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Digital Teaching and Learning in Eswatini Secondary Schools: Bridging Gaps for Resilient and Transformative Education

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The 21st century has positioned digital education as a critical driver for enhancing access, inclusivity, sustainability and relevance within the evolving demands of society and the global economy. Playing a pivotal role in achieving Sustainable Development Goal 4 (SDG4). Eswatini demonstrates a national commitment to this global agenda. However, online learning and digital instruction in secondary schools remains limited and uneven. These disparities continue to expose the education system to vulnerabilities, limiting its resilience against future disruptions. The purpose of this study was to examine factors limiting the integration of digital teaching and online learning in secondary schools, and to identify strategies for improving access, usage, relevance, and sustainability in digital education. Employing a mixed method approach, the study was guided by the Design–Reality Gap framework to analyze the extent to which national policy intentions align with school-level realities. Data were collected through document analysis and questionnaires administered to teachers in nine secondary schools in the Manzini region. The questionnaires were analyzed using descriptive statistical techniques. Findings revealed significant gaps undermining effective digital education: inadequate ICT infrastructure and unreliable internet (technology gap), limited digital pedagogical skills (skills gap), and fragmented professional development policies (management & support gap). These gaps limit inclusivity and resilience. The study concludes that bridging these gaps is essential for creating resilient and transformative education systems. It recommends targeted investment in ICT infrastructure and affordable internet, sustained teacher training in digital pedagogy, policy recalibration for coherence, and engage multi-stakeholder partnerships to co-create sustainable digital education ecosystems.

Introduction

The 21st century has positioned digital education as a critical driver for enhancing access, inclusivity, sustainability, and relevance in response to the evolving demands of contemporary society and the global economy. In alignment with UNESCO's Sustainable Development Goal 4 (SDG4), which advocates for inclusive, equitable, and quality education for all, digital

education has become a cornerstone of global educational transformation (UNESCO, 2023). Digital education does not only expand access to learning opportunities but also strengthens the resilience of education systems, ensuring the continuity of learning during crises such as pandemics, natural disasters, or socio-economic disruptions (UNESCO, 2022; World Bank, 2023).

Educational institutions worldwide, including those within the Southern African region, are increasingly aligning with this global agenda by adopting digital education strategies to transform teaching and learning processes (Akinradewo et al., 2025; Mhlanga & Moloi, 2020). Similarly, Eswatini Ministry of Education is progressively aligning with the 21st century vision of access, affordability, sustainability, innovation, and relevance through ongoing reforms. These reforms include the introduction of the Competency-Based Education (CBE) curriculum, the enhancement of ICT infrastructure, increased connectivity, and the integration of technology in teaching and learning across secondary schools (Ministry of Education and Training [MoET], 2018; UNESCO, 2023). Furthermore, additional initiatives reflecting Eswatini's commitment is strengthening secondary school teachers' digital capacity. Eswatini has implemented targeted initiatives such as the Digital Educator Global Academy (DEGA), which trained teachers in e-learning tools and AI-assisted instruction, and UASF certificate programme in online teaching. Additionally, the Commonwealth of Learning (COL) provided multimedia training to equip educators with skills for creating digital learning resources (MoET, 2025; UASF, 2024; COL, 2023). These efforts demonstrate a national commitment to enhancing teacher readiness and integrating technology into secondary education, supporting more resilient and digitally enabled learning environments.

However, despite these commitments, digital teaching and online learning in Eswatini secondary schools remain limited and unevenly implemented (Dludlu, 2021; Mpofu, 2023; Nkambule, 2020). This persistent gap undermines efforts towards achieving inclusive and equitable quality education as envisioned in SDG 4. Further exposing the education system to limited resilience and vulnerability to future disruptions. The COVID-19 pandemic, further illustrated this fragility, bringing teaching and learning to a near standstill, exposing Eswatini education system's limited digital preparedness (World Bank, 2021; UNDP, 2021). Addressing this systemic fragility requires targeted, evidence-based intervention. Various studies have examined obstacles that hinder digital learning in schools. However, according to literature, studies have been broad, unsystematic, or insufficiently contextualized to specific educational settings (Akinradewo et al., 2025; Ayoung & Abbott, 2021). Moreover, much of the existing research has emphasized ICT access or general teacher preparedness, paying limited attention to the systemic, pedagogical, and contextual factors that shape actual digital learning in public secondary schools. Ayoung and Abbott (2021) highlight, that success or failure of technology-based reforms is strongly influenced by the social and cultural environments in which they are deployed. They further argue that for online systems to function effectively and avoid risks of failure or being underutilized they must be tuned to the context in which they will be used.

