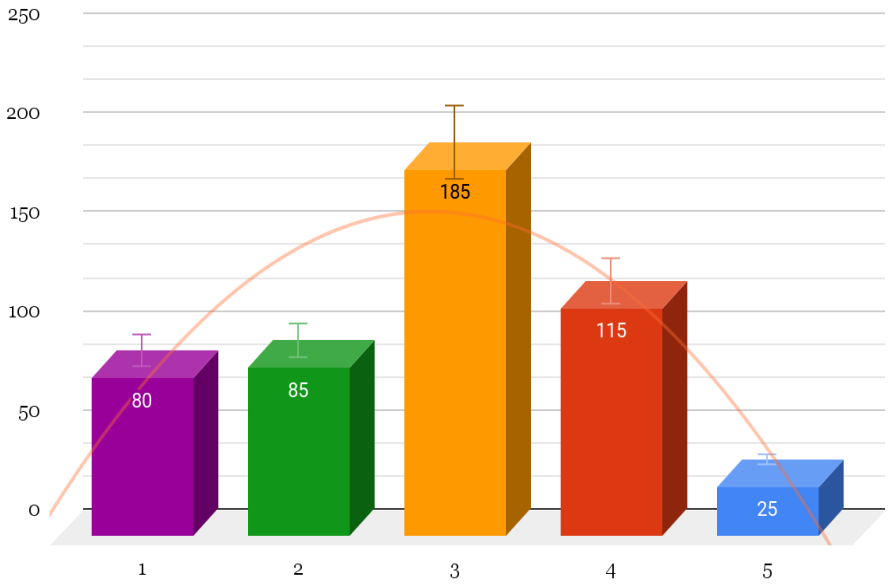

Figure 6: Skills and proficiency in using ODL methods

Familiarity with ODTeL Practices (Strategies)

In-service teachers assessed their familiarity with various ODL strategies on a scale from 1 (not familiar at all) to 5 (extremely familiar). The strategies evaluated included Blended Learning, the Flipped Classroom Model, and Massive Open Online Courses (MOOCs).

Blended Learning (BL) Approach

Blended learning combines online and face-to-face instruction. A small segment of in-service teachers (3.3%, n = 17) reported being extremely familiar with Blended Learning. A substantial proportion (23.1%, n = 113) indicated moderate familiarity. However, the majority (37.2%, n = 182) reported a lack of familiarity. The remaining teachers were somewhat familiar (24.0%, n = 117) or very familiar (12.4%, n = 61). The mean rating was m = 2.51 (SD = 1.16). These results suggest that many teachers need further familiarity with Blended Learning, highlighting the necessity for additional professional development.

Flipped Classroom (FC) Model

Flipped classroom techniques reverse the traditional instructional sequence, delivering content online to allow active learning in class. Only a small percentage of teachers (1.7%, n = 8) reported being extremely familiar with this model, while 13.2% (n = 65) indicated moderate familiarity. The majority (46.3%, n = 227) reported being unfamiliar. Additionally, 24.0% (n = 117) were somewhat familiar, and 14.9% (n = 73) were very familiar. The mean score was m = 2.28 (SD = 1.11). These findings highlight a significant need for increased familiarity with Flipped Classroom techniques, suggesting a potential necessity for further training and professional development.

Massive Open Online Courses (MOOCs)

MOOCs are open-access online courses available to anyone, typically at no cost or a minimal fee. Among respondents (n = 490), only 2.5% (n = 12) indicated extreme familiarity with MOOCs. Approximately 19.8% (n = 97) reported moderate familiarity, while 48.8% (n = 239) stated they were not familiar. The remaining respondents were somewhat familiar (20.7%, n = 101) and very familiar (8.3%, n = 41). The mean rating was m = 2.18 (SD = 1.09). These findings indicate a considerable need for enhanced familiarity with MOOCs among in-service teachers, suggesting a gap in professional development.

HyFlex Design Model

The HyFlex model allows learners to choose between attending in person, online, or both. Among respondents (n = 490), 1.7% (n = 8) reported extreme familiarity, and 9.1% (n = 45) indicated moderate familiarity. The majority (73.6%, n = 360) reported being unfamiliar. The remaining respondents were somewhat familiar (9.9%, n = 49) or very familiar (5.8%, n = 28). The mean score was m = 1.64 (SD = 0.97). These findings suggest a significant gap in familiarity with the HyFlex model, indicating a need for additional training or exposure to this strategy. Professional development initiatives aimed at familiarising in-service teachers with HyFlex strategies may be advantageous.

