An Empirical Assessment of Technological Support for eLearning in Selected Zimbabwean Universities

By

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I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

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Abstract

The rapid adoption of eLearning tools in higher education has created a significant need to evaluate technological support systems in universities. Accordingly, this study was conducted across five universities in Zimbabwe to assess eLearning technological support.

A quantitative research methodology was adopted to enable the systematic collection and analysis of numerical data. The study targeted a population of 25,000 individuals across five universities. Using the Raosoft sample size calculator, a sample size of 379 respondents was calculated. A total of 505 survey questionnaires were distributed, of which 379 were completed and returned, yielding a response rate of approximately 75%. Convenience sampling was used as a non-probability sampling technique. While this method facilitated efficient and cost-effective data collection, it may limit the representativeness of the sample and reduce the generalisability of the findings to the broader population. The data gathered were analysed using descriptive statistics and one-way Analysis of Variance (ANOVA), with results presented through Microsoft Excel tables, bar graphs.

The findings reveal notable differences in eLearning experiences across the five participating universities. The UZ and CUT demonstrated the strongest technological infrastructures, characterised by reliable internet connectivity, well-performing devices, and robust technical support. In contrast, the ZOU and HIT experienced moderate challenges, particularly with slow loading times and occasional system downtime, despite having access to basic eLearning infrastructure. BUSE exhibited the greatest difficulties, with frequent connectivity issues and limited technical assistance. At the aggregate level, 87.1% of students expressed satisfaction with platform performance; however, 43% rated overall institutional support as inadequate. ANOVA confirmed that inter-institutional differences across all key indicators were statistically significant ($p < 0.001$).

Key Words

eLearning infrastructure, eLearning hardware, eLearning software, Technological support, Higher education, Digital learning, Online education, Distance learning, Academic technology, Educational technology.

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LIST OF ABBREVIATIONS/ACRONYMS

LMS	Learning Management Systems
eLearning	Electronic Learning
ICT	Information and Communication Technology
IS	Information System
IT	Information Technology
CUT	Chinhoyi University of Technology
ODeL	Open Distance and e-Learning
ODL	Open and Distance Learning
MS Excel	Microsoft Excel
KPI	Key Performance Indicator
VLE	Virtual Learning Environment
LAN	Local Area Network
WAN	Wide Area Network
TCP/IP	Transmission Control Protocol/Internet Protocol
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
MFA	Multi Factor Authentication
SSO	Single Sign On
AWS	Amazon Web Services
CDS	Content Delivery Systems
TEE	Technology Enhanced Education
RAM	Random Access Memory
OS	Operating System
SVG	Scalable Vector Graphics
HD	High Definition
FCRR	First Contact Resolution Rate
UZ	University of Zimbabwe
CUT	Chinhoyi University of Technology
ZOU	Zimbabwe Open University
HIT	Harare Institute of Technology
BUSE	Bindura University of Science Education
POTRAZ	Postal and Telecommunications Regulatory Authority of Zimbabwe
TAM	Technology Acceptance Model
ZIMCHE	Zimbabwe Council for Higher Education
MHTESTD	Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development

Chapter 1: Introduction to the research

1.1 Introduction

The integration of digital technologies into higher education has accelerated dramatically globally, reshaping teaching, learning, and institutional administration (Mahyoob, 2020). Central to this transformation is eLearning the use of internet-based platforms, digital content, and technology-mediated communication tools to facilitate, manage, and enhance the instructional process within universities (Rajabalee et al., 2020). While eLearning holds considerable promise for expanding access, improving flexibility, and strengthening the quality of higher education, its successful and sustained implementation is not self-executing. It depends, fundamentally, on the adequacy and effectiveness of the technological support structures that universities put in place: the systems, services, personnel, and resources that enable both academic staff and students to engage reliably with digital platforms and to recover effectively when those platforms fail (Maphalala & Adigun, 2020).

In Zimbabwe, eLearning has moved from the periphery to the centre of national higher education policy in recent years. The Education 5.0 framework, introduced by the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development (Mupaikwa, 2025), commits all state universities to a model of higher education that integrates digital technologies across teaching, research, innovation, community service, and industrialisation. This policy mandate, aligned with Zimbabwe's Vision 2030 development agenda, positions technological capability including the infrastructure and support systems that underpin eLearning as a strategic national asset rather than an institutional operational matter. Yet despite the clarity of this mandate, the extent to which Zimbabwean universities are able to deliver adequate and effective technological support for eLearning remains inadequately measured and poorly understood. This study addresses that gap through a systematic, quantitative investigation of technological support effectiveness across five selected Zimbabwean universities.

This chapter establishes the conceptual and contextual foundation of the study. It situates the research within the Zimbabwean higher education context including its national policy and regulatory environment, its telecommunications and connectivity

landscape, and the concrete institutional conditions that shape eLearning implementation across the sector. It presents the problem statement, research questions and objectives, significance of the study, limitations of the study, overview of the research methodology, and the dissertation structure.

1.2 Background of the study

1.2.1 eLearning in Global Higher Education

The adoption of eLearning in higher education has been driven globally by a convergence of factors: the proliferation of accessible and affordable digital devices, the expansion of broadband connectivity, the development of powerful and user-friendly learning management systems (LMS), and the growing expectation that universities must offer flexible, technology-enhanced learning experiences to meet the needs of a diversifying student population (Maphosa et al., 2020). The COVID-19 pandemic (2019–2022) served as a powerful additional catalyst, compelling institutions across the globe to pivot abruptly to remote digital instruction, exposing both the potential of eLearning and the profound consequences of inadequate technological support (Manungo, 2022). Where institutions had invested in robust digital infrastructure, responsive ICT support capacity, and well-trained academic staff, the transition, while demanding, was navigable. Where technological support was weak, unreliable, or absent, learning continuity collapsed, equity gaps widened, and institutional credibility suffered.

Global research on eLearning effectiveness consistently identifies technological support as one of the most critical determinants of successful implementation. The reliability of the LMS, the responsiveness of technical helpdesk services, the adequacy of campus connectivity, the provision of user training and orientation, and the availability of institutional devices for students without personal computing equipment are all dimensions of technological support that directly influence the quality of the eLearning experience and the willingness of users to engage productively with digital platforms (Mpofu & Mpofu, 2023). Where support is absent or inadequate, faculty disengage from digital teaching, students underperform relative to their potential, and institutional investment in eLearning infrastructure fails to deliver its intended benefits.

Despite this global consensus, systematic quantitative evidence on the adequacy of technological support in Sub-Saharan African universities, and in Zimbabwe specifically, remains sparse (Chikuvadze et al., 2025). This study is designed to address that gap through a systematic, quantitative investigation of technological support effectiveness within the Zimbabwean higher education context.

1.2.2 The Zimbabwean Higher Education System: Structure, Scale, and Policy

Zimbabwe's higher education sector is overseen by the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development (MHTESTD). The sector comprises state universities, technical colleges, polytechnics, and a growing number of accredited private institutions (Zimbabwe Council for Higher Education [ZIMCHE], 2022). The sector has expanded substantially since the late 1990s, with student enrolments at state universities exceeding 60,000 by 2022, driven by demographic pressure and increasing demand for higher qualifications in a knowledge-oriented labour market (Dzingirai & Mavhunga, 2023). This expansion has not been matched by commensurate investment in physical infrastructure, academic staffing, or digital systems, creating a sector in which the aspirations of national policy frequently outpace the institutional capacity available to realise them.

Quality assurance in Zimbabwean higher education is the statutory responsibility of ZIMCHE, established under the Zimbabwe Council for Higher Education Act (Chapter 25:27). ZIMCHE accredits programmes, audits institutional quality management systems, and advises the MHTESTD on sector-wide standards. Following the COVID-19 pandemic, ZIMCHE has incorporated eLearning quality assurance criteria into its institutional audit framework, formally requiring universities to demonstrate evidence of institutional eLearning policies, functional ICT support structures, and mechanisms for protecting the integrity of digital assessments (ZIMCHE, 2022). These regulatory expectations constitute a formal institutional obligation to maintain technological support for eLearning. Yet no systematic measurement framework currently exists to assess whether that obligation is being met, or to compare performance across institutions.

1.2.3 Education 5.0: The National Reform Agenda and Its Implications for Digital Learning

The most significant recent development in Zimbabwean higher education policy is the Education 5.0 framework, first implemented by the MHTESTD in 2018 and formally articulated in national policy documentation in 2020 (Marufu & Zhou, 2023). Education 5.0 expands the traditional tripartite university mission of teaching, research, and community service to encompass two additional pillars innovation and industrialisation with digital technology integration positioned as a cross-cutting strategic imperative for all five pillars. Universities operating under Education 5.0 are expected to leverage digital platforms not merely for content delivery but as instruments of research output, community outreach, innovation commercialisation, and national economic development.

The implications of Education 5.0 for digital learning infrastructure, platforms, and ICT support capacity are substantial and direct. For eLearning to serve as a credible instrument of the Education 5.0 agenda, universities must maintain platforms that are reliable, accessible, pedagogically functional, and supported by responsive technical services. An LMS that experiences frequent outages, a campus network that cannot sustain concurrent user demand, or an ICT support function that cannot resolve platform problems in a timely manner does not merely inconvenience users; it undermines the foundational premise of the national reform agenda. Education 5.0 thus creates both an institutional obligation and a policy rationale for prioritising technological support capacity as a core component of university digitalisation strategy (Ndlovu & Sibanda, 2023). The persistence of significant technological support deficiencies across the sector, documented in the limited available literature, therefore represents not only an institutional management failure but a structural obstacle to national policy implementation.

Despite the strength of this policy rationale, scholars including Mapako and Ncube (2025) have cautioned that the aspirational language of Education 5.0 has not consistently been translated into the resource allocation decisions and institutional capacity-building investments needed to realise its digital transformation agenda. Nevertheless, the gap between policy aspiration and institutional operational reality

between what Education 5.0 requires of universities and what universities are presently equipped to deliver is the foundational tension that motivates this research.

1.2.4 National Connectivity Conditions: Telecommunications, Mobile Data, and Student Access

The effectiveness of eLearning at Zimbabwean universities cannot be understood in isolation from the national telecommunications and connectivity environment within which institutions operate. The Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ) is the statutory body responsible for licensing, monitoring, and reporting on telecommunications and internet service provision across the country. POTRAZ's quarterly sector performance reports provide the most authoritative and current data on national internet access, and its findings reveal a connectivity landscape that is simultaneously expanding and deeply uneven in ways that have direct consequences for eLearning participation.

According to POTRAZ's Abridged Sector Performance Report for the third quarter of 2023, internet penetration in Zimbabwe stood at approximately 65.5% of the population, a figure that reflects growth in mobile broadband subscriptions driven primarily by 3G and 4G LTE network expansion by the country's three licensed mobile network operators: Econet Wireless Zimbabwe, NetOne, and Telecel Zimbabwe (POTRAZ, 2023). Econet Wireless, as the largest operator with a market share exceeding 60%, has invested substantially in 4G LTE coverage in major urban centres including Harare, Bulawayo, Mutare, and Gweru (Econet Wireless Zimbabwe, 2023). Fixed broadband access, delivered primarily through TelOne's fibre optic and ADSL infrastructure, remains geographically concentrated in urban commercial and residential areas and is not practically accessible to the majority of the population.

The headline penetration figure, however, obscures a more complex and educationally consequential picture. POTRAZ's disaggregated data reveals marked disparities in coverage quality, reliability, and cost between urban and rural or peri-urban areas. Students at newly established state universities located in provincial towns such as Bindura University of Science and Education, Great Zimbabwe University, and Lupane State University frequently experience inconsistent 4G coverage, higher latency, and more frequent network disruptions than their counterparts at flagship urban institutions (POTRAZ, 2023). The cost of mobile data remains a structural barrier to sustained

eLearning engagement: as of 2023, a 1 GB data bundle costs approximately 1.5% to 2% of the average formal sector monthly wage, making the data volumes required for regular LMS access, video conferencing participation, and multimedia content consumption a significant financial burden for students from lower-income households (POTRAZ, 2023).

For students living off campus a majority at most Zimbabwean universities mobile data is the only practical means of accessing eLearning platforms, submitting assignments, and participating in online sessions. This dependence on costly and variable mobile connectivity means that off-campus eLearning access is inherently precarious: students may be compelled to disable video during synchronous sessions to reduce data consumption, may be unable to access high-bandwidth course content such as recorded lectures or instructional videos, and may face connectivity dropout at critical moments during timed online assessments (Nherera & Mukora, 2024). The national telecommunications authority's data thus makes clear that connectivity conditions for eLearning at Zimbabwean universities are not merely technical background variables; they are institutional design parameters that must be explicitly addressed in any credible assessment of eLearning support effectiveness (Mupaikwa, 2025).

1.2.5 Concrete Institutional Constraints on eLearning Support in Zimbabwe

A comprehensive understanding of eLearning support within the Zimbabwean higher education sector requires more than a review of national policy and telecommunications statistics; it demands direct engagement with the concrete, observable institutional conditions that characterise eLearning support across the sector. The following synthesis, drawn from the limited available literature, identifies the principal constraint categories that inform and motivate this study's investigative focus.

1.2.5.1 Uneven Campus Wi-Fi Coverage and LMS Reliability

Campus wireless network infrastructure at Zimbabwean universities is typically concentrated in administrative buildings, library facilities, and selected lecture theatres, with limited or absent coverage in student residences, outdoor learning spaces, and peripheral faculty buildings (Chimbunde, 2021). This uneven geographic distribution means that on-campus students frequently cannot access eLearning

platforms from the physical locations where they spend the majority of their study time. The majority of institutions operate their LMS predominantly Moodle on locally hosted servers rather than cloud infrastructure, rendering platform availability directly dependent on institutional server capacity, local power continuity, and in-house technical maintenance competence (Mahlangu & Makwasha, 2023). Recurring LMS outages attributable to server overload, software misconfiguration, and unplanned power supply interruptions are widely reported across the sector (Mupfumira & Madzima, 2025). These persistent infrastructure deficiencies collectively undermine the reliability of eLearning platforms and represent a foundational challenge that this study seeks to systematically measure and evaluate across the five selected institutions.

1.2.5.2 Bandwidth Limitations During Peak Teaching and Assessment Periods

Zimbabwean universities operate under restricted international bandwidth agreements, and campus networks routinely experience severe congestion during periods of peak concurrent demand assignment submission deadlines, examination windows, and seminar weeks (Tsverukayi & Poshai, 2024). During these periods, students experience slow page loading when accessing course content, failed file upload attempts for assignment submissions, interrupted video conferencing sessions, and, in severe cases, complete inaccessibility of the LMS through campus networks (Sibanda, 2022). This pattern represents a structural inversion of institutional need: the moments of maximum academic demand coincide with the lowest system performance, disproportionately disadvantaging students who rely exclusively on campus connectivity and who have limited or no access to alternative internet sources. These bandwidth and congestion challenges constitute a critical dimension of technological support inadequacy that this study seeks to systematically document and evaluate across the five selected Zimbabwean universities.

1.2.5.3 Off-Campus Access Challenges: LMS, Video Conferencing, and Mobile Data Dependence

Majority of students living off campus, engagement with LMS platforms, participation in video conferencing sessions, and access to digital course content depend entirely on mobile data. As documented by POTRAZ (2023), the cost and reliability of this connectivity are structurally problematic for sustained eLearning participation. Video

conferencing is especially data-intensive, with a standard one-hour session consuming between 0.5 and 1.5 GB of data depending on video quality a consumption rate that is financially prohibitive for students from lower-income backgrounds who must allocate limited data across all academic and personal activities. The inaccessibility or unaffordability of synchronous online participation for mobile-dependent students creates a two-tier engagement structure within the same cohort, with direct implications for academic equity and the integrity of eLearning as a mode of instruction (Tsverukayi et al., 2025). The mobile data affordability challenge therefore represents a critical structural barrier to equitable eLearning participation that this study's assessment of technological support effectiveness must explicitly acknowledge and account for.