Therefore, investigating and understanding these contextual factors that hinder digital learning at the school level is essential for promoting resilient, sustainable, and equitable digital learning. To systematically address this identified research gap, this study investigated the systematic and contextual factors hindering effective digital learning in Eswatini secondary schools. In the context of the present study, the Digital Reality Gap (DRG) framework was adopted to examine the existing systemic and contextual gaps that impede the effective integration of digital teaching and online learning. The framework offered a systematic approach for investigating these barriers by providing a useful lens through which misalignments between national policy

intentions and the realities experienced in secondary schools can be systematically identified. The broader aim was to generate evidence-based insights to guide educational stakeholders and policymakers on priority areas requiring intervention in order to advance effective digital learning and support the development of a more resilient and transformative education system.

Problem Statement

According to existing literature, digital teaching and online learning in Eswatini's secondary schools remain limited and unevenly implemented (Dludlu, 2021; Nkambule, 2020; Mpofu, 2023; World Bank, 2021; UNDP, 2021). This uneven integration presents a significant challenge, undermining the country's progress toward achieving SDG 4. The inconsistent adoption of digital learning further exposes systemic unreadiness, weak institutional resilience, and widening disparities between schools across different regions and socio-economic contexts. As a result, the education system remains vulnerable to disruptions and insufficiently prepared to leverage digital innovation to enhance teaching and learning outcomes. These vulnerabilities were most evident during the COVID-19 pandemic, when teaching and learning in many schools came to a complete standstill due to limited readiness for remote and technology-supported education. This study, therefore, investigated the factors limiting the integration of digital teaching and online learning in Eswatini's secondary schools, aiming to identify key challenges that need to be addressed to achieve equitable, resilient, and transformative learning outcomes. Without addressing these barriers, the education system risks continued vulnerability to future disruptions and may struggle to achieve equitable, resilient and transformative education.

Aim of the Study

The main purpose of the study was to investigate barriers, readiness, and contextual dynamics shaping the integration of digital learning in Eswatini secondary schools, with the goal of generating insights for a more resilient and transformative education system towards sustainable digital learning.

Research Objectives

1. To ascertain the current status of digital teaching and online learning in Eswatini secondary schools.
2. To investigate the systematic and contextual factors limiting effective digital teaching and online learning in Eswatini education in secondary schools.

Research Questions

1. What is the current state and extent of digital teaching and online learning in Eswatini secondary schools?
2. What systemic and contextual factors limiting effective digital teaching and online learning in Eswatini secondary schools?

Literature Review

Current State and Extent of Digital Teaching and Learning in Eswatini Secondary Schools

Hodgkinson-Williams et al. (2007), in their paper identified several factors enabling and constraining ICT practice in secondary schools: case studies in South Africa. The key enabling and constraining factors surrounding practical issues, includes sufficient hardware, appropriate software and affordable connectivity, sufficient technical support and training, policy-related issues such as the role of national, provincial and school policy, the vital contribution of principal leadership and champion teachers as well as ongoing teacher professional development coupled with a willingness to change. Nxumalo, et.al (2023) in the study which explores EGCSE siSwati teachers' experiences on online teaching. The objectives of the study were to: determine the platforms EGCSE siSwati teachers used for online teaching; determine the extent at which online teaching platforms are used by EGCSE siSwati teachers; and the challenges EGCSE siSwati teachers faced during online teaching. The study revealed that teachers used WhatsApp, Google classroom, Facebook, Microsoft Teams and Zoom. Most used platforms were WhatsApp (40%), Facebook (30%) while least used platforms were Google Classrooms (10%) and Zoom (5%). Nonauthentic assessment, language barrier, lack of professional expertise in ICT use, and minimal learner participation are challenges of online teaching.

Systemic And Contextual Factors Limiting Effective Digital Teaching and Online Learning in Eswatini Secondary Schools.

Nsibandze (2017) investigated how ICT integration can enhance the teaching of reading for high school learners in Eswatini by exploring teachers' practices in English and SiSwati. The study found that teachers understood the importance of ICT in reading lessons but often lacked access to the necessary tools due to socio-economic constraints. Some teachers preferred traditional methods, such as textbooks, and had limited knowledge of ICT applications. During the COVID-19 pandemic, mobile devices facilitated information sharing, but network availability and data costs hindered teaching. There is a notable absence of empirical research on digital teaching and online learning in Eswatini secondary schools, particularly regarding resilient and transformative education, highlighting the need for this study.