Table 2. ODL Methods

ODTeL method	1	2	3	4	5	m	SD
Blended Learning	182	117	113	61	17	2.51	1.16
Flipped Classroom	227	117	65	73	8	2.28	1.11
Massive Open Online Course	239	101	97	41	12	2.18	1.09
HyFlex Model	360	49	45	28	8	1.64	0.97

M: mean; SD: Standard Deviation; 1: Not familiar; 2: Somewhat familiar; 3: Moderately familiar; 4: Very familiar; 5: Extremely familiar; N: sample size

Discussion

This section provides a comprehensive interpretation of the study's findings, explicitly aligning them with the three research questions and supported by visual data from Figures 1 through 7.

Research Question 1: What is the current state of infrastructure, technological resources, and digital access available at TACE to support ODL?

The findings indicate that in-service teachers at TACE experience heterogeneous access to digital hardware, with smartphones identified as the most frequently utilised devices for ODL activities ($M = 3.57$, $SD = 0.10$), suggesting a prevalent adoption of mobile technology (Figure 1). Conversely, access to desktop computers ($M = 2.32$), tablets ($M = 1.67$), and digital whiteboards ($M = 1.55$) is notably limited, with over 70% of respondents reporting infrequent or nonexistent use of digital whiteboards. Laptops ($M = 3.06$) demonstrate moderate utilisation, indicating they may function as a transitional tool between mobile and stationary learning technologies.

The relatively high standard deviations signify an inequitable distribution of device access, revealing structural disparities within the technological infrastructure available to educators. These hardware constraints adversely affect the capacity to deliver and engage with high-quality ODL experiences.

Access to internet connectivity is similarly inconsistent. As depicted in Figure 2, 63.7% of teachers reported stable internet access at home, while only 55.5% experienced reliable access at their workplace. This disparity highlights institutional limitations that restrict teachers' ability to engage with ODL resources during school hours. Although mobile hotspots and personal data plans alleviate some of these challenges, they may not provide sustainable access for continuous, high-bandwidth learning activities such as video conferencing, cloud collaboration, or content streaming. These findings underscore the imperative for targeted investments in institutional internet infrastructure and the development of offline-compatible platforms to ensure consistent digital access for educators.

Research Question 2: To what extent are TACE faculty members prepared, trained, and confident in utilising ODL tools and methodologies for in-service teacher development?

The preparedness of faculty to adopt ODL methodologies exhibits considerable variability. While some in-service teachers reported moderate to high confidence in utilising digital tools, as illustrated in Figure 3, many expressed uncertainty regarding the integration of these tools into instructional contexts. Confidence levels were notably higher for mobile devices compared to desktop platforms or content creation tools, reflecting a digital comfort zone grounded in personal rather than pedagogical use.

In addition to tool confidence, Figure 4 reveals a significant knowledge gap regarding fundamental ODL strategies. Over 60% of teachers indicated unfamiliarity with MOOCs, HyFlex learning, and flipped classroom models. This lack of exposure restricts faculty capability to design or engage in contemporary digital learning environments, underscoring a pressing need for professional development in instructional design and online pedagogy.

Moreover, Figure 5 illustrates that consistent and confident utilisation of Learning Management Systems (LMS) is low among respondents. While some reported basic familiarity, few possessed experience managing asynchronous course content, online assessments, or monitoring learner progress. This underutilisation of LMS functionalities highlights a deficiency in digital teaching literacy and corroborates findings in the literature, indicating that many educators in similar contexts lack the pedagogical fluency necessary for technology-enhanced learning (Ally & Samaka, 2013; Czerniewicz et al., 2019).

Collectively, these findings suggest that while foundational digital access exists, professional and pedagogical readiness for ODL remains fragmented. Continuous, structured training interventions concentrating on both technical proficiency and instructional application are imperative.

Research Question 3: What institutional policies and support systems are in place at TACE to facilitate the effective implementation and sustainability of ODL programs?

Despite faculty enthusiasm for ODL, findings reveal that institutional policies and support systems are insufficiently developed. As illustrated in Figure 6, the most frequently reported challenges include limited funding for digital tools, unreliable school internet infrastructure, and inadequate technical support. These systemic issues hinder even motivated educators from fully engaging in ODL, indicating that faculty effort alone is inadequate in the absence of comprehensive institutional reform.