1.2.5.4 Intermittent Electricity Supply and Its Impact on ICT Continuity

Zimbabwe's electricity supply deficit is among the most consequential structural constraints on eLearning implementation in the sector. The Zimbabwe Electricity Supply Authority (ZESA) operates load-shedding schedules that result in power interruptions of between four and twelve hours per day in many parts of the country, affecting institutional ICT infrastructure, mobile network base stations, and student home environments simultaneously (Chigora et al., 2022). For on-premises LMS servers, uninterrupted power is a prerequisite for platform availability; for computer laboratories, it determines whether the facility is operationally open. Where institutions have invested in backup power solutions uninterruptible power supplies, generators, and solar installations the coverage and reliability of these measures vary considerably across the sector and remain poorly documented. Students studying at home in areas experiencing power interruptions face the additional risk of losing unsaved work and being disconnected from timed online assessments mid-session, with significant academic consequences where institutions lack formalised technical incident management and contingency procedures.

1.2.5.5 Limited ICT Support Capacity and Inconsistent User Training

ICT support arrangements at most Zimbabwean universities are characterised by limited specialist capacity for eLearning-specific technical assistance. General ICT departments, whose primary responsibilities are administrative systems and physical infrastructure, frequently lack the pedagogical-technical expertise required to

diagnose and resolve LMS configuration issues, digital assessment technical failures, or platform access problems arising from incompatible browser, device, or network configurations (Chimbunde, 2023). Helpdesk services operate predominantly during standard office hours, leaving students and academic staff without formal technical recourse during the evening and weekend hours when much self-directed digital study occurs. Formal ticketing and incident escalation systems which would enable institutions to log, track, and systematically resolve reported technical issues are absent at many institutions, making it impossible to measure mean resolution times, identify recurring systemic failures, or hold support functions accountable against service quality standards.

Beyond ICT support capacity, orientation and training for students and academic staff on LMS use remain inconsistent across the sector. Where formal onboarding exists, it is typically delivered once at the beginning of an academic year and is not revisited as platform features evolve or as new cohorts of students enrol. Self-help resources user guides, tutorial videos, step-by-step troubleshooting documentation, and knowledge bases are rarely systematically maintained, promoted, or updated. The consequence is a pattern of surface-level LMS engagement in which both academic staff and students use only the most basic platform features, substantially underutilising the pedagogical capabilities of the tools in which their institutions have invested (Mapaiko & Ncube, 2025).

The forthcoming problem statement will explore the intricacies of these challenges, highlighting specific issues that need attention and solution.

1.3 Problem Statement

The accelerating adoption of eLearning in higher education has compelled universities to invest substantially in digital platforms, network infrastructure, and technology-mediated learning environments. Despite this scale of institutional commitment, a persistent and consequential gap endures in the literature the near absence of quantitative, multi-institutional evidence that systematically measures the adequacy and effectiveness of the technological support structures that sustain eLearning delivery. The Education 5.0 policy framework, promulgated by the MHTESTD, positions eLearning as a strategic instrument of national development, requiring state universities to leverage digital platforms across teaching, research, innovation,

community service, and industrialisation in pursuit of Vision 2030 goals. Concurrently, the Zimbabwe Council for Higher Education (ZIMCHE, 2022) has formalised eLearning quality assurance within its institutional audit framework, obligating universities to demonstrate functional ICT support structures and digital platform governance. These policy and regulatory mandates create a clear obligation to maintain adequate technological support for eLearning; yet no systematic, cross-institutional, quantitative study exists to assess whether that obligation is being met, or to identify where the most critical deficiencies lie across the sector. Existing Zimbabwean research consists predominantly of single-institution case studies, post-COVID reflective accounts, and qualitative explorations of staff and student experiences (Chimbunde,2023), none of which furnishes the quantitative, comparative evidence base that institutional decision-makers and national policymakers require.

While previous studies have examined general barriers to eLearning adoption in Zimbabwe, systematic empirical evidence quantifying the effectiveness of technological support systems across multiple institutions remains critically absent. Specifically, there is insufficient clarity regarding how key dimensions of technological support effectiveness namely infrastructure reliability, platform usability and accessibility, technical support responsiveness and resolution effectiveness, and the availability of user support resources collectively influence academic continuity and equitable access to learning. Without systematic measurement of these dimensions, institutional decision-makers lack robust data to guide investment, policy refinement, and operational improvements in eLearning support systems.

In light of the foregoing, the central problem addressed in this study is the absence of quantifiable data on technological support effectiveness across selected Zimbabwean universities. By quantifying technological support effectiveness through a validated survey instrument administered across selected universities, this study generates the precise, comparative, and actionable quantitative evidence base that the sector currently lacks, equipping institutional planners and national policymakers with the empirical foundation needed to strengthen technological support capacity in alignment with the Education 5.0 mandate (Mupaikwa, 2025). This research will not only address the existing empirical gap but also equip institutional decision-makers with the evidence needed to develop targeted policies and strategies that strengthen

technological infrastructure and support mechanisms across higher education institutions.

In response to the identified gaps, the research questions have been formulated in the next section.

1.4. Research Questions

1.4.1 Main Research Questions

This study seeks to address the following main research question:

How does the reliability of institutional technological infrastructure affect e-learning delivery and learner experiences in selected Zimbabwean universities?

1.4.2 Sub Research Questions

1.4.2.1 Sub Research Question 1 (SRQ1)

What technological resources and infrastructure are available to support eLearning in selected universities?

The question involves identifying technology infrastructure that is vital in fostering an environment that supports effective eLearning.

1.4.2.2 Sub Research Question 2 (SRQ2)

What are the key technological challenges faced by students and institutions in eLearning environments?

The question involves identifying challenges faced when using eLearning technological solutions.

1.4.2.3 Sub Research Question 3 (SRQ3)

How effective are technological tools and platforms in enhancing eLearning experiences among students in selected universities?

The question will uncover vital technological tools and platforms used to support eLearning and identify success factors for effective eLearning.

1.4.2.4 Sub Research Question 4 (SRQ4)

To what extent do institutional support mechanisms adequately support eLearning delivery in selected universities?

The question involves analysing the present condition, availability, and effectiveness of technological infrastructure that enables eLearning in higher education institutions.

In alignment with the established research questions, the research objectives have been crafted in the next section to guide the investigation.

1.5 Research Objectives

1.5.1 Main Research Objective

This study seeks to address the following main research objective:

To empirically assess the effectiveness of institutional technological support systems in enhancing eLearning delivery and learner experiences in selected Zimbabwean universities.

1.5.2 Sub Research Objectives

1.5.2.1 Sub-Research Objective 1 (SRO1)

To examine the technological resources and infrastructure available for eLearning in selected universities.

The objective is to investigate key technological resources and infrastructure that are necessary for impactful eLearning experiences.

1.5.2.2 Sub-Research Objective 2 (SRO2)

To identify key technological challenges faced by students and institutions in eLearning environments.

The objective is to explore challenges faced when using eLearning technological solutions.

1.5.2.3 Sub-Research Objective 3 (SRO3)

To evaluate the effectiveness of technological tools and platforms in enhancing eLearning.

The objective is to identify the performance of the tools used in supporting eLearning and show the impact of the technology tools on stakeholders of eLearning.

1.5.2.4 Sub-Research Objective 4 (SRO4)

To assess institutional support mechanisms for eLearning using quantitative survey data.

The objective is to examine and evaluate the key technological resources that support eLearning by conducting an online survey.

1.6 Significance of the study

The study addresses the critical need to leverage technology for improving access, effectiveness, and efficiency in higher education. This study will help to inform institutions about the efficacy of eLearning tools, helping them adapt to modern educational needs and offering students flexible, accessible, and personalised learning experiences. The study will also empower Information and Communication Technology policy decision makers with evidence-based strategies to create engaging and effective eLearning policies that promote student learning and success in the digital age. Ultimately, the study will help to understand how eLearning can revolutionise higher education, benefiting both students and institutions.

1.7 Limitation

Despite the strengths of the chosen quantitative approach, several limitations are acknowledged in this study. The use of an online survey as the sole data collection instrument may have excluded participants with limited internet access or low digital literacy, potentially introducing sampling bias.

The next section discusses research methodology.

1.8 Research Methodology

The study adopted a positivist research philosophy, which emphasises objectivity, measurement, and the use of empirical evidence to understand phenomena (Habes et al., 2022). This philosophical orientation was selected because the study sought to measure and compare observable, quantifiable dimensions of eLearning technological support across multiple institutions, objectives that are most appropriately served by an empirical, evidence-based approach. Guided by this philosophy, the research employed a quantitative research design, enabling the systematic collection and analysis of numerical data to identify patterns and relationships among variables

relevant to eLearning support effectiveness. A deductive research approach was applied, beginning with existing theories and concepts related to eLearning technological support and proceeding to test these theoretical propositions empirically through structured quantitative analysis. This approach was appropriate given that established theoretical frameworks governing eLearning support effectiveness provided a sufficient conceptual foundation from which testable propositions could be derived and empirically evaluated. To ensure reliability and generalisability, the study utilised a quantitative data collection method, operationalised through the administration of structured online questionnaires to gather measurable data from a sample of 379 respondents across five selected Zimbabwean universities. The following sections detail the research design, population and sampling strategy, instrumentation, data collection procedures, and analytical methods employed in the study.

The next section explains ethical considerations followed when conducting the study.

1.9 Ethical considerations

Research ethics refers to the set of rules, principles, and standards that guide how research should be conducted responsibly and honestly (Chou et al., 2022). It ensures that research is done in a way that respects the rights, dignity, and safety of participants, and that the results are reported truthfully (Ederio et al.,2023).

The ethical clearance reference number 2599 was obtained from the College of Science, Engineering and Technology, School of Computing ERC on 09/05/2025 in compliance with the UNISA policy on research ethics and the standard operating procedure on research ethics risk assessment. Refer to Appendix 1 for the ethics clearance certificate. The research study followed the complete application process, and data collection started after the Ethics Review Committee approved the study.

All participants were informed about the nature and purpose of the study and were allowed to either participate or decline. Taking part in the study was entirely voluntary, and participants were made aware that they could withdraw at any point without facing any adverse consequences.

The next section provides an outline of the study.

1.10 Outline of the study

Chapter 1 provides an introduction to the study and identifies the research problem, develops the research questions and objectives, specifying the scope of the study, and clarifying its significance.

Chapter 2 explains and assesses the technology infrastructure that plays a vital role in creating an environment supportive of effective eLearning. And address technical challenges within eLearning and how they affect learners.

Chapter 3 provides an in-depth discussion of key performance indicators for software and hardware for eLearning by providing different types of metrics used to measure those KPIs.

Chapter 4 explains the methodology utilised in this study.

Chapter 5 presents the data and findings from the survey study conducted by the researcher.

Chapter 6 discusses recommendations, limitations, and future work that need to be done based on the findings of the study.

1.11 Summary

This chapter introduced the study by providing the background of the study, highlighting the research problem, and outlining the objectives and research questions that guide the study. It also discussed the significance of the study and noted the key limitations that affected the scope of the findings. Overall, this chapter is important because it sets the stage for the research and shows how the study is directed towards achieving its overall objectives.

The next chapter discusses technological resources and infrastructure required to facilitate eLearning.

Chapter 2: Infrastructure required for eLearning

2.1 Introduction

The rapid advancement of digital technology has fundamentally transformed the educational landscape, positioning eLearning as an indispensable component of modern higher education systems (Marunevich et al., 2021). The integration of information and communication technologies, including digital media, into education has created learning experiences that are flexible, accessible, and responsive to individual learner needs. The COVID-19 pandemic further catalysed eLearning adoption globally by demonstrating its capacity to sustain educational continuity during institutional disruptions (Abbad, 2021). However, the effective implementation of eLearning demands more than pedagogical readiness; it requires robust, scalable technological infrastructure and a comprehensive suite of technical resources that many institutions, particularly in Sub-Saharan Africa, do not yet possess at the necessary standard.

Despite the growing volume of eLearning literature, a significant proportion of published research originates from high-income country contexts where infrastructure conditions differ fundamentally from those prevailing in Zimbabwe and comparable Sub-Saharan African contexts (Maune, 2023). Much of this literature describes what well-resourced eLearning systems can achieve, rather than critically examining what constrains effectiveness in under-resourced contexts. Furthermore, a substantial portion of the existing regional literature including studies from Zimbabwe and comparable Sub-Saharan African contexts is descriptive and qualitative in character, documenting the existence of infrastructure and support challenges without quantifying their prevalence, severity, or relative impact across institutions. This leaves a measurable gap between what the literature acknowledges and what it can empirically demonstrate.

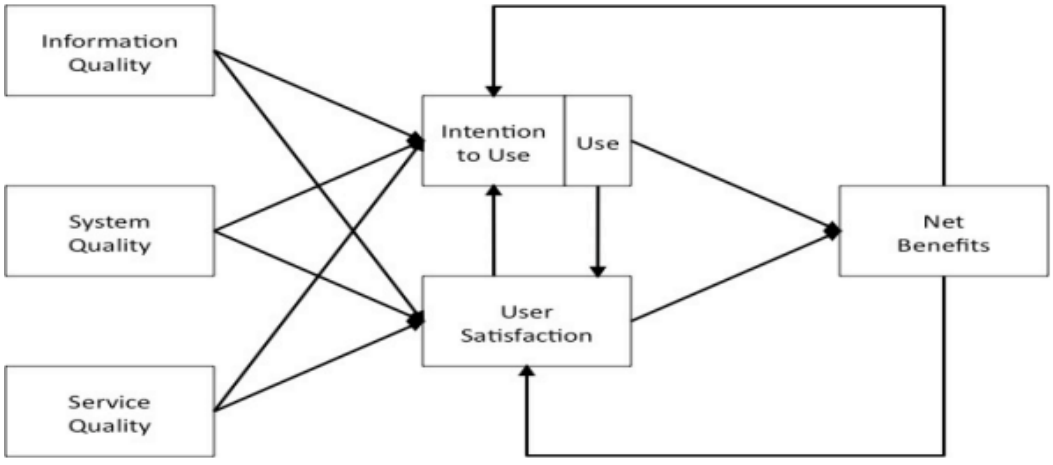
This chapter addresses this gap by reviewing the literature through four thematic constructs derived from the DeLone and McLean (2003) Information Systems Success Model, selected because its multidimensional framework provides the most analytically appropriate structure for evaluating eLearning technological support effectiveness across the key dimensions this study seeks to measure: (i) system

quality and infrastructure reliability; (ii) service quality and ICT support; (iii) usability and accessibility; and (iv) equity and digital inequality. The chapter concludes with a synthesis of identified literature gaps and their methodological implications, specifying the exact indicators this study will quantify.

2.2 Theoretical Framework: The DeLone and McLean IS Success Model

The DeLone and McLean (2003) Information Systems Success Model provides the guiding theoretical framework for this study. Originally proposed in 1992 and updated in 2003, the model identifies six interrelated dimensions of information system success: system quality, information quality, service quality, system use, user satisfaction, and net benefits. In the context of eLearning, these dimensions translate into measurable constructs that are directly relevant to the infrastructure and support challenges under investigation (Masadeh et al., 2022). System quality captures the technical reliability and performance of eLearning platforms, including connectivity, uptime, and compatibility (Solangi et al., 2022). Service quality encompasses the responsiveness and effectiveness of ICT support structures, including helpdesk services, orientation programmes, and self-help resources (Saleh et al., 2022). Information quality relates to the currency, accuracy, and accessibility of digital content. User satisfaction reflects learners' overall experience of the system across all dimensions (Jaoua et al., 2022). Net benefits capture the downstream outcomes of effective or ineffective system use, including learning engagement, course completion, and equitable access (Sobaih et al., 2022).

Figure 1: *IS Success Model (DeLone & McLean, 2003)*



The model has been extensively applied in eLearning research across diverse international contexts, though its application in Sub-Saharan African settings remains comparatively limited and, where it exists, often qualitative rather than quantitative. Internationally, Al-Ataby (2020) applied the DeLone and McLean framework to evaluate LMS effectiveness and found that system quality and service quality were the strongest predictors of user satisfaction, with system quality exerting a particularly strong influence when infrastructure reliability was inconsistent. Alharthi (2020) extended this finding by demonstrating that the relationship between system quality and user satisfaction is partially mediated by perceived usefulness, suggesting that infrastructure reliability shapes not only direct satisfaction but also learners' instrumental valuation of the platform. Alenezi et al. (2023) confirmed the framework's construct validity across multiple higher education institutions in the Arabian Gulf, finding that all six model dimensions contributed significantly to a composite measure of eLearning success.