Theoretical Framework

The Design Reality Gap (DRG) framework was developed by Heeks in 2002, to investigate why information system (IS) projects, in developing countries fail (Masiero, 2016). Heeks (2016), further emphasizes that DRG framework is not only used to explain why ICT systems fail, but it can be used as a lens to examine the extent to which systems can be integrated effectively in their context. In a study conducted by Said (2021), the DRG framework was used to evaluate the process of developing digital skills in higher education institutions in Kenya, assessed and identified potential obstacles that could result in a digital skills gap. Furthermore, Dasuki et al. (2015) used the DRG framework to evaluate the adoption of international computing curricula in African universities. In another study, the framework was used in Ethiopia to assess the readiness of Ethiopian secondary schools to integrate ICT into teaching and learning (Bati & Workneh, 2021). Moreover, according to McCarthy et al. (2022), DRG framework facilitates the identification of discrepancies between policy expectations and the actual experiences of teachers in practice.

Although the DRG framework has been widely applied in educational research across Africa to explore ICT adoption challenges, ICT systems failures, and the misalignment between policy intentions and realities, its use remains largely concentrated in these areas. However, there is still a noticeable gap in its application to studies focusing specifically on digital learning and digital readiness in secondary school contexts. Existing literature does not adequately examine how policy intentions towards digital learning translate into everyday teaching practices in Eswatini's public secondary schools. It does not fully address the systemic and contextual barriers that shape teachers' capacity to integrate digital learning. This gap is significant given the national and global shift toward resilient and transformative education systems. In response, the present study employed the DRG framework to analyze the status of digital teaching and online learning in Eswatini secondary schools by comparing intended policy designs with actual school-level realities. This analysis facilitated the identification of the systemic and contextual factors that constrain effective digital teaching and online learning in Eswatini secondary schools.

The DRG framework was initially developed with seven dimensions, abbreviated as ITPOMSO. It was later modified to include eight essential dimensions abbreviated as OPTIMISM (Bati & Workneh, 2020). These dimensions are illustrated in Figure 1 below. DRG dimensions provide a systematic approach for assessing gaps between design and reality (Bass & Heeks, 2011). For the purposes of this study, only four dimensions (OTMS) were considered because they are more relevant for analyzing digital teaching and learning at the school level. However, the remaining dimensions were excluded because they relate to broader organizational structures and administrative systems that fall outside the scope of this study and have limited direct influence on the research problem.

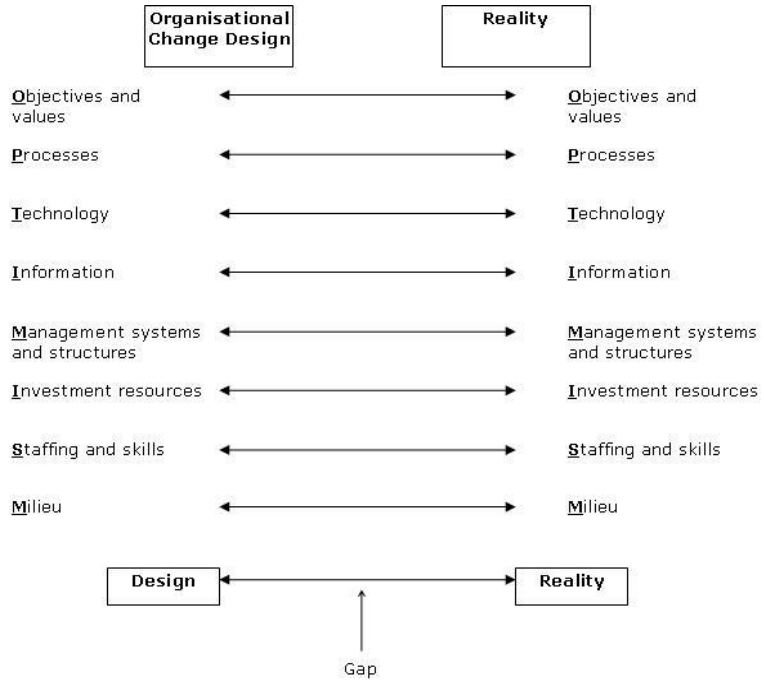

Figure 1: Design Reality Gap Framework (Bass & Heeks, 2011).

The arrows shown in Figure 1, represents the gaps between the design and reality for each dimension. Gaps can be assessed and rated low, medium or high (Bati & Workneh, 2020). According to Ayoung and Abbott (2021), the size of the gap between the design and reality determine whether a project will succeed or fail. The smaller the gap, the higher the likelihood

that a project will succeed, whereas larger gaps increase the risk of failure (Ayoung & Abbott, 2021). The study used dimensions to examine gaps or mismatches between policy design and realities observed at the secondary school level. Gaps were presented in percentage values and they were used to assess the key areas that require critical attention to promote effective digital teaching and online learning in Eswatini secondary schools. Four of the dimensions are discussed below.