Furthermore, many respondents indicated the lack of formal ODL guidelines, incentives, or workload accommodations for online instruction. This observation aligns with concerns expressed in the literature regarding the need for clear policy frameworks, leadership support, and strategic investments to make ODL viable and sustainable (Bates, 2015; Sangrà et al., 2012).

In terms of capacity-building, Figure 7 demonstrates a distinct preference among teachers for in-person workshops and microlearning formats over fully online models. This finding underscores the importance of designing blended professional development programs that are practical, modular, and context-sensitive. Such formats may serve as effective entry points for enhancing digital confidence while aligning with teachers' learning preferences.

Adapting ODL training and institutional support systems to reflect these realities can significantly enhance faculty engagement and overall program sustainability.

Discussion

This section interprets the study's findings in relation to the three research questions, highlighting their implications for practice at Tamale College of Education (TACE) and situating them within the broader ODL literature.

Infrastructure, Technological Resources, and Digital Access

The findings reveal a reliance on smartphones as the dominant device for ODL among in-service teachers, with limited access to laptops, desktops, and digital whiteboards. While this suggests mobile technology offers a valuable entry point for digital learning, it also reflects structural inequities in access to more versatile devices. Similar to Bozkurt et al. (2020), who noted that hardware disparities exacerbate educational inequalities in developing contexts, our study shows that such inequities remain a pressing challenge at TACE. Unlike institutions that invested in scalable cloud-based systems and robust hardware before the pandemic (Bond et al., 2021), TACE appears under-resourced, limiting its resilience in times of educational disruption.

Internet access further compounds these challenges. Although a majority of respondents reported home connectivity, institutional access was far less reliable. This mirrors findings from the Commonwealth of Learning (2015), which highlighted infrastructural inadequacies in Sub-Saharan Africa as a persistent barrier to ODL. While personal data plans partially fill this gap, they are unsustainable for bandwidth-intensive learning activities. This suggests that unless TACE invests in institutional connectivity and explores offline-compatible platforms, ODL will remain unevenly accessible to its faculty and students.

Faculty Preparedness, Training, and Confidence

Faculty readiness emerged as fragmented, with comfort in using mobile devices but limited confidence in deploying advanced pedagogical models such as MOOCs, HyFlex learning, and flipped classrooms. This digital comfort zone reflects personal rather than professional engagement with technology, consistent with Cutri and Mena's (2020) observation that many educators entered online teaching without adequate preparation. The gap in familiarity with contemporary ODL models further echoes Czerniewicz et al.'s (2019) findings that educators in emerging economies often lack both the digital literacy and pedagogical fluency needed for technology-enhanced learning.

Importantly, limited engagement with Learning Management Systems (LMS) highlights a deeper pedagogical issue: technology use remains tool-based rather than strategy-based. While LMS platforms can support content delivery, assessment, and learner monitoring, underutilisation reflects insufficient training in instructional design and online pedagogy. This aligns with Ally and Samaka's (2013) conclusion that technology adoption without pedagogical grounding results in superficial, fragmented practice. The implication is that TACE must move beyond one-off training to continuous, structured professional development that integrates technical skills with digital pedagogy, thereby enabling faculty to design transformative rather than replicative online experiences.

Institutional Policies and Support Systems

Findings indicate that institutional frameworks at TACE remain underdeveloped, with insufficient funding, unreliable infrastructure, and a lack of clear guidelines or incentives for ODL adoption. This resonates with Bates' (2015) assertion that without coherent institutional policies, technology integration becomes fragmented and unsustainable. Similarly, Sangrà et al. (2012) demonstrated that institutions with strong leadership and strategic visions embedded technology-enabled practices more effectively than those without clear policy direction.

The absence of workload adjustments and incentives also reflects a broader problem in ODL implementation: reliance on faculty goodwill rather than institutional commitment. This mismatch risks burnout and disengagement, limiting long-term sustainability. At the same time, faculty preferences for in-person and modular professional development suggest that policy frameworks should promote blended, context-sensitive training rather than a wholesale shift to online-only models. This aligns with Forkosh-Baruch and Avidov-Ungar's (2019) recommendation that ICT implementation be progressive, systematic, and tailored to educators' needs.