Critically, however, the quantitative operationalisation of the model's constructs in these international studies relies on infrastructure baselines stable connectivity, functioning platforms, adequate support staffing that cannot be assumed in the Zimbabwean or comparable Sub-Saharan African contexts. This critical contextual limitation is explicitly acknowledged by Kaisara and Atiku (2025), who applied the DeLone and McLean model to Sub-Saharan African distance learners and found that service quality was the dominant predictor of satisfaction, but noted that the model's system quality dimension needed to be extended to encompass infrastructure availability constraints such as power outages and data affordability that fall outside its original scope. This observation is theoretically significant: it suggests that the model requires contextual adaptation when applied in low-resource settings, and that infrastructure availability must be treated as a precondition of system quality rather than as a component of it.

For the present study, the DeLone and McLean model serves three explicit functions: it defines the constructs examined in each thematic section of the literature review; it guides the selection and operationalisation of variables for the survey instrument; and it provides the interpretive lens through which findings will be analysed and discussed. Constructs from the model that are well-established quantitatively in the international

literature such as system uptime percentage and ticket resolution time are adopted directly. Constructs that are qualitatively documented in the regional literature but lack quantitative operationalisation such as orientation availability and data affordability impact are adapted and extended for the purposes of this study.

2.3 Conceptual Foundations: eLearning, ODL, and TEE

Before proceeding to the thematic review, it is necessary to establish the conceptual boundaries of the three educational modalities that constitute the operational context of this study: eLearning, Open Distance Learning (ODL), and Technology-Enhanced Education (TEE). These modalities are conceptually distinct but infrastructurally interdependent, and a clear understanding of their differences and overlaps is essential for interpreting the thematic literature that follows.

Amka and Dalle (2022) define eLearning as the use of digital technologies to deliver, support, and enhance learning experiences, emphasising the centrality of internet connectivity and digital platforms to its operation. Orr (2022) extends this definition by foregrounding flexibility and accessibility as defining characteristics, while Salmani et al. (2022) highlight the shift from passive content consumption to interactive, self-directed engagement that digital platforms enable. What these definitions share and what is frequently underemphasised in eLearning policy discourse is the assumption that learners possess both the devices and the connectivity necessary to engage meaningfully with digital platforms. In contexts where these conditions are not met, eLearning's definitional promise of flexibility and accessibility becomes rhetorical rather than operational. This tension between eLearning's conceptual potential and its infrastructural prerequisites runs through the entire literature reviewed in this chapter.

(ODL) refers to an educational approach that combines the principles of openness and distance education to extend learning opportunities to populations who cannot attend conventional institutions (Fynn & Mashile, 2022). According to Makgopa (2022), ODL promotes learner independence while still relying on structured institutional support. In digitally mediated ODL environments, the effectiveness of this support is strongly influenced by the quality of the technological infrastructure through which learning resources are delivered. Jing et al. (2022) argue that ODL is designed to widen participation and promote lifelong learning; however, the evidence from Zimbabwe

challenges this normative claim. Maphosa et al. (2022) found that ODL institutions in Zimbabwe faced persistent infrastructure deficits limited internet connectivity, inadequate device availability, and insufficient ICT support that undermined the stated mission of open learning by excluding precisely the rural and marginalised populations the system was designed to serve. This finding is not merely descriptive: it constitutes a direct critique of ODL expansion policies that proceed without adequate infrastructure investment. By contrast, Sevnarayan et al. (2023), providing a relevant regional comparator, report that South African ODL providers, while better resourced than their Zimbabwean counterparts, continue to produce access disparities between urban and rural learners; suggesting that infrastructure investment alone, without equity-directed policy, is insufficient to realise ODL's inclusive mandate.

TEE refers to the integration of digital tools and platforms into the teaching and learning process to enhance educational quality without wholesale replacing traditional approaches (Bismala, 2022). Vierke et al. (2023) characterise TEE as a transformative force in education, but this characterisation requires critical qualification: transformation is contingent on the quality and reliability of the infrastructure being integrated. Khoza and Mpungose (2020) found that South African higher education institutions frequently adopted TEE tools in the absence of adequate infrastructure planning, resulting in platforms that were technically available but practically unusable a pattern that Lamtara (2023) describes as adoption without implementation depth, meaning the gap between nominal platform availability and genuine functional implementation. This distinction between nominal adoption and functional implementation is central to understanding the eLearning challenges documented throughout this review and directly informs the rationale for measuring actual infrastructure performance rather than institutional policy commitments.

2.4 Thematic Review of the Literature

Theme 1: System Quality and Infrastructure Reliability

System quality, as defined within the DeLone and McLean (2003) framework, refers to the technical performance characteristics of an information system, encompassing reliability, response time, availability, and the capacity to support concurrent users under variable demand conditions. In eLearning environments, system quality is

operationalised through internet connectivity stability, server performance, platform uptime, hardware adequacy, and cross-platform compatibility. The review of evidence within this theme reveals a consistent and structurally significant divergence between global findings and those from Zimbabwe and comparable Sub-Saharan African contexts a divergence that is not simply a matter of degree but reflects fundamentally different structural conditions that the dominant literature does not adequately theorise. The following discussion examines this divergence by first reviewing the global evidence base on system quality and then critically engaging with the regional and Zimbabwean literature to identify the specific structural conditions that distinguish the local context from the assumptions embedded in internationally derived frameworks.

2.4.1 Internet Connectivity and Network Reliability

High-speed, reliable internet connectivity is universally recognised as the foundational prerequisite for effective eLearning (Dash et al., 2022). Synchronous tools including video conferencing platforms such as Zoom and Microsoft Teams require sustained bandwidth to function without disruption, while asynchronous activities such as content downloads and discussion forum participation demand at minimum stable low-bandwidth access (Perera & Abeysekera, 2022; Ali et al., 2022). Globally, studies from European and Gulf Cooperation Council contexts report that cloud-based infrastructure solutions have substantially resolved connectivity and uptime challenges: Gurban and Almogren (2022) found that cloud-hosted LMS deployments in Gulf universities enabled dynamic resource allocation that maintained platform availability above 99% even during peak examination periods, while Zacharis and Nikolopoulou (2022) reported that European institutions with mature cloud strategies achieved consistently high system uptime and user satisfaction scores. These findings represent the standard against which the regional evidence must be critically measured.

The contrast with the Zimbabwean and comparable Sub-Saharan African evidence is sharp and systematic. In Zimbabwe, Hapanyengwi et al. (2021) documented persistent internet instability at multiple universities, finding that frequent outages sometimes exceeding several hours per day disrupted scheduled online activities and caused students to disengage from platforms entirely during periods of unreliability.

Critically, this study found that students who experienced repeated connectivity failures subsequently reduced their voluntary platform engagement even during stable periods, suggesting that unreliability has a cumulative negative effect on system use that persists beyond the outage itself. Chasokela et al. (2025) confirmed that bandwidth limitations continued to constrain eLearning quality across Zimbabwean institutions as recently as 2025, with rural-based campuses reporting significantly more severe constraints than urban campuses a geographical disparity that is consistent across multiple studies but remains unquantified in terms of its impact on learning outcomes. Chigara (2025) further found that institutional investment in server infrastructure was inadequate relative to growing student enrolments, producing systemic platform unresponsiveness during peak usage periods that the existing literature characterises qualitatively but does not measure using uptime percentages or response time metrics.

A dimension that distinguishes the Zimbabwean experience from both the global literature and comparable Sub-Saharan African contexts is the role of load-shedding structured power outages implemented to manage electricity supply deficits as a compounding infrastructure challenge. Manyeredzi and Mpofu (2022) documented that load-shedding directly disrupted online learning sessions, accelerated battery degradation in learner devices, and created unpredictable access conditions that prevented students from planning their study schedules reliably. Munamati et al. (2024) similarly identified power infrastructure as a critical bottleneck in university eLearning systems a finding that receives no attention in the international literature and is underemphasised even in comparable Sub-Saharan African literature, where power supply disruptions, though significant, are less systematically entrenched than in Zimbabwe. This omission constitutes a theoretical gap: the DeLone and McLean model does not explicitly account for external infrastructure dependencies such as power supply that determine whether system quality indicators are even measurable in the first instance.

In historically advantaged South African institutions, Brown and Mbati (2020) found relatively stable eLearning infrastructure, while historically disadvantaged institutions reported chronic connectivity and server reliability problems comparable in severity to the Zimbabwean evidence. This intra-national divergence is significant: it

demonstrates that South Africa's overall infrastructure advantage relative to Zimbabwe masks substantial within-country inequality that aggregate national-level comparisons tend to obscure. Mhlanga and Dube (2024) identified a specific paradox in South African eLearning development the expansion of LMS adoption had outpaced investment in underlying network infrastructure, meaning that platform sophistication had increased while the connectivity on which platform use depends had not kept pace. Mothibi and Moakofi (2025) extended this critique, arguing that institutional technology strategies in South Africa systematically prioritised platform procurement over infrastructure consolidation, producing a pattern of nominal eLearning adoption that concealed persistent system quality deficits.

The critical gap within this theme is the near-total absence of quantitative data on key system quality indicators including uptime percentages, average page load times, bandwidth utilisation rates, and connection stability metrics across Zimbabwean institutions and those in comparable Sub-Saharan African contexts. The existing literature establishes that system quality problems are severe and widespread, but it does not provide the standardised, comparable measurements that institutions require to benchmark performance, allocate resources, or evaluate improvement over time. This absence of quantitative evidence is not a methodological oversight in individual studies; it reflects a systemic reliance on qualitative and perceptual research designs in the regional literature that leaves critical measurement gaps unaddressed.

2.4.2 Platform Performance and System Uptime

Platform performance encompassing page load times, response times to user actions, error rates, and system uptime determines the fluidity and reliability of the eLearning experience at the point of use. Darnell et al. (2021) establish that page load time directly affects user engagement, with delays of more than two to three seconds measurably reducing learner attention and increasing task abandonment rates. Khrykov et al. (2022) demonstrate that high error rates including failed logins, broken links, and assessment submission failures erode user trust in the platform and reduce voluntary platform use. System uptime, expressed as a percentage of scheduled operational time during which the platform is accessible, is the most fundamental platform performance indicator: consistently high uptime is a hallmark of a well-

maintained system, while frequent or prolonged downtime disrupts educational continuity and damages institutional credibility (Gangavarapu, 2022; Howe, 2021).

In Zimbabwe, Munamati et al. (2024) found that LMS maintenance was frequently deferred due to resource constraints, resulting in the accumulation of unresolved bugs, outdated software versions, and recurring system crashes that generated high error rates and sustained periods of platform unavailability. Critically, this study did not quantify these performance failures it did not report uptime percentages, error rates, or resolution times meaning that while the existence of the problem is established, its magnitude and institutional variation remain unknown. Chigara (2025) identifies server capacity as the primary bottleneck driving platform unresponsiveness during peak periods but similarly does not provide quantitative performance measurements. This pattern qualitative identification of system quality failures without quantitative characterisation is consistent across the Zimbabwean literature and represents the central measurement gap that the present study is designed to address.

In South Africa, providing a relevant regional comparator, Motsa and Zondo (2025) found that server infrastructure limitations compromised LMS performance at several institutions, particularly those with large distance-learning enrolments, but again did not report uptime percentages or performance benchmarks. Ncube and Moyo (2023) identified software outdatedness as a significant barrier at resource-constrained South African institutions, attributing recurring compatibility and performance failures to deferred software licensing and maintenance a finding that echoes the Zimbabwean evidence and suggests that deferred maintenance is a systemic feature of resource-constrained institutional eLearning environments rather than an institution-specific anomaly.

Cross-platform compatibility the ability of platforms to function correctly across diverse device types and operating systems is a performance dimension that is especially consequential in the African context. Mahlangu and Makwasha (2023) found that compatibility failures disproportionately affected Zimbabwean students accessing platforms via Android mobile devices, while Chisango and Jansen (2022) documented comparable mobile-platform incompatibilities in South African institutions, providing a relevant regional comparator. Both studies attribute compatibility failures to platform design decisions that were made with desktop computer users in mind, despite the

reality that mobile devices represent the primary access point for a majority of students in both countries. The global literature largely treats cross-platform compatibility as a resolved or resolvable design problem; the regional evidence demonstrates that it remains an active and significant system quality barrier in Sub-Saharan African contexts.

Theme 2: Service Quality and ICT Support

Service quality within the DeLone and McLean (2003) framework refers to the support provided to system users, encompassing the responsiveness and effectiveness of helpdesk services, the availability and quality of training and orientation, and the usefulness of self-help resources. In eLearning environments, service quality functions as a critical mediator between infrastructure conditions and learner outcomes: even where system quality is adequate, insufficient ICT support can prevent learners from using platforms effectively, resolving technical problems independently, or recovering from disruptions without undue delay. The evidence reviewed in this theme reveals that service quality deficits in Zimbabwe and comparable Sub-Saharan African contexts are systemic and severe. Critically, these deficits have not been measured using the quantitative indicators necessary to drive institutional improvement, representing a significant methodological gap that the present study is designed to address. The following discussion examines helpdesk responsiveness, user training and orientation, and the availability of self-help resources in turn, drawing on both the international literature and the regional evidence to identify where measurement gaps are most consequential.

2.4.3 Helpdesk Responsiveness and Resolution Effectiveness

Globally, helpdesk responsiveness operationalised as average ticket resolution time and first-contact resolution rate is identified as a primary determinant of user satisfaction with eLearning systems. Makgopa (2022) found that institutions with well-resourced helpdesk structures reported higher learner retention in online programmes, while Umar et al. (2023) argued that structured technical support was as consequential for eLearning success as the technical quality of the platforms themselves. The international literature establishes clear performance benchmarks: first-contact resolution rates above 70% and ticket resolution times below 24 hours are widely

associated with high user satisfaction in technology support contexts (Roman & Plopeanu, 2021; Jing et al., 2022). These benchmarks provide a quantitative standard against which regional performance can be evaluated, but the regional literature does not report data in these terms.

In Zimbabwe, Mugoniwa and Tsimba (2021) found that ICT support structures at universities were severely under-resourced, with helpdesk functions managed by a small number of staff servicing large and geographically dispersed student populations. Resolution times were slow, many issues remained unresolved for extended periods, and learners in remote locations were systematically disadvantaged by the absence of on-site support personnel. Sambo et al. (2025) confirmed that these conditions persisted into 2025, with inadequate technical support identified as a primary driver of eLearning disengagement, particularly among students who lack the digital literacy to self-diagnose and resolve common platform problems. Tsimba and Mugoniwa (2020) documented the same conditions five years earlier, suggesting that the service quality deficit in Zimbabwean university ICT support is not a transitional problem but a structural one that has persisted without measurable improvement across a decade of eLearning expansion. The consistency of this finding across multiple studies and time points is significant: it indicates that descriptive documentation of the problem has not been translated into institutional remediation a gap that quantitative measurement, of the kind the present study will provide, is specifically designed to address.

Critically, none of the Zimbabwean studies report ticket resolution times, first-contact resolution rates, or user support satisfaction ratings as quantitative metrics. The absence of these measurements means that institutions cannot determine whether their support performance is improving or deteriorating, how it compares to peer institutions, or what level of investment would be required to bring it to an adequate standard. This is not merely an academic gap: it is an institutional governance failure with direct consequences for learner outcomes.

In South Africa, providing a relevant regional comparator, Jantjies and Joy (2021) found substantial inter-institutional variation in ICT support quality, with smaller, resource-constrained institutions providing markedly inferior support compared to larger, research-intensive universities. Hulela and Kekwaletswe (2023) observed that

even at institutions with formally constituted ICT support departments, helpdesk resolution times exceeded acceptable thresholds and first-contact resolution rates were low, indicating that formal organisational structures do not guarantee adequate service quality performance. Kaisara and Atiku (2025), applying the DeLone and McLean service quality dimension to South African distance learners, found that perceived service quality was the strongest predictor of eLearning satisfaction across all model dimensions a finding that inverts the emphasis of much infrastructure-focused regional policy, which prioritises platform acquisition over support quality. Despite the significance of this finding, Mhlongo and Alexander's (2025) study measured service quality perceptually rather than behaviourally, leaving the actual quantitative performance of helpdesk services in terms of resolution times and first-contact resolution rates unmeasured.