Objectives and Values

This dimension encompasses formal and informal objectives, organizational culture, and established procedures (Munene, 2015). Formal objectives are the official, documented goals set by an institution or governing body, such as policies and strategic plans (Munene, 2015; Bass & Heeks, 2011). In addition, informal objectives, by contrast, are culturally embedded, or practice-driven priorities that shape how initiatives are actually implemented at the school level (Munene, 2015). They include values such as teacher resistance to technology due to beliefs, attitude and habits (Ayoung & Abbott, 2021). Therefore, the study examined both formal policy objectives and informal objectives to critically assess how policy design intentions align with realities, revealing gaps that hinder effective digital teaching and online learning (Bass & Heeks, 2011).

Technology

Technological dimension examines the availability, accessibility, and adequacy of digital infrastructure and tools required for effective digital learning. This includes electricity, reliable internet access, computers, tablets, software, learning management systems (LMS) and other digital resources (Ayoung & Abbott, 2021). For schools, to function successfully and efficiently, such resources should be made available and sufficient, claim (Bati & Workneh, 2020). Through this dimension, the study assessed whether schools possess the necessary technology to implement digital teaching effectively, and whether technological shortcomings contribute to the observed gaps between policy and practice.

Management Systems and Structures

This dimension examines how national to school-level policies, leadership decisions, and operational systems support or constrain digital teaching and online learning. Bati and Workneh (2020), state that ICT support and maintenance should be provided at school level for digital initiative to be effective. The study used DRG framework and investigated the availability and implementation of ICT policies, maintenance, support and other factors influencing digital teaching and online learning.

Staffing and Skills

According to Ayoung and Abbott (2021), this dimension aims to examine the availability of staffing and skills needed for efficient and effective technology initiatives. The dimension mainly focuses on teacher digital literacy skills and pedagogical competencies necessary for successful digital integration. Through the DRG framework, the study examined discrepancies by comparing the expected standards to the realities found in schools.

Methodology

Research Design

The study employed a mixed descriptive case study design to explore the contextual realities influencing digital teaching and online learning in Eswatini secondary schools. The case study approach was appropriate because it allowed for an in depth understanding of teachers' experiences, school contexts, and institutional barriers within a natural setting.

Sampling Method and Size

The target population consisted of secondary school teachers in the Manzini region of Eswatini. A purposive sampling technique was employed to select schools that had partial ICT infrastructure and teachers with varying digital exposure. A total of 60 in-service teachers from 9 secondary schools participated in the study. This sample size was sufficient to capture diverse perspectives while ensuring manageability for detailed quantitative analysis.

Data Collection Instruments

Data were collected using structured closed-ended questionnaires to obtain actual conditions and experiences from teachers within the school context, while document analysis was used to examine national and international policy intentions regarding digital learning. The questionnaire provided quantifiable evidence on access, skills, and institutional support on the ground, whereas the policy documents helped identify gaps or alignment between intended reforms and school level realities. Both instruments were reviewed by experts and piloted to ensure clarity and reliability.

Data Analysis and Presentation

Quantitative data from the closed-ended questionnaire were analyzed using descriptive statistical techniques using Microsoft Excel, where frequency responses were calculated, converted into percentages, and presented using tables. Qualitative data from the document analysis were examined through content analysis, in which policy documents were reviewed, coded, and organized into themes aligned with the OTMS DRG dimensions.

Ethical Considerations

Permission to conduct the study was obtained from the Ministry of Education and Training (Eswatini) and participating schools. Participants were assured of anonymity, confidentiality, and the voluntary nature of participation. Data were securely stored and used solely for academic purposes.

Results and Discussions of Findings

This chapter presents the analysis and discussion of findings guided by the two research objectives.

Table 1:
Presentation of Demographics Information (Percentage, n=60)

Gender		Teaching experience		Subjects	Yes	No
Male	36	less than a year	8	Maths	77	23
Female	24	1-2 years	5	Science	58	42
		3 - 5 years	10	ICT	17	83
		6 -10 years	23			
		More than 10 years	53			

Table 1 represents the demographics of the teachers who participated in the study. A total of 60 teachers participated, 36 males and 24 females. Only 5 teachers had one year of teaching experience, while the majority (32 out of 60) had over ten years. 46 (77%) were Mathematics teachers, 35 (58%) Science, and only 10 (17%) teach ICT or related subjects.

Research Objective 1:

To Ascertain the Current Status of Digital Teaching and Online Learning in Eswatini Secondary Schools.

To address research objective 1, the study analysed policy intentions and teacher responses to determine the extent to which digital practices are currently being implemented. Guided by the DRG framework, the study revealed key gaps between intended policy design and actual practice on the ground. To operationalize the framework, the *design component*, was examined through document analysis of key national educational policies, strategic documents and international frameworks. In addition, the *reality component* of the DRG framework, was examined using questionnaire data collected from teachers. The comparison between the two data sets provided the basis for determining the design–reality gap analyses.