Synthesis and Implications

Taken together, the findings underscore a paradox: while there is enthusiasm for ODL among in-service teachers, structural, pedagogical, and policy barriers constrain meaningful adoption. Infrastructure and connectivity gaps reflect broader systemic inequalities documented across Sub-Saharan Africa, but at TACE they also highlight the urgency of targeted investments in institutional internet access and device provision. Faculty preparedness is not merely a matter of technical skills but of cultivating digital pedagogical fluency through sustained professional development.

Institutional policies must evolve beyond aspirational statements to concrete frameworks that allocate resources, incentivize faculty engagement, and provide technical support.

Critically, the interaction among these domains suggests that addressing any single challenge in isolation will yield limited impact. Infrastructure without faculty readiness risks underutilisation; faculty enthusiasm without institutional support leads to burnout; policies without resources remain rhetorical. For TACE, a holistic strategy that integrates infrastructure, professional development, and policy reform is therefore essential for building sustainable ODL capacity to support in-service teachers.

Limitations and Suggestions for Further Studies

This study provides important baseline insights into the state of Open, Distance, and Technology-Enabled Learning (ODTEL) at Tamale College of Education. However, a number of limitations should be acknowledged. First, the study employed a descriptive approach without the use of inferential statistical techniques. As such, the findings cannot establish causal relationships or statistically significant differences across demographic variables such as age, gender, teaching experience, or digital literacy levels. Second, the study was confined to one institution—TACE—limiting the generalizability of the results to other Colleges of Education or higher education institutions in Ghana. Third, the reliance on self-reported data may have introduced social desirability bias, with respondents potentially overstating their confidence or readiness to adopt ODTEL.

To address these limitations, future studies should employ more rigorous methodologies. The use of inferential statistics such as regression analysis, structural equation modeling, or ANOVA could provide deeper insights into the predictors of faculty readiness and confidence in adopting ODTEL. Expanding the scope of research to include multiple Colleges of Education or a nationwide sample would enhance the representativeness of findings and allow for meaningful comparative analysis. Moreover, adopting a mixed-methods approach that combines surveys with interviews or focus groups would capture richer perspectives on the challenges and opportunities of ODTEL adoption. Finally, longitudinal studies could track changes in faculty attitudes, competencies, and infrastructural support over time, offering evidence of progress and the long-term effectiveness of interventions.

Practical Implications

The findings of this baseline study carry several important practical implications for advancing Open, Distance, and Technology-Enabled Learning (ODTEL) at Tamale College of Education (TACE) and similar institutions:

1. **Strategic Infrastructure Investments** – Limited access to reliable internet connectivity, advanced hardware, and functional ICT facilities highlights the need for targeted infrastructural development. Policymakers and administrators should prioritize the provision of affordable broadband, upgraded computer laboratories, and multimedia teaching spaces to create an enabling environment for ODTEL delivery.
2. **Faculty Professional Development** – The study revealed enthusiasm but low confidence among faculty in leveraging digital pedagogies and ODTEL models such as MOOCs and HyFlex learning. This underscores the need for continuous, practice-oriented training and mentorship programs that enhance digital literacy and pedagogical innovation.
3. **Policy and Governance Frameworks** – The absence of comprehensive institutional policies for ODTEL adoption points to the necessity of structured guidelines on quality assurance, assessment, and technology integration. Clear policies will provide faculty with direction and consistency while strengthening institutional accountability.
4. **Equity in Teacher Professional Development** – By addressing the infrastructure and training gaps identified, TACE can provide more equitable access to professional development for in-service teachers, especially those in underserved regions. This aligns with Ghana's broader agenda of improving teacher quality and educational outcomes.
5. **Scalable Model for Other Colleges of Education** – The insights generated from this baseline assessment provide a roadmap that can be adapted by other Colleges of Education in Ghana seeking to integrate ODTEL into their professional development initiatives.

Conclusion

This baseline study highlights significant variability in infrastructure, digital literacy, and institutional support for Open, Distance, and Technology-Enabled Learning (ODL) at TACE. While smartphone access is widespread, gaps in reliable internet connectivity, advanced hardware, and digital pedagogy remain pressing challenges. Faculty demonstrate enthusiasm for ODL but lack confidence in applying contemporary models such as MOOCs, HyFlex, and LMS integration. Moreover, institutional policies and support structures are underdeveloped, limiting the sustainability of ODL adoption.

Overall, the findings underscore the urgent need for coordinated investments in infrastructure, sustained faculty development, and supportive institutional policies. By addressing these gaps, TACE can build a robust foundation for ODL, enabling equitable access to professional development for in-service teachers and contributing to broader educational transformation in Ghana.

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