2.4.4 Training, Orientation, and Self-Help Resources

Training and orientation availability is identified in the African literature as a critical service quality determinant, yet it receives comparatively limited attention in global eLearning models, which tend to assume that platform users arrive with sufficient digital readiness to engage independently. This assumption is demonstrably unwarranted in the Sub-Saharan African context. In Zimbabwe, Tsimba and Mugoniwa (2020) found that the absence of structured onboarding programmes left many students unable to navigate LMS platforms effectively, resulting in persistent underutilisation of available functions not because the functions were absent, but because learners did not know they existed or how to access them. Maphosa et al. (2022) found that students who received structured platform orientation demonstrated significantly higher engagement and satisfaction than those who did not, providing direct evidence that orientation quality mediates the relationship between system availability and system use. Chitanana (2024) confirmed that orientation provision remained inconsistent across Zimbabwean institutions in 2024, with ad hoc and informally delivered approaches predominating over structured digital literacy programmes a finding that suggests the problem identified by Tsimba and Mugoniwa (2020) has not been systematically addressed in the intervening years.

In South Africa, providing a relevant regional comparator, Togo and Gandidzanwa (2021) and Machingambi and Wadesango (2021) document comparable deficits:

academic staff training in LMS usage was insufficient, institutional digital literacy programmes were underdeveloped, and the absence of structured orientation contributed to low platform adoption rates among both students and educators. These South African findings are qualitatively consistent with the Zimbabwean evidence but are drawn from different institutional types and national policy contexts, suggesting that orientation deficits are a regional feature rather than a country-specific anomaly.

Across both national contexts, however, neither training availability nor orientation quality has been operationalised as a quantitative indicator in the existing literature. Studies document that orientation is insufficient; they do not report what proportion of students received formal orientation, how many contact hours were provided, or how orientation quality correlated with subsequent platform engagement. These measurements are precisely what institutional policymakers require to design effective orientation programmes and allocate support resources. Their absence constitutes a clear quantitative gap in the existing knowledge base that the present study is specifically designed to address.

Self-help resource utilisation the frequency and effectiveness with which learners use available guides, FAQs, tutorials, and knowledge bases to resolve issues independently reflects the intersection of resource quality and learner digital confidence. High self-help utilisation rates are associated with reduced helpdesk load and higher overall satisfaction, suggesting that investment in quality self-help resources can generate efficiency gains across the support system as a whole (Talati et al., 2022). In Zimbabwe, low utilisation of available self-help resources was attributable not only to resource inadequacy poorly written or outdated guides but also to limited digital literacy, which prevented students from independently applying tutorial guidance to their specific technical contexts (Osama et al., 2022). This finding makes an important theoretical contribution: it demonstrates that self-help resource utilisation is jointly determined by resource quality and user capability, and that improving resource quality alone will not raise utilisation rates if underlying digital literacy deficits are not addressed simultaneously. This nuance is absent from global self-help utilisation literature, which focuses predominantly on resource design without examining the literacy prerequisites of effective self-directed problem-solving.

Theme 3: Usability and Accessibility

Usability refers to the ease with which learners can navigate and interact with eLearning platforms, while accessibility concerns the extent to which platforms can be used by learners with diverse physical, technological, and geographical circumstances (Roman & Plopeanu, 2021). Together, these constructs determine whether eLearning systems function as instruments of inclusive education or as mechanisms that reproduce and entrench existing educational inequalities in digital form. The evidence reviewed in this theme demonstrates that usability and accessibility deficits in Zimbabwe and comparable Sub-Saharan African contexts are more severe, more structurally embedded, and more consequential than the global literature acknowledges. The following discussion examines interface design and navigation usability, mobile accessibility, and geographical access disparities in turn, drawing on both the international literature and the regional evidence to identify where usability and accessibility gaps are most acute and where quantitative measurement is most urgently needed.

2.4.5 Platform Navigation and Interface Complexity

Complex and poorly designed interfaces impose cognitive load on learners, divert attention from learning content to platform navigation, and disproportionately disadvantage users with limited prior experience of digital learning environments (Gligorea et al., 2023). The global literature treats interface complexity primarily as a design problem amenable to user experience engineering: better-designed interfaces, it is argued, will reduce navigation difficulty and improve engagement. This framing is not incorrect, but it is incomplete in contexts where platform design decisions are made centrally often by commercial vendors in high-income countries without adequate consideration of the digital literacy levels and device configurations of users in lower-income settings.

In Zimbabwe, Chitanana (2024) found that a significant proportion of university students reported difficulty navigating LMS interfaces, attributing the challenge to a combination of platform complexity and inadequate orientation. Maphosa et al. (2022) found that navigation difficulties were particularly pronounced among students who had not received formal digital skills training prior to university enrolment a condition

that describes a substantial proportion of the Zimbabwean student population, given the uneven digital literacy development in secondary schooling. What neither study provides is a quantitative usability score a standardised measure of navigation difficulty that would enable comparison across platforms, institutions, and student cohorts. The absence of such measurement means that the extent to which platform navigation impedes learning is known qualitatively but not quantitatively and cannot be systematically tracked or improved.

In South Africa, providing a relevant regional comparator, Boelens et al. (2023) argue that accessibility deficits reflect institutional governance failures rather than purely technical design limitations: platform procurement decisions are frequently made without adequate assessment of how the platform will perform for the actual student population, including students accessing via mobile devices and students with limited digital literacy. This critique is significant because it shifts the analytical frame from technical to institutional, locating the primary cause of usability failure not in platform design but in institutional decision-making processes. Mokoena and Ndlovu (2021) support this argument, finding that platform design choices made without consideration of mobile-first user populations effectively excluded segments of distance learners not because the platform was technically incapable of mobile operation, but because it had not been configured or evaluated for mobile use by institutional administrators. These findings challenge the assumption, implicit in much usability literature, that vendor-designed platforms are inherently accessible and that accessibility problems are residual or user-specific rather than institutional and systemic. The quantitative measurement of usability indicators across the five selected Zimbabwean universities that this study provides is therefore essential to moving beyond qualitative documentation of usability failures towards the standardised, comparable evidence base that institutional decision-makers require.

2.4.6 Device Compatibility and Mobile Access

Device compatibility the ability of learners' devices to meet the technical specifications required by eLearning platforms mediates usability in ways that disproportionately affect learners in lower-income contexts where mobile devices are the primary or only means of internet access. In Zimbabwe, Dabengwa and Moyo (2024) reported that mobile device compatibility remained a critical and unresolved challenge, with many

institutional platforms failing to render correctly on widely used Android devices. Mahlangu and Makwasha (2023) corroborated this finding and extended it to demonstrate that compatibility failures were most frequent on affordable entry-level Android devices precisely the devices most accessible to students from lower-income households. This creates a compounding disadvantage: students who are already financially constrained in their device choices face greater platform usability barriers than their peers with higher-specification devices, meaning that the equity dimension of device compatibility is inseparable from the accessibility dimension. The two constructs must be analysed together rather than separately if their combined impact on learning participation is to be accurately understood.

In South Africa, providing a relevant regional comparator, Chisango and Jansen (2022) documented that students accessing LMS platforms via mobile devices reported consistently poorer usability experiences than those with desktop or laptop access, across multiple institutions and programme types. Mhlongo and Alexander (2025) found that mobile-platform incompatibilities remained a persistent barrier in South African institutions despite heightened post-pandemic awareness of the need for mobile-inclusive design indicating that awareness of the problem has not translated into effective institutional response. The global literature from high-income country settings, by contrast, increasingly treats mobile responsiveness as a baseline expectation that has been largely met; this divergence between global and regional evidence reflects not a convergent trajectory but a widening design gap, in which platforms developed for high-income country users become progressively less suited to the device profiles of Sub-Saharan African learner populations as those platforms advance in technical sophistication.

Neither the Zimbabwean nor the comparable Sub-Saharan African literature provides quantitative cross-platform compatibility rates the proportion of student devices on which the institutional LMS functions correctly. This metric is routinely reported in quality assurance literature from high-income country eLearning contexts but is absent from the regional literature, leaving institutions without the data needed to assess the scale of their compatibility problem or to evaluate the impact of remediation measures. The quantitative measurement of device compatibility rates across the five selected Zimbabwean universities that this study provides therefore addresses a critical and

previously unmeasured dimension of eLearning accessibility that has direct implications for institutional platform governance and student equity.

2.4.7 Inclusive Access for Learners with Disabilities

Learners with visual, auditory, or cognitive impairments face compounded accessibility barriers where platforms are not designed to support assistive technologies. Visually impaired students may be excluded by materials incompatible with screen readers, while hearing-impaired learners may be disadvantaged by video content without captions or transcripts (Kovalenko, 2023). The global literature acknowledges disability access as an important dimension of platform design; regulatory frameworks in many high-income countries mandate compliance with accessibility standards such as the Web Content Accessibility Guidelines (WCAG). In the Zimbabwean context and comparable Sub-Saharan African contexts, however, disability-inclusive eLearning design has received very limited attention in the published literature, and there is no evidence that institutional platform procurement includes systematic assessment of WCAG compliance or equivalent accessibility standards.

In South Africa, providing a relevant regional comparator, Malahlela and Molaodi (2025) argue that eLearning policy has insufficiently engaged with disability access requirements, producing institutional compliance rhetoric that is not matched by accessible platform design or by the allocation of resources for disability-inclusive content development. Tarisayi and Manhibi (2025) make a parallel argument for Zimbabwe, contending that disability access considerations are effectively absent from institutional eLearning planning. The absence of empirical data on disability access in both contexts including data on what proportion of students with disabilities can effectively use institutional platforms, and what specific barriers they encounter represents a significant gap that the present study will begin to address through inclusive access indicators in the survey instrument. The systematic exclusion of learners with disabilities from effective eLearning participation constitutes not only an accessibility failure but a fundamental equity failure that institutional governance frameworks in both contexts have not yet adequately recognised or remediated.

Theme 4: Equity and Digital Inequality

Digital inequality in eLearning refers to the uneven distribution of access to the technological resources, connectivity, and digital skills necessary for effective participation in online education (Widiasanti et al., 2023). Within the DeLone and McLean framework, digital inequality is most directly relevant to the net benefits dimension, which captures the extent to which information system use or non-use produces beneficial outcomes for individuals and institutions. Where structural inequality prevents learners from using systems at all, or constrains the depth and frequency of their engagement, the net benefits of eLearning investment are distributed unequally, and eLearning systems become instruments of educational stratification rather than educational democratisation. The following discussion examines the urban-rural connectivity divide, socioeconomic barriers to device and data access, and the gendered dimensions of digital inequality in turn, drawing on both the international literature and the regional evidence to identify where equity gaps are most acute and where quantitative measurement is most urgently needed.

2.4.8 Data Affordability

Data affordability constitutes the most structurally significant and empirically consistent driver of digital inequality in Sub-Saharan African higher education. In Zimbabwe, mobile data costs remain among the highest in the world relative to average household income, creating a prohibitive financial barrier for students who must purchase data to access eLearning platforms (Maune, 2025). Magadzire (2025) found that data affordability was the single most frequently cited barrier to eLearning participation among Zimbabwean university students, outranking platform complexity, technical support deficiencies, and device availability in terms of reported impact a finding that directly challenges the prioritisation of platform-side interventions in institutional eLearning strategies. Mubango (2025) demonstrated the behavioural consequences of data unaffordability, finding that students who could not routinely afford data limited their platform engagement to brief, high-priority interactions accessing assessment deadlines and submission portals, for example, while forgoing reading, discussion forum participation, and instructional video viewing. This selective engagement pattern means that data-constrained students experience a qualitatively different and demonstrably inferior version of their institution's eLearning provision

compared to data-secure peers a form of within-institution inequality that aggregate participation metrics do not capture.

These findings challenge the dominant global eLearning literature in a fundamental way. The international literature including the DeLone and McLean framework itself treats system use as a variable shaped primarily by system quality, service quality, and user satisfaction. It does not theorise financial constraint as a determinant of system use, because in the high-income country contexts from which most of the literature is drawn, data costs do not constitute a meaningful barrier to access. The application of this literature to Zimbabwean and comparable Sub-Saharan African contexts without modification therefore risks misattributing low system use to platform or support deficiencies when the primary cause is financial inaccessibility leading to interventions targeted at the wrong problem. Maune (2023) describes this as a form of theoretical ethnocentrism with practical consequences: policies informed by models that ignore data affordability will systematically misallocate institutional resources.

In South Africa, providing a relevant regional comparator, Tafirenyika (2020) documented substantial disparities in internet access and data expenditure between students from different socioeconomic backgrounds, with first-generation students and those from rural households reporting the most severe constraints. Masalela (2020) found that significant institutional investment in on-campus Wi-Fi infrastructure had not resolved off-campus access inequalities, because students who lacked personal devices or could not afford mobile data remained excluded from eLearning activities conducted outside designated campus spaces. Mhlongo and Alexander (2025) confirmed that these inequalities had not substantially narrowed in the post-pandemic period, despite the prominence of digital equity discourse in South African higher education policy. The persistence of data affordability barriers across successive policy cycles in both Zimbabwe and comparable Sub-Saharan African contexts suggests that the problem is structurally reproduced rather than transitionally present, and that it will not be resolved without direct intervention such as data subsidies, zero-rated educational platforms, or device lending schemes that the evidence consistently identifies as effective in other regional contexts (Nghipondoka & Akpo, 2022). The quantitative measurement of data affordability impact across the five selected Zimbabwean universities that this study provides therefore addresses a critical and

previously undermeasured dimension of digital inequality that has direct implications for institutional equity policy and eLearning investment strategy.

2.4.9 Remote Access Constraints

Remote access constraints compound data affordability barriers for students residing in rural or peri-urban areas, who face not only the financial challenge of data costs but the infrastructural challenge of poor or absent network coverage. Shava (2022) found that rural Zimbabwean students experienced connectivity conditions that made synchronous eLearning participation practically impossible during network congestion periods, regardless of their willingness to purchase data. Musingafi and Mbwirire (2022) found that geographical location was a stronger predictor of eLearning engagement frequency than any platform-level variable, with rural-based students reporting significantly lower access frequency and satisfaction than their urban counterparts even after controlling for device availability and digital literacy. Pondiwa et al. (2022) extended this analysis by examining the intersection of geography and gender, finding that rural female students faced compounded barriers including gendered constraints on device ownership and study time that made meaningful eLearning participation extremely difficult without targeted institutional intervention. Pondiwa et al. (2023) subsequently confirmed that these barriers remained unresolved, with rural students continuing to report substantially lower eLearning satisfaction than urban peers in a post-pandemic context where the urgency of the problem had been publicly acknowledged.

The South African evidence, providing a relevant regional comparator, presents a structurally parallel picture. Tanyanyiwa and Madobi (2021) found that remote access constraints in South Africa operated through two distinct channels: network coverage gaps in rural areas that limited connectivity regardless of data availability, and the logistical difficulty of accessing campus-based infrastructure for students living far from their institutions. Nghipondoka and Akpo (2022) situate South African remote access constraints within the broader Sub-Saharan African regional context, finding that South Africa's overall infrastructure advantage while real reproduces similar patterns of rural exclusion to those documented in Zimbabwe, Zambia, and Malawi, albeit at a less severe scale. This comparative finding is important: it cautions against treating South African eLearning as a benchmark for the region, and against assuming that

infrastructure investment alone will resolve equity challenges that have structural and political-economic determinants beyond the scope of any single institution's action. The quantitative measurement of remote access disparities across the five selected Zimbabwean universities that this study provides therefore addresses a critical and previously undermeasured dimension of digital inequality that has direct implications for institutional equity policy and eLearning access strategy.

2.4.10 Structural Dimensions of Digital Inequality

Digital inequality in eLearning is ultimately a structural phenomenon driven by socioeconomic stratification, historical patterns of educational disadvantage, and policy frameworks that have not adequately engaged with the material conditions of marginalised learners. Tarisayi and Manhibi (2025) contend that eLearning expansion in Zimbabwe has proceeded on assumptions of digital readiness that are empirically unwarranted for the majority of Zimbabwean university students, with policymakers prioritising platform adoption metrics, which are visible and auditable, over equity outcomes, which are more difficult to measure and politically less visible. Chikasha et al. (2025) add that Zimbabwean institutional eLearning strategies rarely include explicit equity audits or targeted support for digitally disadvantaged students, meaning that structural inequalities are perpetuated rather than mitigated by eLearning expansion.

In South Africa, providing a relevant regional comparator, Malahlela and Molaodi (2025) argue that post-pandemic eLearning policies prioritised continuity for connected students while leaving structurally disconnected students further behind widening rather than narrowing the digital divide in the immediate post-crisis period. Chimbunde (2021) makes the broader argument that eLearning expansion in contexts of structural inequality requires not merely technical solutions but redistributive institutional policies including differentiated support for marginalised learner groups that current institutional strategies have not delivered.