Design Intentions

Key national policies, strategic plans, and international curriculum frameworks were examined to ascertain policy intensions on digital learning. Table 2 summarizes the findings from the documents.

Table 2:
Document Analyses-Policies

Policy Source	Key Design Intention / Policy Mandate
Ministry of Education National Policy Statement on Education (1999)	Articulates a clear vision for integrating ICT into education to prepare learners for the 21st century, highlighting digital literacy. Promotes positive teacher attitudes toward digital literacy and innovative pedagogy through inclusion of ICT across learning areas.
Education Sector Strategic Plan (ESSP) 2022–2034	Prioritizes education system resilience and digital transformation through investment in technology and innovation. Reinforces the need for teacher mindset change to embrace technology in the classroom
Parliament of the Kingdom of Eswatini ICT Master Plan (2020)	Commits to establishing ICT infrastructure and services as essential for modern education and public service delivery, including connectivity for secondary schools and community centres.
Ministry of Information, Communications and Technology (2022)	Details initiatives such as broadband rollout to schools and provision of end-user devices (e.g., mobile laboratories with laptops) to promote ICT integration in teaching and learning.
Education and Training Sector Policy (2018)	Emphasizes continuous teacher capacity building through INSET and professional development to enable effective technology integration in teaching.
ESSP (2022–2034)	Aims to raise teacher competencies and qualifications; includes incentives and professional development systems for improved teaching quality and digital readiness.
UNESCO ICT Competency Framework for Teachers (2018); European Framework for the Digital Competence of Educators (DigCompEdu); ISTE Standards for Educators	Defines teacher digital competencies such as digital literacy, digital content creation, assessment, digital pedagogy, digital communication and collaboration, facilitator needed to build digital teaching capacity aligned with global pedagogical transformation goals.
ESSP (2022–2034)	Advocates for establishing and updating a comprehensive teacher management system harmonized with EMIS and the Teaching Service Commission to enhance digital coordination.
National Curriculum Centre (NCC) & Ministry of Education and Training (2018)	Promotes structured institutional support for teacher development and curriculum adaptation, teacher training through workshops.
UNESCO ICT Competency Framework for Teachers (2018)	Encourages education systems to institutionalize policies that continuously monitor and evaluate teacher digital competencies, ensuring sustainability and accountability in ICT integration.

Table 2 summarizes key national and international policy documents expressing strong intentions and emphasis to investment in ICT infrastructure, internet connectivity, provision of devices, teacher professional development, and the establishment of supportive management systems to build digital readiness. The international frameworks, such as the UNESCO ICT Competency Framework for Teachers, DigCompEdu and ISTE Standards, provide global

benchmarks for educator digital skills, outlining competencies in digital pedagogy, assessment, communication, and content creation. These frameworks highlight what teachers should be able to do in digitally enabled classrooms. In overall, the policies and international standards demonstrate a clear strategic direction towards digital transformation. The policies were organized into themes based on the OTMS DRG dimensions to guide the analysis. Table 3 summarizes key policy intentions under each DRG dimension.

Table 3:
Key Policy Intentions Per the DRG Dimension

DRG Dimension	Policy Intentions Summary
Objectives and Values	Establishing a clear vision for ICT integration, preparing 21st century learners, promoting positive teacher attitudes, digital pedagogies and ensuring education system resilience through digital transformation.
Technology	Committing to establishing essential ICT infrastructure and services, including internet connectivity for schools. Details initiatives like broadband rollout and providing end-user devices (e.g., mobile labs/laptops, computer laboratories) to promote ICT in teaching and learning.
Management Systems and Structures	National Curriculum Centre (NCC) & Ministry of Education and Training advocates for comprehensive teacher support systems to enhance teacher competencies. Promoting structured institutional support for teacher development (e.g., training workshops) and encourages education systems to monitor and evaluate teacher digital competencies. There is Computer Education Trust (CET) in Eswatini that provide and maintain computer equipment, and support the integration of technology in schools to improve digital literacy.
Staffing and Skills	Emphasizing continuous teacher capacity building through professional development to ensure effective technology integration. Digital competency skills necessary for teacher are outlined by global frameworks such as UNESCO ICT Competency Framework and DigCompEdu.