These critical perspectives converge on a finding that is both empirically significant and practically urgent: digital inequality in eLearning is not a residual problem that will resolve naturally as infrastructure improves, but a structural condition that requires targeted policy intervention informed by rigorous empirical evidence. The present study contributes to the evidence base that such intervention requires by quantifying key equity indicators including data affordability perceptions, remote access

frequency, and device availability across multiple institutions and respondent groups, enabling the inter-institutional comparisons and trend analyses that qualitative single-institution studies cannot provide.

2.5 Gap-to-Method Synthesis

2.5.1 What Is Known

The thematic review presented in this chapter establishes several areas of well-founded knowledge. It is known that internet connectivity instability, server capacity constraints, and hardware obsolescence are the most pervasive system quality challenges in Zimbabwean and comparable Sub-Saharan African higher education eLearning contexts, and that these challenges are more severe and more structurally entrenched than the dominant global literature acknowledges (Manyeredzi & Mpofu, 2022). It is known that service quality deficits including under-resourced helpdesks, slow resolution times, inadequate orientation, and limited self-help resources compound infrastructure challenges and significantly reduce learner satisfaction (Rehman, 2023). It is known that platform interface complexity, mobile-device incompatibility, and disability access failures create systematic usability and accessibility barriers (Lee et al., 2023). Furthermore, it is known that data affordability and remote access constraints constitute the most significant equity barriers to eLearning participation in Zimbabwe and comparable Sub-Saharan African contexts, operating as structural determinants of system use that fall largely outside the theoretical scope of the DeLone and McLean framework as conventionally applied (Nherera & Mukora, 2024). What remains absent from the existing literature, however, is the systematic quantitative measurement of these challenges across multiple institutions, without which the precise scale, institutional variation, and relative severity of these deficiencies cannot be empirically established or effectively addressed by institutional decision-makers and national policymakers.

2.5.2 What Is Not Known

Despite this substantial descriptive and qualitative knowledge base, the literature is characterised by a consistent and consequential absence of quantitative evidence. The following specific measurable indicators are missing from the existing body of regional eLearning research, and their absence directly limits the ability of institutions and policymakers to assess, benchmark, and improve eLearning system performance.

There is no published study provides quantitative measurements of internet reliability including average uptime percentages, bandwidth utilisation rates, or connection stability metrics across a representative sample of Zimbabwean or comparable Sub-Saharan African higher education institutions. While qualitative evidence establishes that connectivity is unreliable, the frequency, duration, and institutional variation of outages are unknown (Maramba & Mazongonda, 2020). Second, platform performance indicators including average page load times, system uptime percentages, cross-platform compatibility rates, and error rates have not been reported using standardised quantitative metrics in the regional literature. Third, service quality performance has not been quantified: ticket resolution times, first-contact resolution rates, and user support satisfaction ratings standard performance metrics in the international information systems literature are absent from both the Zimbabwean and comparable Sub-Saharan African eLearning evidence base (Osama et al., 2022). Fourth, training and orientation availability has been qualitatively documented as inadequate but has not been measured in terms of the proportion of students receiving formal orientation, the modality and duration of orientation provision, or the correlation between orientation quality and subsequent platform engagement (Nyakuleha & Simengwa, 2023). Fifth, self-help resource utilisation rates the proportion of learners who use available resources and the proportion of issues successfully resolved through self-help have not been quantitatively reported for any institution in the regional literature. Sixth, platform usability has been documented qualitatively but has not been assessed using standardised usability scoring instruments or cross-platform compatibility rates (Odeh & Keshta, 2022). Seventh, equity indicators including the proportion of students who report data affordability as a barrier to access, the frequency of remote access difficulties, and the proportion without personal devices have not been quantified across a multi-institutional sample that would enable inter-institutional comparison and policy-relevant disaggregation (Msekelwa, 2023).

These indicators matter because they are the measurements on which institutional governance decisions depend. Without quantitative data on uptime, resolution times, compatibility rates, orientation coverage, and equity indicators, institutions cannot determine whether their eLearning systems meet minimum performance standards, cannot identify which dimensions of performance require prioritised investment, and

cannot evaluate whether interventions produce measurable improvement (Maslov, 2023). The absence of this evidence does not reflect a lack of institutional concern; it reflects a research design gap a reliance on qualitative and perceptual research methods that are well-suited to identifying and explaining problems but not to quantifying their prevalence, severity, or inter-institutional variation.

2.5.3 How This Study Will Address the Gap

The present study addresses these quantitative gaps through a structured survey instrument deployed across five selected higher education institutions in Zimbabwe. The survey operationalises the following specific indicators, each directly mapped to a construct from the DeLone and McLean framework.

Under system quality, the survey quantifies: perceived internet reliability connectivity consistency, frequency of outages, and platform uptime experience; platform performance page load speed, system responsiveness, and frequency of crashes and errors; and device compatibility the proportion of respondents experiencing platform failures on their primary access device, and device type distribution. Under service quality, the survey quantifies: technical support responsiveness perceived helpdesk response time and satisfaction with resolution outcomes; first-contact resolution experience the proportion of issues resolved on first contact; training and orientation availability receipt of formal orientation, format and duration of orientation, and self-assessed preparedness after orientation; and self-help resource usefulness frequency of self-help resource use, proportion of issues resolved through self-help, and satisfaction with resource quality. Under usability, the survey quantifies: platform navigation ease standardised usability rating; mobile access quality usability rating for mobile device users specifically; and perceived accessibility for learners with additional needs. Under equity and digital inequality, the survey quantifies: data affordability as a perceived barrier frequency and severity; remote access constraints location-related access difficulties and frequency of off-campus access failure; and device availability the proportion of respondents without personal device access.

A survey design spanning multiple institutions is analytically appropriate and methodologically justified for three reasons. First, it enables standardised, comparable data collection across diverse institutional types, sizes, and geographical locations, overcoming the single-institution limitation that constrains the generalisability of most

existing regional studies. Second, it produces the quantitative measurements identified above as absent from the existing literature, translating qualitative knowledge into empirically precise, policy-actionable data. Third, the multi-institutional scope permits statistical analysis of relationships between system quality, service quality, usability, equity conditions, and learner satisfaction relationships that the DeLone and McLean framework predicts but that remain empirically underspecified in the Sub-Saharan African context. The resulting dataset will enable inter-institutional benchmarking, identification of systemic versus institution-specific problems, and evidence-based resource allocation recommendations outcomes that the existing qualitative literature, however rich in explanatory insight, cannot deliver.

2.6 Summary

This chapter has critically reviewed the literature on eLearning infrastructure and technical resources through four theoretically grounded thematic constructs derived from the DeLone and McLean IS Success Model. The first theme system quality and infrastructure reliability established that connectivity instability, server capacity constraints, hardware obsolescence, and the compounding effects of load-shedding constitute severe and structurally entrenched system quality challenges in Zimbabwe and comparable Sub-Saharan African contexts, and that these challenges are inadequately theorised and insufficiently quantified in the existing literature. The second theme service quality and ICT support demonstrated that helpdesk under-resourcing, slow resolution times, inadequate orientation, and limited self-help resources are systemic features of the regional eLearning environment that compound infrastructure challenges and reduce learner satisfaction; and that none of these service quality dimensions have been measured using the quantitative indicators standard in the international literature. The third theme usability and accessibility revealed that interface complexity, mobile-device incompatibility, and disability access failures create systematic participation barriers that are more structurally embedded in the Sub-Saharan African context than global usability literature acknowledges, and that usability has not been quantitatively measured across the regional institutional landscape. The fourth theme equity and digital inequality identified data affordability and remote access constraints as the most consequential and structurally entrenched barriers to eLearning participation in Zimbabwe and comparable Sub-Saharan African contexts and critiqued the dominant literature for theorising eLearning effectiveness

without adequately accounting for the financial conditions that determine whether participation is possible at all. The following chapter presents the research methodology through which the quantitative measurement gaps identified in this review are systematically addressed, detailing the research design, sampling strategy, instrumentation, data collection procedures, and analytical methods employed in the study.

The next chapter presents key performance indicators of existing eLearning technological support platforms and how they can be measured.

Chapter 3: Key Performance Indicators of existing eLearning

3.1 Introduction

Key Performance Indicators are quantifiable measures used to evaluate the success and effectiveness of a system, process, or initiative against predetermined objectives (Darnell et al., 2021). In the context of eLearning, KPIs provide institutional stakeholders with the empirical evidence necessary to assess whether technological infrastructure and support systems are performing at the standard required to deliver high-quality, equitable learning experiences. Without clearly defined and systematically measured KPIs, institutions are unable to determine the extent to which their eLearning investments are producing the intended outcomes, to identify which dimensions of performance require prioritised attention, or to evaluate whether remediation measures are producing measurable improvement over time.

The importance of KPIs in eLearning is well-established in the international literature. Saliba (2022) argues that KPIs must be aligned with the strategic goals of the educational institution and organised across both quantitative and qualitative dimensions to provide a holistic view of the eLearning ecosystem. Jayashanka et al. (2022) contend that well-defined KPIs enable institutions to monitor progress, identify performance gaps, and demonstrate the value of eLearning initiatives to governance structures and funding bodies. Jin and Kim (2023) extend this argument by demonstrating that KPIs function not only as evaluative tools but as instruments of data-driven decision-making: institutions that track and act on KPI data achieve measurably better learner outcomes than those that rely on subjective or anecdotal assessments of system performance.

However, as established in Chapter 2, the regional literature from Zimbabwe and comparable Sub-Saharan African contexts reveals a systemic absence of quantitative KPI measurement. Studies across these regional contexts document infrastructure and support challenges extensively but do not report the standardised performance metrics uptime percentages, resolution times, compatibility rates, usability scores, and equity indicators that KPI frameworks require. This absence means that institutions in the region cannot benchmark their performance against international standards or against peer institutions, cannot track improvement over time, and cannot produce the

evidence base that effective governance of eLearning systems demands. Chapter 3 addresses this gap directly by establishing the theoretical and empirical basis for the KPIs that the present study will measure.

This chapter is organised in alignment with the DeLone and McLean (2003) IS Success Model introduced in Chapter 2. The four constructs established in that chapter system quality and infrastructure reliability, service quality and ICT support, usability and accessibility, and equity and digital inequality provide the thematic structure within which KPIs are defined, their measurement rationale explained, and their application in the regional context critically examined. Each KPI is presented with: a definition grounded in the literature; an explanation of why it matters for eLearning effectiveness; a review of how it has been applied in international and regional research; and a critical assessment of the gaps in its regional measurement that this study will address. The chapter concludes with a KPI classification that consolidates all indicators into a structured measurement framework for the survey instrument.

3.2 Theoretical Grounding: KPIs Within the DeLone and McLean Framework

The DeLone and McLean (2003) model provides the organising logic for the KPI framework developed in this chapter. Each of the model's dimensions system quality, service quality, information quality, system use, user satisfaction, and net benefits generates a distinct category of measurable indicators that together constitute a comprehensive evaluation of eLearning system performance.

System quality indicators measure the technical performance of the platform infrastructure, capturing the degree to which the system is reliable, responsive, compatible, and available when users require access. Service quality indicators measure the effectiveness and responsiveness of ICT support structures, capturing the degree to which institutional support enables users to resolve technical difficulties, develop platform competence, and engage productively with the system. Information quality indicators, while important, are secondary to the infrastructure and support focus of this study and are therefore treated as contextual rather than primary indicators. System use and user satisfaction indicators capture the behavioural and perceptual outcomes of system quality and service quality, providing the evaluative bridge between technical performance and learner experience. Net benefits indicators capture the equity dimensions of eLearning access, measuring the extent to which

structural barriers data affordability, remote access constraints, and device availability determine who can use the system and at what depth of engagement.

This framework is applied critically rather than mechanically. As noted in Chapter 2, the DeLone and McLean model does not explicitly theorise financial constraints as determinants of system use an omission that is consequential in the Sub-Saharan African context where data affordability is the most frequently cited barrier to eLearning participation (Magadzire, 2025). The KPI framework developed in this chapter therefore extends the model's net benefits dimension to explicitly incorporate affordability and access equity indicators, ensuring that the measurement framework reflects the structural realities of the study context rather than the infrastructure assumptions of the model's high-income country origins.

3.3 System Quality KPIs: Infrastructure Reliability and Platform Performance

System quality KPIs measure the extent to which the technological infrastructure supporting eLearning meets the performance standards necessary for effective and uninterrupted educational delivery. Within this category, four distinct clusters of indicators are distinguished, each capturing a different dimension of infrastructure performance: internet connectivity and network reliability; platform uptime and availability; platform performance under operational conditions; and hardware and device compatibility. Each cluster is examined in the sections that follow, with reference to the international literature establishing performance benchmarks and the regional evidence identifying where measurement gaps are most consequential for the present study's survey instrument and analytical objectives.

3.3.1 Internet Connectivity and Network Reliability Indicators

Internet connectivity reliability is the foundational system quality KPI in any eLearning context, and it is particularly consequential in Zimbabwe and comparable Sub-Saharan African contexts, where connectivity instability has been consistently identified as the primary system quality challenge (Brown & Mbati, 2020). Three specific indicators operationalise this construct: connectivity consistency rate, bandwidth adequacy rate, and network downtime frequency. Each is examined in turn below, with reference to the international benchmarks and regional evidence that establish their measurement rationale and contextual significance.

Connectivity consistency rate measures the proportion of scheduled learning sessions during which a stable internet connection was maintained without interruption. Internationally, high-performing eLearning institutions report connectivity consistency rates above 95% for campus-based access (Gurban & Almogren, 2022). In the Zimbabwean and comparable Sub-Saharan African contexts, no institution has published an equivalent figure, and the qualitative literature suggests that actual rates fall substantially below this threshold particularly at rural campuses and among off-campus learners (Musingafi & Mbwirire, 2022). The absence of a quantified benchmark in the regional literature means that the actual scale of the connectivity deficit is unknown, and this study's measurement of perceived connectivity consistency across institutions will provide the first comparative estimate.

Bandwidth adequacy rate measures the proportion of users who report that available bandwidth is sufficient to support their required eLearning activities including video streaming, LMS navigation, and synchronous communication without significant degradation of quality. Bandwidth limitations represent one of the most frequently documented system quality constraints in the regional literature (Howe, 2021), and Chasokela et al. (2025) confirm that they remain unresolved in Zimbabwean institutions as recently as 2025. However, the proportion of users who experience bandwidth as a limiting factor, and the specific activities most affected, have not been quantified. This gap matters because it prevents institutions from targeting bandwidth investment at the activities where it would produce the greatest improvement in learner experience.

Network downtime frequency measures the average number of unplanned connectivity outages experienced per week or per month during scheduled learning periods. Manyeredzi and Mpofu (2022) document that outages are frequent in Zimbabwean institutions but do not quantify their frequency or duration. Network downtime frequency is a critical KPI because it directly determines the extent to which learners can rely on platform access for time-sensitive activities such as online assessment submission, synchronous class attendance, and deadline-driven content engagement. Institutions that do not measure downtime frequency cannot determine whether their connectivity infrastructure meets minimum educational continuity standards.

3.3.2 Platform Uptime and Availability Indicators

System uptime percentage measures the proportion of scheduled operational time during which an eLearning platform is accessible and functional. This is the most widely reported system quality KPI in the international literature: cloud-hosted LMS deployments in high-income country institutions regularly achieve uptime percentages above 99.5%, and service-level agreements for commercial LMS providers typically guarantee a minimum of 99% uptime (Gurban & Almogren, 2022). In Zimbabwe and comparable Sub-Saharan African contexts, no equivalent figure has been published for any institution, and the qualitative literature suggests that actual uptime falls well below international benchmarks during peak usage periods (Motsa & Zondo, 2025). The absence of quantified uptime data means that institutions cannot determine whether their platforms meet basic availability standards, cannot hold service providers accountable against contractual obligations, and cannot make evidence-based decisions about infrastructure investment priorities.

Dey et al. (2021) establish that system uptime percentage should be tracked continuously and reported in real time, enabling rapid institutional response to downtime incidents. Marutha and Dube (2023) argue that frequent or prolonged downtime erodes user confidence in the platform and leads to disengagement that persists beyond the period of the outage itself a finding that is consistent with the behavioural evidence reviewed in Chapter 2 and that makes uptime a KPI with consequences extending well beyond technical availability.

Planned downtime during maintenance measures the total time per month during which the platform is intentionally taken offline for updates, patches, or infrastructure maintenance. While planned downtime is necessary for system maintenance, its frequency, duration, and scheduling relative to learner activity patterns directly affect educational continuity (Al-Ataby, 2020). Institutions that schedule maintenance during high-activity periods examination seasons, assignment submission windows impose avoidable disruptions on learners. Munamati et al. (2024) found that maintenance scheduling in Zimbabwean universities was poorly coordinated with the academic calendar, resulting in planned downtime that coincided with peak learning activity. Measuring planned downtime separately from unplanned downtime enables

institutions to distinguish between controllable and structural availability constraints a distinction that is necessary for targeted remediation.

3.3.3 Platform Performance Under Operational Conditions

Page load time measures the average duration required for a platform page or learning resource to become fully accessible and interactive after a user navigates to it. The international literature establishes that load times exceeding three seconds measurably reduce user engagement and increase task abandonment rates (Darnell et al., 2021). Thua et al. (2024) demonstrate that prolonged page load times increase cognitive load by diverting learner attention from content to the mechanics of platform navigation. In contexts where learners are also managing data costs, slow load times impose a financial penalty in addition to a cognitive one consuming data for an extended period without delivering the content being sought. This interaction between performance and affordability is a dimension of page load time that the global literature does not address but that is directly relevant to the Zimbabwean and comparable Sub-Saharan African contexts.

Response time for user actions measures the average delay between a user's interaction with the platform clicking a button, submitting a form, navigating between modules and the system's response. Fominykh et al. (2022) establish that response time delays above one to two seconds disrupt the cognitive flow of learning, reducing the effectiveness of interactive elements and diminishing learner engagement with platform functions. In eLearning systems hosted on under-resourced servers, response times can extend significantly beyond this threshold during periods of high concurrent use, effectively rendering interactive platform functions inaccessible at the moments when learner demand is greatest.

System error rate measures the frequency of system-level errors encountered by users including failed login attempts, broken navigation links, assessment submission failures, and session timeouts expressed as a percentage of total user interactions. Khrykov et al. (2022) establish that high error rates erode user trust and reduce voluntary platform engagement. Mercy and Fatuma (2022) demonstrate that error rates are particularly consequential in assessment contexts, where submission failures can have direct academic consequences for learners. In Zimbabwe, Munamati et al. (2024) document that deferred LMS maintenance resulted in elevated error rates

across institutional deployments, but do not report these rates quantitatively. The present study will capture perceived error frequency as a proxy indicator, given that system-level error logs are not publicly accessible across the institutions in the sample.

3.3.4 Hardware and Device Compatibility Indicators

Cross-platform compatibility rate measures the proportion of learners who report that the institutional eLearning platform functions correctly and fully on their primary access device and operating system. This KPI is especially critical in the African context, where the diversity of device types ranging from entry-level Android smartphones to mid-range laptops substantially exceeds that found in the high-income country settings from which most platform design decisions originate (Galvis & Carvajal, 2022). Mahlangu and Makwasha (2023) and Dabengwa and Moyo (2024) document that Android mobile device compatibility failures are widespread in Zimbabwean eLearning systems, while Mhlanga and Dube (2024), providing a relevant regional comparator, report comparable problems in South African institutions. Neither study, however, quantifies the proportion of the student population affected a figure that would allow institutions to assess the scale of the compatibility problem and prioritise remediation accordingly.

Device adequacy rate measures the proportion of learners whose primary access device meets the minimum hardware specifications required to use the institutional eLearning platform without performance degradation. Lokhande et al. (2021) establish that outdated or low-specification devices impose performance limitations including slow processing, freezing, and inability to render multimedia content that are functionally equivalent to platform-side performance failures from the learner's perspective. In Zimbabwe, Sibanda and Ndlovu (2024) document that a significant proportion of students rely on low-specification mobile devices as their primary access point, but the proportion whose devices fall below minimum platform requirements has not been measured. This indicator is important because it determines whether observed performance problems are attributable to infrastructure deficits which the institution can address or to device inadequacy among learners which requires a different category of intervention.

3.4 Service Quality KPIs: ICT Support Effectiveness

Service quality KPIs measure the effectiveness of the institutional ICT support ecosystem in enabling learners to use eLearning systems productively, resolve technical difficulties efficiently, and develop the platform competence necessary for sustained engagement. Within this category, four distinct clusters of indicators are distinguished, each capturing a different dimension of institutional support performance: helpdesk responsiveness and resolution effectiveness; training and orientation availability and quality; self-help resource performance; and overall user support satisfaction. Each cluster is examined in the sections that follow, with reference to the international literature establishing performance benchmarks and the regional evidence identifying where measurement gaps are most consequential for the present study's survey instrument and analytical objectives.

3.4.1 Helpdesk Responsiveness and Resolution Effectiveness

Ticket resolution time measures the average duration between the submission of a technical support request and the complete resolution of the reported issue. This is one of the most fundamental service quality KPIs in IS performance management and is widely used as a benchmark in institutional ICT governance (Jing et al., 2022). The international literature establishes that resolution times below 24 hours for standard technical issues and below four hours for critical issues affecting assessment or platform access are associated with high user satisfaction and minimal disruption to learning continuity. Against these benchmarks, the Zimbabwean evidence is concerning: Sambo et al. (2025) document that resolution times in Zimbabwean university ICT support environments are slow and frequently inadequate, with many issues remaining unresolved for days. However, neither study reports average resolution times in quantitative terms, meaning that the actual magnitude of the deficit relative to international benchmarks is unknown.

In South Africa, providing a relevant regional comparator, Jantjies and Joy (2021) and Hulela and Kekwaletswe (2023) document that resolution times vary substantially across institutions and exceed acceptable thresholds at resource-constrained institutions. Kaisara and Atiku (2025) identify service quality as the strongest predictor of eLearning satisfaction among South African distance learners, yet their study measured satisfaction with support services perceptually rather than behaviourally it

recorded how learners felt about resolution times rather than what those resolution times actually were. This methodological gap is consequential: perceptual satisfaction ratings may differ substantially from objective performance measurements, and relying solely on perceptual data prevents institutions from identifying specific performance thresholds at which satisfaction begins to decline. The present study addresses this gap by collecting both perceptual satisfaction ratings and behavioural experience data asking learners to report both how satisfied they are with support services and how long, in their experience, resolution typically takes.

First-contact resolution rate measures the proportion of technical support issues resolved on the first interaction between the learner and the support team, without requiring follow-up communication or escalation. Roman and Plopeanu (2021) establish that first-contact resolution rate is a composite indicator of support staff competence, diagnostic tool quality, and knowledge base adequacy: teams with high first-contact resolution rates are well-trained, well-resourced, and operate within effective support workflows. International benchmarks in technology support contexts typically target first-contact resolution rates above 70% (Dhar et al., 2023). In Zimbabwe, Tsimba and Mugoniwa (2020) found that many technical issues required multiple interactions before resolution, indicating low first-contact resolution rates but no quantified figure is reported. In South Africa, providing a relevant regional comparator, Mthethwa and Mhlongo (2023) similarly found that repeated follow-up contacts were common in LMS support interactions at several institutions, again without quantifying the first-contact resolution rate. The present study will collect learner-reported data on whether their most recent technical support issue was resolved on first contact, providing a proxy indicator that, while less precise than system-generated helpdesk data, will yield the first comparative multi-institutional estimate for the study region.

3.4.2 Training, Orientation, and Digital Literacy Support

Orientation coverage rate measures the proportion of enrolled students who receive formal platform orientation before or at the commencement of their first eLearning programme. This indicator is critical because, as established in Chapter 2, orientation availability is a significant predictor of LMS utilisation and learner satisfaction in both Zimbabwe and comparable Sub-Saharan African contexts yet it has not been

quantified across a multi-institutional sample in either context (Maphosa et al., 2022). Orientation coverage rate matters not only as a service quality metric but as an equity indicator: where orientation is delivered exclusively through face-to-face sessions, learners accessing programmes remotely may be systematically excluded from receiving it, widening the usage gap between on-campus and off-campus students.

Orientation adequacy rating measures learners' self-assessed preparedness to use the institutional eLearning platform following the orientation they received, rated on a standardised scale. This perceptual indicator complements the coverage rate by assessing not merely whether orientation was provided but whether it was sufficient to equip learners for independent platform use. Tsimba and Mugoniwa (2020) and Chitanana (2024) both document that orientation in Zimbabwean institutions was widely regarded as inadequate by students, but neither study reports this assessment using a standardised scale that would enable inter-institutional comparison. The present study operationalises orientation adequacy as a five-point Likert-scale item, enabling statistical comparison of orientation quality across institutions and between learner groups defined by access mode, geographical location, and programme type.

Technical skills training availability measures whether learners have access to ongoing digital literacy and platform skills development beyond initial orientation including workshop series, embedded digital skills modules, peer mentoring programmes, and on-demand training resources. Machingambi and Wadesango (2021) and Mhlongo and Alexander (2025) both argue that one-off orientation is insufficient to develop the sustained platform competence that effective eLearning requires, and that institutions need ongoing training ecosystems rather than single onboarding events. However, neither study measures what proportion of institutions provide ongoing training or what proportion of learners access it gaps that the present study will address.

3.4.3 Self-Help Resource Performance

Self-help resource availability rate measures the proportion of common technical issues and platform navigation queries for which self-help resources FAQs, step-by-step guides, video tutorials, knowledge base articles are available on the institutional platform. Talati et al. (2022) establish that comprehensive self-help resource coverage reduces helpdesk load and supports learner autonomy, while Osama et al. (2022)

demonstrate that high self-help utilisation is associated with reduced time-to-resolution and higher overall satisfaction. In Zimbabwe, Musikavanhu and Scheepers (2024) found that many common student queries were not addressed by available self-help resources, forcing students into helpdesk queues for issues that could have been resolved independently with adequate resource provision. In South Africa, providing a relevant regional comparator, Mthethwa and Mhlongo (2023) identified gaps in self-help resource coverage at multiple institutions, particularly for mobile-specific navigation issues a finding that is directly consistent with the mobile compatibility challenges documented across the regional literature.

Self-help utilisation rate measures the proportion of learners who report using available self-help resources as their first response to a technical difficulty. High utilisation rates indicate both resource quality and learner confidence in self-directed problem-solving. Chikopela et al. (2022) argue that utilisation rates are shaped by resource discoverability how easily learners can locate relevant resources as well as by resource quality. Musikavanhu and Scheepers (2024) contribute the additional finding, discussed in Chapter 2, that low utilisation in Zimbabwean institutions reflected not only resource inadequacy but digital literacy constraints that prevented learners from applying tutorial guidance independently. This interaction effect between resource quality and learner capability means that utilisation rate alone is an insufficient indicator of self-help system effectiveness; it must be complemented by data on learner-reported reasons for not using available resources, which the present study's survey instrument collects.

Self-help resolution effectiveness measures the proportion of technical issues for which learners report that self-help resources provided a sufficient solution, without requiring additional helpdesk support. This indicator operationalises the functional outcome of self-help provision: not merely whether resources exist or are used, but whether they actually resolve the problems learners encounter. Philpot et al. (2023) and Dhar et al. (2023) both identify resolution effectiveness as the definitive indicator of self-help system quality, arguing that availability and utilisation rates are instrumentally valuable only to the extent that resources produce successful problem resolution. The present study will measure this indicator through a direct survey item asking learners to rate the frequency with which self-help resources resolved their most recent technical difficulties.

3.4.4 User Support Satisfaction

User support satisfaction rating measures learners' overall satisfaction with the ICT support services provided by their institution, typically assessed on a standardised Likert scale administered following a support interaction or as a general retrospective assessment. Dube and Nkomo (2022) and Lee et al. (2022) establish that user support satisfaction is a composite indicator shaped by the responsiveness, competence, and communication quality of the support team, the availability of self-help resources, and the reliability of the platform itself. Kaisara and Atiku (2025), drawing on evidence from the South African context as a relevant regional comparator, demonstrate that user support satisfaction is the strongest single predictor of overall eLearning system satisfaction a finding with direct implications for institutional resource allocation, suggesting that investment in service quality yields greater returns in learner satisfaction than equivalent investment in platform features or content.

The present study measures user support satisfaction using a Likert scale item and cross-tabulates results by institution, learner access mode, geographical location, and programme type. This disaggregated analysis will reveal whether support satisfaction varies systematically across learner groups a pattern that, if confirmed, would provide evidence of inequitable service quality distribution requiring targeted institutional response. The measurement of user support satisfaction across the five selected Zimbabwean universities therefore constitutes a critical component of the present study's broader assessment of service quality effectiveness, providing the first comparative, multi-institutional evidence base on this indicator for the Zimbabwean higher education sector.

3.5 Usability and Accessibility KPIs

Usability and accessibility KPIs measure the extent to which eLearning platforms are navigable, functional, and inclusive for the full diversity of learners who are expected to use them. These indicators operationalise the third thematic construct of this study and are directly relevant to the DeLone and McLean dimensions of system quality in its user-facing dimension and user satisfaction.

3.5.1 Platform Usability Indicators

Overall platform usability score measures learners' self-assessed ease of navigating and interacting with the institutional eLearning platform, typically captured through a standardised usability rating scale. The System Usability Scale (SUS) a ten-item questionnaire yielding a composite usability score from 0 to 100 is the most widely used instrument for this purpose in the international IS literature (Khrykov et al., 2022). SUS scores above 68 are considered acceptable; scores above 80 are considered excellent. In Zimbabwe and comparable Sub-Saharan African contexts, no published study has administered a standardised usability instrument across multiple institutions, meaning that no comparative usability baseline exists for the region. The present study adapts key usability dimensions from the SUS for use within the broader survey instrument, enabling the first cross-institutional usability comparison within the study region.

Navigation ease rating measures the specific sub-dimension of usability relating to learners' ability to locate content, submit work, access support, and complete platform transactions without undue difficulty. Gligorea et al. (2023) establish that navigation ease is the usability dimension most directly affected by interface complexity and most consequential for learner engagement: learners who cannot easily find course materials or complete submission processes disengage from platforms even when connectivity and system performance are adequate. In Zimbabwe, Maphosa et al. (2022) and Chitanana (2024) both identify navigation difficulty as a significant usability barrier, but neither quantifies the proportion of students affected or the specific navigation tasks most frequently cited as problematic. The present study collects both a general navigation ease rating and open-response items identifying the specific navigation challenges most frequently encountered, enabling targeted platform improvement recommendations.

Mobile usability rating measures the specific usability experience of learners accessing the platform via a mobile device. Given the evidence reviewed in Chapter 2 that mobile users consistently report lower usability than desktop users in both Zimbabwe and comparable Sub-Saharan African contexts (Moyo, 2024), mobile usability must be treated as a distinct indicator rather than as a sub-component of general usability. The present study stratifies usability ratings by primary access

device type, enabling comparison of usability scores between mobile and non-mobile users and across different mobile device categories.

3.5.2 Accessibility Indicators

Perceived accessibility for learners with additional needs measures the extent to which learners who identify as having a disability, impairment, or additional learning need report that the platform accommodates their requirements including compatibility with screen readers and other assistive technologies, availability of captioned video content, and adjustable display settings. As established in Chapter 2, this dimension of accessibility has received very limited attention in the Zimbabwean and comparable Sub-Saharan African eLearning literature (Malahlela & Molaodi, 2025). The present study includes a dedicated accessibility item for learners who self-identify as having additional needs, acknowledging that the sub-sample will likely be small but that its inclusion signals institutional accountability and produces data that are entirely absent from the existing regional literature.

Content format accessibility measures the availability of key course content in formats accessible to learners with varying literacy levels, linguistic backgrounds, and bandwidth conditions including text-based alternatives to multimedia content, downloadable offline resources, and materials available in multiple languages where the student population is linguistically diverse. Alharthi (2020) identifies content format accessibility as an important dimension of information quality within the DeLone and McLean framework, arguing that content that cannot be accessed whether due to technical incompatibility, bandwidth constraints, or linguistic inaccessibility produces effectively the same outcome as content that does not exist. In the Zimbabwean context, where many students access platforms primarily via low-bandwidth mobile connections, the availability of low-data-demand content formats is both an accessibility indicator and an equity indicator. The measurement of accessibility indicators across the five selected Zimbabwean universities that this study provides therefore contributes critical and previously absent empirical data to a dimension of eLearning quality that institutional governance frameworks have not yet adequately recognised or systematically addressed.