The analysis of policy documents revealed that Eswatini's education policies clearly outline the Ministry of Education and Training's commitment to advancing ICT integration in teaching and learning. The policies emphasize the need to digitize curriculum content, prepare learners with 21st century skills, and cultivate positive teacher attitudes toward digital-based instruction. These intentions reflect a strong formal policy direction aimed at promoting a technology-enabled education system. Under the technology dimension, national policies commit to expanding technology infrastructure and internet connectivity in schools. Through broadband connectivity and provision of devices to enable ICT supported teaching. In terms of the management systems and structures, teacher support structures are outlined in the educational policies. National Curriculum Centre (NCC) & Ministry of Education and Training advocates for comprehensive teacher support systems to enhance teacher competencies. In addition, CET provide and maintain computer equipment, and support the integration of technology in schools to improve digital literacy. Finally, for staffing and skills dimension, digital competency frameworks such as the UNESCO ICT-CFT and DigCompEdu outlined the essential digital literacy and pedagogical skills that teachers are expected to demonstrate for successful digital teaching and online learning.

In summary, the policy analysis indicated a clear strategic commitment to advancing digital transformation in education. Building on this foundation, the following section presents the findings from teacher's responses.

Reality in Secondary Schools

Objectives & Values dimension

Table 4 below shows the Objectives & Values dimension. This dimension captures teachers' attitudes and beliefs toward digital integration, reflecting how policy intentions translate into practice at the school level.

Table 4:
Teacher Attitude (Percentage, n=60)

Attitude Variable	Strongly Agree	Agree	Disagree	Strongly Disagree	Reality
Confident integrating digital tools	19	30	11	0	79
Digital technologies improve outcomes	33	22	2	3	87
Prefer traditional methods	8	8	26	17	47
Disrupts current teaching	11	6	21	22	48
Overall Average Reality					65

The findings reveal a generally positive attitude among teachers toward digital integration, though with persistent traditional preferences and perceived instructional challenges. The overall average reality score of 65% suggest a moderately favorable attitudinal environment toward digital teaching and online learning within Eswatini's secondary schools. The highest attitudinal readiness was recorded for teachers' belief that digital technologies improve learning outcomes (87%), followed closely by confidence in integrating digital tools into teaching (79%). These high ratings indicate that most teachers recognize the pedagogical value of ICT and are psychologically inclined toward digital transformation. However, significant gaps remain in teachers' willingness to depart from traditional pedagogies, with 47% expressing preference for conventional methods and 48% perceiving digital tools as disruptive to existing teaching practices. Teacher attitude dimension, suggests that while most teachers exhibit a readiness mindset, the transition toward sustained digital pedagogy requires continuous support through professional development, mentoring, and clear policy reinforcement.

Technology Dimension

Findings as reflected in Table 5 below, indicate the reality in secondary schools with regards to availability, accessibility, and adequacy of technology infrastructure.

Table 5:
Technology availability (Percentage, n=60)

Technological Resources	Excellent	Good	Adequate	Poor	None	Reality
Internet speed	0	23	27	30	20	51
School Wi-Fi	0	35	27	35	3	59
Data bundles provided	3	5	8	17	67	36
Laptops provided	23	8	18	10	40	51
Computer lab access	25	27	23	17	8	68
Projector access	23	17	18	13	28	61
Interactive whiteboards	25	8	3	2	62	47
Printer access	33	27	20	10	10	72
LMS availability	2	10	7	17	65	39
Overall Average Reality						54

The findings from teacher responses as indicated in Table 5 above, indicate substantial gaps in the technological resources available in secondary schools, with an overall Reality Score of 54%. In reality, connectivity remains weak, as unreliable internet speed (51%) and inconsistent Wi-Fi access (59%). This severely limits the ability to stream educational content, access online platforms, or conduct virtual lessons. This inadequate infrastructure at the school level, hinder sustained digital instruction, reflecting regional challenges highlighted by UNESCO (2020) and Tondeur et al. (2017). Provision of teacher data bundles (36%) and laptops (51%) is limited, echoing studies that identify inadequate device access as a major constraint to teacher digital readiness (Kafyulilo et al., 2015; Isaacs, 2018). While computer labs (68%) and printers (72%) are relatively available, more interactive teaching technologies such as projectors (61%) and interactive whiteboards (47%) remain scarce, consistent with Schmid et al. (2021) who note that such tools are essential for learner engagement in digital pedagogy. The low availability of LMSs (39%) deprives schools of a critical platform for supporting online and blended learning, thereby limiting their capacity to implement digital teaching effectively (Mtebe & Raisamo, 2014; Chisango et al., 2021). Overall, these results confirm that despite pockets of infrastructure, Eswatini's secondary schools face significant digital readiness deficits that impede effective online learning.