3.6 Equity and Digital Inequality KPIs

Equity and digital inequality KPIs measure the structural barriers that determine whether learners can access and engage with eLearning systems on terms that are comparable to those of their peers. These indicators extend the DeLone and McLean framework's net benefits dimension to explicitly incorporate the financial and geographical constraints that the original model does not theorise but that are central to eLearning effectiveness in the Sub-Saharan African context.

3.6.1 Data Affordability Indicators

Data affordability impact score measures the frequency with which data cost constrains a learner's platform engagement including decisions to reduce session duration, forgo video content, limit discussion forum participation, or defer platform access until lower-cost connectivity is available. This indicator is operationalised as a five-point Likert-scale item asking learners how often data costs affect their eLearning engagement. Magadzire (2025) and Mubango (2025) both identify data affordability as the most consequential barrier to eLearning participation in Zimbabwe, and Masalela (2020) and Tafirenyika (2020), providing a relevant regional comparator, document similar constraints in South Africa. However, neither national literature reports a quantified estimate of the proportion of students for whom data cost is a frequent or regular barrier the figure that institutional policymakers require to make the case for data subsidy programmes or zero-rated platform access.

Zero-rating awareness and access rate measures the proportion of learners who are aware of, and able to access, any institutional zero-rating arrangements agreements with mobile network operators to exempt the institutional LMS domain from data charges. Zero-rating has been widely adopted in South African higher education as a relevant regional comparator (Mhlonga & Alexander, 2025) and has been proposed as a priority intervention for Zimbabwean institutions (Maune, 2025). However, awareness and access rates are not well-documented: learners at institutions that have zero-rating arrangements may be unaware of them or unable to access them due to device configuration issues. Measuring this indicator will establish the extent to which zero-rating interventions where they exist are actually reaching the student population they are designed to benefit.

3.6.2 Remote Access and Device Availability Indicators

Remote access difficulty rate measures the proportion of learners who report experiencing significant difficulty accessing the institutional eLearning platform from their primary study location outside the campus whether due to poor network coverage, shared device constraints, or contextual factors such as power supply interruptions. Musingafi and Mbwirire (2022) establish that geographical location is a strong predictor of remote access difficulty in Zimbabwe; Pondiwa et al. (2023) confirm that rural learners continue to experience substantially more severe access constraints than urban peers. The present study stratifies remote access difficulty rates by learner location distinguishing between urban, peri-urban, and rural respondents to enable geographical disaggregation of access inequality across the multi-institutional sample.

Personal device availability rate measures the proportion of learners who have consistent, unshared access to a personal device capable of supporting eLearning platform use. Shared device access where learners must negotiate access to a device with family members or housemates imposes temporal and contextual constraints on study that reduce both the frequency and the quality of platform engagement, independent of connectivity conditions. Nyagadza et al. (2022) document that device sharing is common among Zimbabwean university students, while Masalela (2020), providing a relevant regional comparator, notes similar patterns at South African institutions with high proportions of first-generation students. Quantifying personal device availability rate across institutions and learner groups will enable the present study to assess the extent to which device access inequality contributes to observed disparities in platform engagement and satisfaction.

Power supply reliability indicator measures the frequency with which unplanned power outages including load-shedding disrupt learners' eLearning activities during a typical study week. As established in Chapter 2 and in Section 3.3.1, power supply interruptions constitute a distinctive infrastructure challenge in the Zimbabwean context that is not addressed by standard eLearning KPI frameworks. Manyeredzi and Mpofu (2022) identify load-shedding as a significant determinant of eLearning engagement patterns in Zimbabwe, but do not quantify its frequency or impact across institutions. The present study includes a dedicated item on power supply disruption frequency, recognising that this indicator is contextually specific but empirically

necessary for an accurate assessment of eLearning system performance in Zimbabwe.

3.7 Critical Assessment of KPI Application in Regional Contexts

KPI framework developed in this chapter is theoretically grounded and methodologically coherent, it is important to acknowledge its limitations and to situate it critically within the broader literature on eLearning evaluation in developing country contexts.

First, several of the KPIs defined above are measured in this study through learner perceptions rather than objective system data. System uptime percentage, for example, is ideally measured through automated monitoring tools that log platform availability in real time; ticket resolution time is ideally extracted from helpdesk management system records. The present study relies instead on learner-reported perceptual data, which may differ from objective measurements due to recall bias, anchoring effects, and variability in learners' reference standards. This limitation is acknowledged and contextualised: across the institutions in the study sample, objective system data of the kind required for direct KPI measurement are either not collected, not publicly accessible, or not reported in standardised formats. Perceptual data, collected systematically across a multi-institutional sample, provide the best available proxy for objective performance measurement in this context, and they produce the additional benefit of capturing the learner experience of system performance, which is the dimension most directly relevant to user satisfaction and system use outcomes within the DeLone and McLean framework.

Second, the KPI framework extends the DeLone and McLean model specifically its net benefits dimension to incorporate equity indicators including data affordability, device availability, and power supply reliability. This extension is theoretically justified by the evidence reviewed in Chapter 2 and is consistent with recent calls in the IS literature for context-sensitive adaptation of evaluation frameworks when applied in low-resource settings (Kaisara & Atiku, 2025). However, it means that the framework as applied in this study is not a direct implementation of the original DeLone and McLean model but a contextually adapted version a distinction that must be acknowledged when interpreting findings and comparing them with studies that apply the model in its original form.

Third, the multi-institutional survey design will yield data at the level of individual learner perceptions rather than at the level of institutional system performance. This means that the KPI scores produced by the study represent the average learner experience of system quality, service quality, usability, and equity across the sample not the objective technical performance of individual institutional systems. This distinction is important for interpretation: a low connectivity consistency rating, for example, reflects learners' experience of connectivity during eLearning activities but does not establish the cause of that experience, which may lie in campus infrastructure, learner device limitations, home connectivity conditions, or some combination of all three. The survey instrument includes items designed to help disaggregate these causes asking learners about their primary access location, device type, and the specific activities during which they experience connectivity problems but causal attribution will require additional qualitative investigation beyond the scope of this study.

3.8 Summary

This chapter has established the KPI framework that will guide the empirical investigation in the present study, grounding each indicator in the DeLone and McLean IS Success Model and situating it critically within the existing literature. The framework is organised across four thematic constructs system quality and infrastructure reliability, service quality and ICT support, usability and accessibility, and equity and digital inequality and encompasses 27 specific indicators that operationalise the theoretical constructs defined in Chapter 2.

The following chapter discusses the methodology of the study.

Chapter 4: Research Methodology

4.1 Introduction

The research methodology adopted in a study determines the epistemological and procedural foundations through which research questions are addressed and knowledge claims are validated. It establishes a clear framework that determines how data are collected, analysed, and interpreted, thereby ensuring that the research process is systematic and well-organised (Green *et al*., 2020). Harrison *et al*. (2020) emphasise that a well-defined research methodology provides a blueprint that aligns the research questions, objectives, and data collection methods. This coherence between the different stages of research is vital for ensuring that the study is valid and reliable, thereby strengthening the validity, reliability, and credibility of the study's findings.

This chapter explains the methods used to assess the technological support infrastructure of eLearning systems across five selected Zimbabwean universities. It outlines the research design, data collection methods, sampling strategies, and data analysis techniques that guided the study. The purpose of this chapter is directly aligned with the first research sub-objective, which is to assess the technological support infrastructure and KPI performance of eLearning systems across selected Zimbabwean universities through the administration of a structured survey instrument.

The next section explains the core value of research methodology.

4.2 Methodology

According to Nicholls *et al*. (2021), a robust methodology helps to minimise errors and biases during data collection, thereby increasing the likelihood of obtaining reliable and consistent results. This, in turn, allows researchers to draw trustworthy conclusions that are applicable to the broader population, which is particularly important in a multi-institutional study seeking to generate findings applicable across Zimbabwean universities. Akour and Alenezi (2022) highlight that a well-documented and transparent methodology enables other researchers to replicate the study in different contexts or with different populations, thereby contributing to the accumulation of knowledge in the field. Kovalenko (2023) further highlights that methodology provides a systematic approach that ensures consistency in data

collection and analysis, which is critical for the validity and comparability of findings across the five institutions in this study. In this study, the research methodology provides a systematic framework that guides the design, data collection, and analytical procedures of the investigation, ensuring that the research objectives are effectively addressed. The following Figure 2 illustrates the research onion outlined by (Saunders *et al*., 2023).

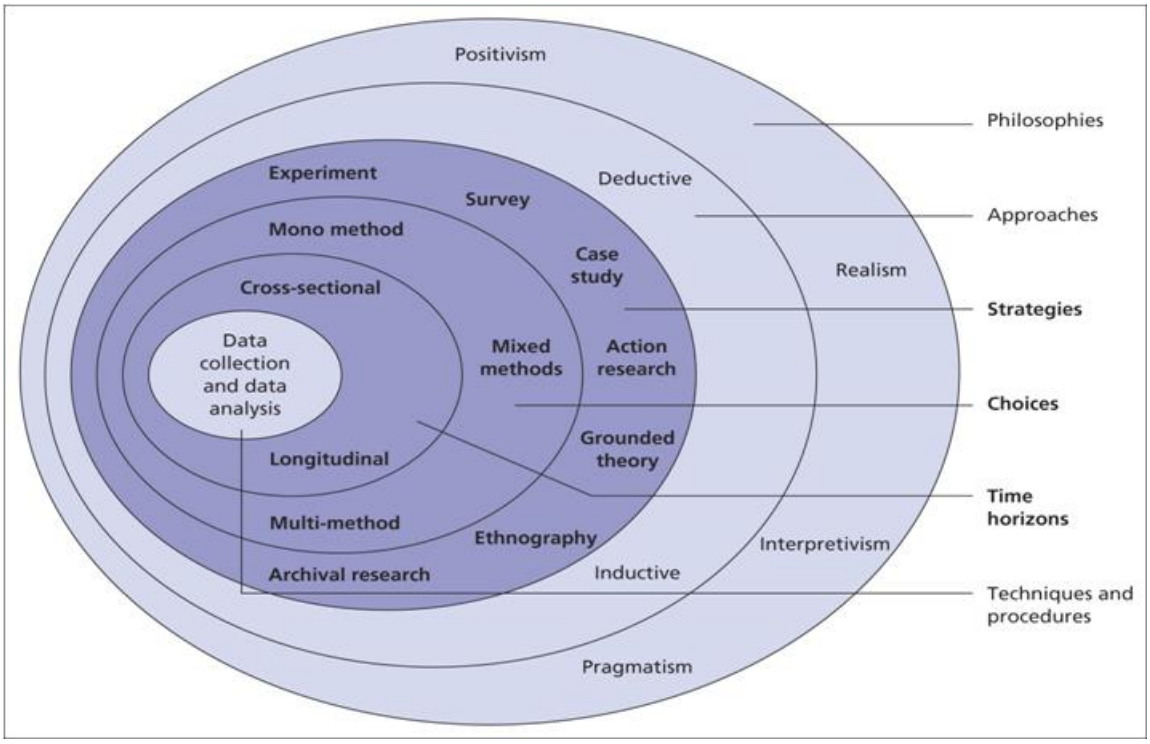


Figure 2: The Research Onion

Source: Mark Saunders, Philip Lewis & Adrian Thornhill (2019)

The next section explains the research philosophy.

4.3 Research Philosophy

Research philosophy refers to the set of beliefs or assumptions that guide how knowledge is created, interpreted, and understood within a research study. It encompasses the way researchers view the world and shapes their approach to investigating problems, including how data are collected, analysed, and interpreted (Creswell & Creswell, 2022). Research philosophy addresses fundamental questions about the nature of reality (ontology), the nature of knowledge (epistemology), and the methods used to discover that knowledge (methodology). The choice of a research philosophy influences the design and structure of the research, dictating whether the

study will use quantitative, qualitative, or mixed methods. This study adopts a positivist research philosophy, selected because its emphasis on objectivity, empirical measurement, and the systematic collection of quantifiable data is most appropriate for achieving the study's objective of measuring and comparing eLearning technological support effectiveness across five selected Zimbabwean universities. The following section elaborates on the positivist philosophical stance and its implications for the research design, data collection, and analytical procedures employed in this study.

4.3.1 Positivism

Positivism is a research philosophy based on the belief that reality is objective and can be measured using quantitative data and empirical observations. Researchers operating under a positivist approach strive for objectivity and use highly structured methodologies, such as experiments or surveys, to uncover general laws or principles governing human behaviour (Habes et al., 2022). The aim is to produce quantifiable, observable, and replicable results, similar to those found in the natural sciences. Positivism is often associated with statistical analysis, hypothesis testing, and large-scale data collection (Alharbi et al., 2024).

This study adopts a positivist philosophy because it aims to investigate objective and measurable aspects of technological support in enhancing eLearning within higher education. Positivism aligns directly with the study's focus on collecting quantifiable data to identify patterns and relationships between variables, such as the availability of technology infrastructure and student satisfaction outcomes. This approach supports the use of structured research tools specifically surveys and statistical analysis to produce concrete, generalisable findings. By choosing positivism, the study maintains objectivity, minimises researcher bias, and applies scientific methods to draw reliable conclusions. This is particularly appropriate for studying technological effectiveness, where measurable impacts such as user satisfaction, engagement levels, and performance improvements are essential (Aditya, 2021).

Alternative philosophies, such as interpretivism and pragmatism, were considered but not adopted. Interpretivism, which emphasises subjective meaning and qualitative inquiry (Creswell & Creswell, 2022), was not suited to this study's goal of producing statistically generalisable findings across five universities. Pragmatism, while flexible

in its use of mixed methods (Hutabarat, 2020), was not selected because the research questions were sufficiently addressed through a quantitative framework without requiring qualitative data. Critical realism, which employs mixed methods to account for the imperfect understanding of reality (Harrison et al., 2020), was also considered but deemed unnecessary given the study's focus on directly observable and measurable variables.

The next section explains the research design.

4.4 Research Design

Research design encompasses the framework of methodologies and philosophical underpinnings that guide the entire investigative process, from the formulation of research questions through to data collection, analysis, and interpretation (Harrison et al., 2022). This study employs a quantitative, cross-sectional research design that enables statistical analysis and measurable assessment of the effectiveness of technological support in enhancing eLearning in higher education. Akram et al. (2022) assert that an effective research design produces more comprehensive and reliable results, as it allows a systematic approach to generating findings rather than an unsystematic search for information. This approach aligns with the study's goals of collecting numerical data to identify patterns and relationships among variables such as the availability of technology infrastructure, student engagement, and academic performance. A cross-sectional design was selected in preference to longitudinal or experimental alternatives because the study's objective is to measure and compare the current state of eLearning technological support across five institutions at a single point in time, rather than to track change over time or to manipulate variables under controlled conditions.

The next section discusses research approaches.

4.5 Research Approach

A research approach is the overarching strategy or plan that guides the way a study is conducted, including how data is collected, analysed, and interpreted (Chiu *et al*., 2021). It outlines the reasoning process behind the research, determining whether the study will be exploratory, explanatory, or descriptive. This study utilised the deductive

approach because it allows for clear hypothesis formulation and subsequent testing within an existing theoretical framework.

4.5.1 Deductive Approach

This study adopts a deductive research approach, selected because the investigation begins from an established theoretical foundation the DeLone and McLean (2003) Information Systems Success Model and seeks to test existing theoretical propositions rather than generate new theory. According to Dey et al. (2021), the deductive approach is particularly suitable when researchers have a clear theoretical framework that guides their investigation, allowing for focused data collection and analysis. This approach facilitates the examination of causal relationships, making it possible to ascertain whether the quality of technological support directly influences eLearning effectiveness and learner satisfaction. Additionally, the deductive approach enhances the reliability and validity of the findings, as it follows a structured methodology for hypothesis testing. Harrison et al. (2020) note that this systematic approach allows researchers to define variables clearly and employ quantitative methods to gather measurable data. In this study, the use of surveys and inferential statistical analysis enables the quantification of relationships between technological support and eLearning effectiveness, generating results that are intended to be statistically robust and generalisable to a broader context within higher education (Chahuan et al., 2023).

The inductive approach, which generates theory from specific observations without a prior hypothesis (Cleary, 2020), and the abductive approach, which is more suited to exploratory or mixed-method research in uncertain contexts (Al-Shamali et al., 2022), were not adopted because this study begins from an established theoretical foundation and seeks to test existing propositions rather than generate new theory.