Management Systems & Structures Dimension

Table 6:
Policy Availability & Support Provided (Percentage, n=60)

Policy	Yes	No	Not Sure	Reality
Professional development policy exists	13	43	43	47
Digital tools allowed	13	43	43	47
Learners prohibited from mobile devices	95	2	3	97
Teachers access computer labs	83	10	7	90
ICT maintenance available	8	43	48	43
Overall Average Reality				65

The data as shown in Table 6, reveals significant inconsistencies between the intended design and the actual use of digital technologies in secondary schools. Data responses show most teachers having enough access to computer labs (90%) on the ground. However, access is pointless, if teachers do not have the skills. Furthermore, the effectiveness of this access is undermined by weak professional development structures, as evidenced by the limited teacher

professional development policies reported (47%). Teacher responses further indicated inadequate support for ICT maintenance (43%). These however undermines the long-term effectiveness of digital learning in secondary schools. Similarly, respondents indicated that in schools there is strict device use regulations (97%), where learners are prohibited from using mobile phone on school premises. This however, suggests that schools prioritize control and compliance over pedagogical innovation. The overall average reality score of 65% reflect moderate policy alignment with the digital transformation goals outlined in the ICT in Education Master Plan.

Staffing and Skills Dimension

Table 7:
Teacher Digital Pedagogical Competence (Percentage, n=60)

Pedagogical Skill	Excellent	Good	Adequate	Poor	None	Reality
Creating digital content	5	40	27	17	12	62
Creating learning materials	8	27	30	18	17	58
Online assessments	10	10	10	32	38	44
Online communication	15	20	15	25	25	55
Facilitating discussions	8	13	13	28	37	46
Providing online feedback	7	20	17	27	30	49
Tracking/Monitoring learner progress	10	17	20	28	25	52
Overall Average Reality						52

Table 7 presents teachers' response data indicating moderate to low levels of digital pedagogical skills. The Reality range from 44% to 62%, indicate that half or more of the secondary school teachers lack strong digital competencies needed for effective digital learning. The average Reality across all skills is 52%. The results from the teacher survey, showed that some teachers possess basic ICT skills and many struggle with advanced digital competencies such as creating e-learning content, conducting online assessments, or tracking learner progress. The data show that fewer than 30% rated their skills as "Excellent" or "Good," with most indicating "Adequate" or "Poor." This skill gap limits teachers' ability to transition from traditional to digital pedagogy. Mhlanga and Moloi (2020) and Akinradewo et al. (2025) similarly note that limited teacher preparedness remains a critical barrier to digital transformation in African school.

Research Objective 2

To Identify Systemic and Contextual Factors Limiting Effective Digital Teaching and Online Learning in Eswatini Secondary Schools.

The analysis of policy documents (design intentions) alongside teachers' responses (realities) as discussed above, revealed a noticeable mismatch between the expected policy outcomes and the actual conditions in secondary schools. The gaps between design and reality as illustrated in Figure 2 below highlighted the systemic and contextual factors limiting effective digital teaching and online learning in Eswatini secondary schools. According to Kyakulumbye et al. (2019), the extent of gaps between design and current realities determines whether a system succeeds or fails, the greater the gap between design and reality, the higher the chance of failure.

Similarly, the smaller the gap, the higher the likelihood of success. The reality gaps identified in the study are presented in Figure 2 below, expressed as percentage values.

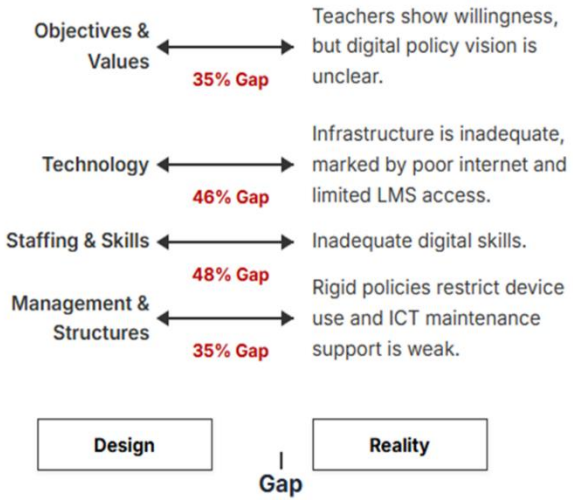

Figure 2: Design Reality Gaps Analyses

Figure 2 illustrates a clear misalignment between policy intentions and the realities in secondary schools. The highest deficit appears in Staffing and Skills, revealing a substantial design–reality gap (48%), showing that limited teacher digital competence remains the main barrier to digital learning. While teachers may have the willingness mentioned in the *Objectives & Values* section, a lack of digital skills restricts the effective implementation of digital learning. This is consistent with UNESCO (2018) and OECD frameworks, which emphasize that teacher adequate competence is central to effective digital pedagogy. Although policy and international standards outline digital competencies teachers should possess, the survey results show these expectations are only partially achieved, echoing findings by Tondeur et al. (2017) and Komba (2021).

The Technology Gap score of 46% reveals a substantial design–reality gap, indicating that the ICT infrastructure currently available in secondary schools remains substantially below the targets set in national education and ICT policies. Policy design intentions reflected schools having reliable internet connectivity and adequate digital devices. However, because schools have not yet reached this expected technological baseline, they remain at risk of implementing digital teaching and online learning effectively and sustainably. Heeks (2002) asserts, digital initiatives often fail when design assumptions diverge from contextual realities, and this pattern is clearly evident in the current secondary school environment. Moreover, even the most willing teachers cannot implement digital teaching effectively without reliable internet and access to essential Learning Management Systems (LMS). Addressing this substantial technological deficit is therefore essential and should be prioritized ahead of dimensions exhibiting lower levels of mismatch.

Both Objectives & Values and Management & Structures dimensions reflect crucial policy and governance gaps, each at 35%, highlight systemic issues. For Objectives & Values, the reality is that teachers show willingness, they have positive attitude towards digital learning, but digital policy vision is unclear. This indicates a misalignment between the enthusiasm of teachers and a clear, directional mandate from policymakers. The absence of a clear digital policy vision hinders concerted, system-wide efforts toward resilient education. Literature show that positive

teacher attitudes and beliefs strongly influence meaningful adoption of technology in classrooms (Teo, 2019; Tondeur et al., 2017). The design reality gap on Management & Structures is due to rigid policies restricting device use and ICT maintenance support is weak. This points to a restrictive and insufficiently supported operational environment. Rigid policies act as a systemic barrier, discouraging innovation and local adaptation, while the weak ICT maintenance support compounds the infrastructure issues.

In summary, the gaps between design intentions and realities in school's context based on the OTMS dimensions were discussed above. The mismatches identified through these gaps reflect the key systemic and contextual factors that continue to limit effective digital teaching and online learning. These gaps suggest that although the policy design assumes the availability of skilled teachers and technology infrastructure capable of sustaining digital learning, the reality reflects limited pedagogical readiness, technology, fragmented professional development policies and insufficient access to supportive digital ecosystems. These results demonstrate that Eswatini's digital transformation goals will remain constrained unless teacher capacity, infrastructure, and institutional support are strengthened. This mismatch is further reinforced by evidence from literature showing that Eswatini schools struggled to maintain learning continuity during COVID-19 due to limited digital readiness. Thus, the DRG analysis highlighted systemic capacity weaknesses that undermine the intended shift toward resilient, technology enabled learning. Figure 2 clearly illustrates that achieving resilient and transformative education requires prioritizing the most urgent areas for intervention such as closing the Staffing and Skills Gap (48%) through mandated PD and addressing the Technology Gap (46%) by investing heavily in sustainable connectivity and centralized learning platforms.

Conclusion

The study, investigated the factors limiting digital teaching and online learning in Eswatini secondary schools. The findings of the study demonstrated that while there are strong political intensions and initiatives for ICT integration, e-learning, and digital transformation, advancing digital education, effective digital teaching and online learning in secondary schools is severely constrained by key systemic and contextual factors. These include limited digital competencies among teachers (*skills gap*), inadequate technological infrastructure coupled with unreliable internet connectivity (*technology gap*), and fragmented professional development policies that fail to provide coherent support (*management and structures gap*). To achieve resilient and transformative education Eswatini education systems must focus on systematically closing the identified OTMS Design-Reality Gaps.

Recommendations

The study recommends:

- Establishing a Unified National Digital Education Policy: Move beyond fragmented initiatives to create a single, overarching national policy for digital teaching and learning that clearly defines roles, responsibilities, and standards across all secondary schools (urban and rural).
- Strengthen technological infrastructure and internet connectivity.
- Enhance teachers' digital pedagogical competencies.
- Prioritize Equitable Infrastructure Investment: Engage multi stakeholder partnerships to co-create sustainable digital education ecosystems.

- Establish clear, coherent continuous professional development frameworks towards digital learning.

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Conflict of Interest
Authors declare that there is no conflict of interests regarding the publication of the paper or otherwise.

Authors' contributions
Sithole Bongiwe: Conception/design, development of data collection instrument, analysis, interpretation of data, revised manuscript (30%)
Sithole Bongiwe: Conception/design, data collection, analysis, interpretation of data, editing and first draft (20%)
Sithole Bongiwe: Analysis and Interpretation of data (10%)
Ndlela Nelsiwe: Interpretation of data, first draft and revision (10%)
Sithole Bongiwe: Data collection, interpretation of data and first draft (10%)
Ndlela Nelsiwe: Interpretation of data, first draft and editing (10%)
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