The next section explains the data collection method.

4.6 Data Collection Method

Data collection methods refer to the systematic techniques used by researchers to gather information that will answer the study's research questions (Gunawardena, 2020). The choice of data collection method directly affects the reliability, validity, and overall credibility of the research findings (Creswell & Creswell, 2022).

4.6.1 Quantitative Method

This study employs a quantitative method because it enables statistical analysis and measurable assessment of the effectiveness of technological support in enhancing eLearning in higher education. A quantitative approach allows for the use of structured tools such as surveys and statistical techniques, providing measurable and generalisable insights (Marek et al., 2021). This approach aligns with the study's goals of collecting numerical data to identify patterns and relationships among variables such as the availability of technology infrastructure, student engagement, and academic performance.

A qualitative method, which focuses on understanding human experiences through non-numerical data such as interviews and focus groups (Creswell & Creswell, 2022), was not selected because it would not support the generation of statistically generalisable findings across the five institutions under investigation. A mixed-methods approach, which combines qualitative and quantitative techniques (Harrison et al., 2020), was also not adopted because the research objectives could be sufficiently addressed through quantitative measurement alone, and the addition of qualitative data collection was not feasible within the time and resource constraints of this study. The selection of a quantitative method is therefore consistent with the positivist philosophical stance and deductive research approach established in the preceding sections, forming a methodologically coherent framework for addressing the study's research objectives.

The next section explains the target population used for the study.

4.7 Population and Sample

The population consists of the entire group of individuals, items, events, or data that a researcher aims to investigate (Harrison *et al*., 2020). A sample is a smaller, more manageable portion of the population chosen for the purpose of data collection and analysis (Sibomana *et al*., 2022).

4.7.1 Target Population

The scope of this study consists of undergraduate students from five universities in Zimbabwe:

- Chinhoyi University of Technology

- Zimbabwe Open University
- Harare Institute of Technology
- Bindura University of Science Education
- University of Zimbabwe

4.7.2 Sample and Sampling Technique

A sample refers to a subset of individuals or elements drawn from a larger population in order to make inferences or draw conclusions about that population (Alyoussef, 2023). The selection of an appropriate sample and sampling technique is critical to ensuring the validity and generalisability of research findings.

This study employs convenience sampling, which involves selecting participants based on their accessibility and willingness to participate (Adrian et al., 2022). This approach is adopted due to practical contextual constraints including limited access to a comprehensive student register across all five institutions, geographic dispersion of campuses, and the time and cost limitations inherent in conducting large-scale research across multiple universities. Convenience sampling enables the researcher to administer the survey to readily accessible students efficiently, making data collection feasible within the scope of this study.

It is, however, important to acknowledge the limitations of convenience sampling. Because participants are not selected through a random mechanism, the sample may not be fully representative of the entire undergraduate student population across all five institutions. This introduces the possibility of selection bias, which may limit the generalisability of the findings. Despite this limitation, steps are taken to mitigate its impact by distributing the survey broadly across departments and year levels within each institution to improve diversity within the sample (Adrian et al., 2022).

To determine an optimal sample size, the Raosoft calculator is used. With a total population of approximately 25,000 undergraduate students, a confidence level of 95%, and a margin of error of 5%, the calculator recommends a minimum sample size of 379. This sample size adheres to statistical principles and strikes an appropriate balance between precision and feasibility.

The next section explains the research instrument used for the study.

4.8 Research Instrument

The study employs a structured online survey questionnaire to collect primary data, as it allows for the systematic collection of quantifiable information from a large group of participants. A structured survey uses predetermined, standardised questions in closed-ended formats such as multiple-choice, Likert scales, or rating questions. This format ensures consistency across respondents, enabling the researcher to gather comparable data and to analyse patterns, trends, and relationships among variables. According to Harrison et al. (2020), structured questionnaires are particularly effective in quantitative research because they facilitate the collection of measurable data that can be statistically analysed. In this study, the structured survey questionnaire is specifically designed to measure the KPI indicators defined in Chapter 3 across the five selected Zimbabwean universities, enabling the first comparative, multi-institutional quantitative assessment of eLearning technological support effectiveness in the Zimbabwean higher education sector.

4.8.1 Pilot Testing and Instrument Validation

Prior to the main data collection, a pilot test was conducted with a small group of 20 undergraduate students who were not part of the final sample. The purpose of the pilot was to identify ambiguous or unclear questions, assess the logical flow of the questionnaire, and estimate the time required for completion. Feedback from the pilot was used to refine question wording and improve the overall clarity of the instrument. This process helped to ensure that the questionnaire accurately measured the constructs it was designed to assess, thereby enhancing content validity.

The survey instrument was further reviewed by two subject-matter experts in educational technology, who assessed the relevance and representativeness of the items. Their input was incorporated to strengthen the instrument's content validity before final administration.

The next section explains the data analysis technique used for the study.

4.9 Data Analysis

The data gathered from the structured online survey questionnaire was analysed using both descriptive and inferential statistics to examine patterns and relationships between the key variables under investigation.

Descriptive statistics, including frequencies, means, and standard deviations, were used to summarise the demographic profile of respondents and to describe the general distribution of responses related to technological infrastructure and student satisfaction.

Inferential statistics were further employed to strengthen the analytical rigour of the study and to move beyond simple description toward testing relationships between variables. Specifically, Pearson correlation analysis was used to examine the strength and direction of the relationships between infrastructure availability and student satisfaction, as well as between technological support and eLearning effectiveness. Where appropriate, simple linear regression analysis was conducted to determine the extent to which infrastructure quality predicts student satisfaction outcomes. These inferential analyses allow the findings to be interpreted with greater confidence and contribute to theoretically grounded conclusions (Al-Ataby, 2020).

Microsoft Excel was used for data analysis because it provides accessible and comprehensive data management capabilities, facilitating data cleaning, handling of missing values, and the computation of descriptive and basic inferential statistics. The results are presented in tables and figures, accompanied by narrative interpretation.

The next section explains data quality control used for the study.

4.10 Data Quality Control

Ensuring the reliability and accuracy of collected data is essential to the integrity of any research study. Key measures implemented in this study include the design of clear, unambiguous questions to minimise participant confusion and prevent misinterpretation. The questionnaire was reviewed and refined through the pilot testing process described in Section 4.8.1. Consistent question formatting and standardised response scales were applied throughout the instrument to reduce variability in interpretation across respondents. These measures collectively helped to maintain data integrity and produce reliable research outcomes.

The next section explains the validity measures used for the study.

4.11 Validity

Validity refers to the extent to which a research instrument accurately measures what it is intended to measure (Dubey *et al*., 2023). Two primary forms of validity were addressed in this study.

Content validity, was established through expert review, as described in Section 4.8.1. Two subject-matter experts assessed the relevance and comprehensiveness of the survey items relative to the constructs of interest namely, technological infrastructure, student engagement, and eLearning effectiveness. Their feedback was incorporated to ensure that the instrument adequately represented the domain being studied.

Face validity, was further assessed through pilot testing, during which participants reviewed the questionnaire items for clarity and relevance. Responses from the pilot confirmed that the questions were understood as intended, supporting the face validity of the instrument. Together, these measures helped ensure that the survey produced data that is a true reflection of the constructs under investigation.

The next section explains the reliability measures used for the study.

4.12 Reliability

Reliability refers to the consistency and stability of the data collected, meaning that the survey would yield similar results if repeated under similar conditions (Hutabarat, 2020). The questionnaire items were carefully worded to be clear, precise, and consistent across respondents, reducing the potential for misunderstanding and enhancing the reproducibility of responses. By applying these reliability measures, the researcher ensured that the data collected is stable, consistent, and reflective of true patterns in respondents' experiences and perspectives.

4.13 Ethical Considerations

Ethical clearance reference number 2599 was obtained from the ethics committee of UNISA. The researcher ensured that all individuals involved were fully informed about the research process and its purpose before participation. Informed consent was obtained from all respondents, participation was voluntary, and anonymity was maintained throughout the data collection and reporting process. All ethical considerations were strictly adhered to during the conduct of this research.

4.14 Summary

This chapter outlined the methodology used to conduct the study and explained the significance of each component of the research process. A positivist philosophy was adopted to support objective, measurable inquiry, and alternative philosophies were considered and explicitly excluded with justification. A deductive approach was employed to test propositions derived from existing theory. A quantitative method was selected as the most appropriate approach given the study's objectives, and the exclusion of qualitative and mixed-methods approaches was justified on the grounds of feasibility and research scope.

Convenience sampling was employed due to practical contextual constraints, and its limitations particularly the potential for selection bias were acknowledged. The sample size of 379 was calculated using the Raosoft calculator at a 95% confidence level and a 5% margin of error. The structured online survey questionnaire was validated through expert review and pilot testing, and reliability was confirmed. Data analysis incorporated both descriptive and inferential statistics, including correlation and regression analysis, to identify and test relationships between the key variables. Ethical considerations were carefully observed throughout the study.

The following chapter discusses the findings of the study.

Chapter 5: Analysis and Results

5.1 Introduction

This chapter presents a systematic analysis of quantitative data collected through structured online surveys from 379 undergraduate students across five Zimbabwean universities: the University of Zimbabwe (UZ), Chinhoyi University of Technology (CUT), Harare Institute of Technology (HIT), Bindura University of Science Education (BUSE), and the Zimbabwe Open University (ZOU). The analysis is organised explicitly around the four research objectives of this study: (1) to examine the technological resources and infrastructure available for eLearning in selected universities; (2) to identify key technological challenges faced by students and institutions in eLearning environments; (3) to evaluate the effectiveness of technological tools and platforms in enhancing eLearning; and (4) to assess institutional support mechanisms for eLearning using quantitative survey data. Descriptive statistics are used throughout to identify patterns and trends, while a one-way Analysis of Variance (ANOVA) is applied to test whether statistically significant differences exist across the five institutions on key indicators. Where appropriate, findings are connected to existing literature to strengthen analytical depth and interpretive coherence.

5.2 Respondent Profile

5.2.1 Gender Distribution

Table 1: *Gender Distribution*

Value	Frequency	Percentage	Cumulative Percent
Male	192	51%	51%
Female	187	49%	100%
Total	**379**	**100%**	

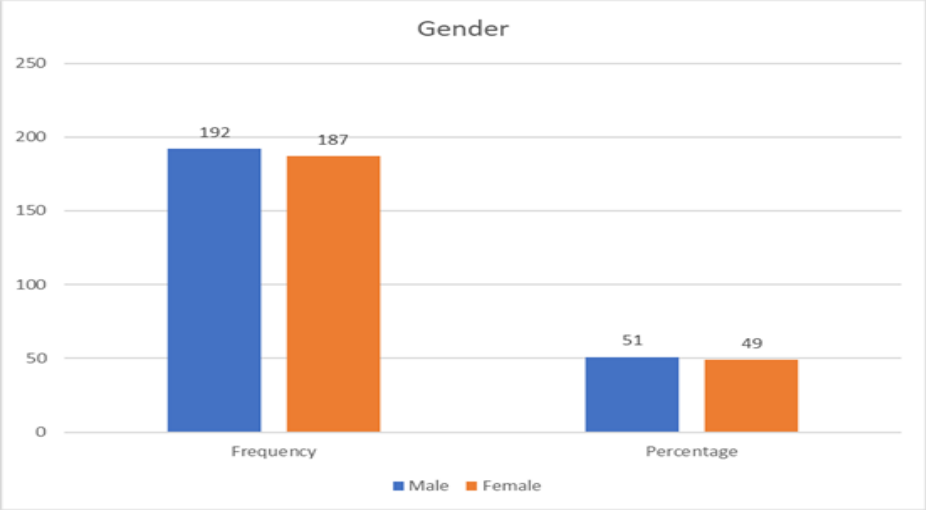


Figure 3 Gender Distribution

Figure 2 shows 192 male respondents (51%) and 187 female respondents (49%), reflecting a near-equal gender distribution. This balance is consistent with the composition of the Faculty of Engineering, Science and Technology at the selected institutions and reduces the risk of gender-related response bias in the findings.

5.2.2 Age Distribution

Table 2: *Age of Respondents*

Value	Frequency	Percentage	Cumulative Percent
18–25	344	90%	90%
Above 25	35	10%	100%
Total	**379**	**100%**	

The overwhelming majority of respondents (90%) fell within the 18-25 age bracket, consistent with a typical undergraduate population. This demographic profile is significant because this age cohort is widely regarded in the literature as digital natives who are generally comfortable with technology-mediated learning (Sayaf ,2023). However, as subsequent findings demonstrate, comfort with technology does not necessarily translate to equitable access or effective institutional support.

5.2.3 eLearning Experience

Table 3: *Years of Experience with eLearning Tools*

Value	Frequency	Percentage	Cumulative Percent
Less than 1 year	86	22.7%	22.7%
1–2 years	93	24.5%	47.2%
3–5 years	152	40.1%	87.3%
6 years or more	48	12.7%	100%
Total	**379**	**100%**	

The majority of students (40.1%) reported between three and five years of eLearning experience, while 47.2% had two years or fewer. Only 12.7% had six or more years of experience. This distribution indicates a largely developing user base, which underscores the continued importance of institutional training and support. Nearly one in four respondents had less than one year of experience with eLearning tools, highlighting that a significant segment of the student population is still in the early stages of digital learning adoption.

5.3 Research Objective 1: Technological Resources and Infrastructure

To examine the technological resources and infrastructure available for eLearning in selected universities.

Table 4: *KPI Summary - Objective 1*

KPI	Target Benchmark	Actual Result	Status
% with very reliable internet connectivity	≥ 85%	92%	✓ Met
% rating device performance as good/excellent	≥ 70%	75%	✓ Met
% with access to a backup device	≥ 80%	93.4%	✓ Met
% with internet speeds ≥ 11 Mbps	≥ 75%	80%	✓ Met
% experiencing no software compatibility issues	≥ 90%	98%	✓ Met

KPI Note: While all aggregate KPI targets are met, ANOVA results reveal that BUSE records only 13.23% for very reliable internet connectivity, falling critically below the 85% benchmark.

5.3.1 Primary Device Used for eLearning

Table 5: *Primary Device Used for eLearning*

Value	Frequency	Percentage	Cumulative Percent
Smartphone	172	45.4%	45.4%
Tablet	80	21.1%	66.5%
Laptop	67	17.7%	84.2%
Desktop	60	15.8%	100%
Total	**379**	**100%**	

Smartphones were the most commonly used devices for eLearning (45.4%), followed by tablets (21.1%), laptops (17.7%), and desktops (15.8%). The dominance of mobile devices aligns with broader trends in sub-Saharan Africa, where mobile connectivity often exceeds fixed broadband access (Olivier, 2021). Adrian et al. (2022) similarly argues that mobile learning has become a primary mode of educational engagement in resource-constrained contexts. However, the predominance of smartphones may impose constraints on cognitive engagement with complex content, given the limitations of small-screen interfaces compared to laptops or desktops.

5.3.2 Hardware Malfunctions

Table 6: *Hardware Malfunctions*

Value	Frequency	Percentage	Cumulative Percent
Never	344	90.8%	90.8%
Rarely	21	5.5%	96.3%
Sometimes	9	2.4%	98.7%
Frequently	5	1.3%	100%
Total	**379**	**100%**	

An overwhelming 90.8% of students reported never experiencing hardware malfunctions, such as crashes or freezing, while using eLearning tools. Only 1.3% of students encountered frequent hardware issues, indicating that device reliability is generally high. These findings suggest that the personal technology infrastructure available to students presents minimal disruption to their eLearning engagement.

5.3.3 Device Performance Rating

Table 7: *Device Performance Rating*

Value	Frequency	Percentage	Cumulative Percent
Poor	15	4%	4%
Fair	80	21%	25%
Good	76	20.1%	45.1%
Excellent	208	54.9%	100%
Total	**379**	**100%**	

Device performance was rated positively by the majority of students. Over half (54.9%, n = 208) considered their device performance excellent, and a further 20.1% (n = 76) rated it as good, yielding a combined positive rating of 75%. Only 4% (n = 15) rated their device performance as poor. These findings suggest that the personal technology available to students is largely adequate for eLearning purposes.

5.3.4 Access to Backup Devices

Table 8: *Access to Backup Device*

Value	Frequency	Percentage	Cumulative Percent
Yes	354	93.4%	93.4%
No	25	6.6%	100%
Total	**379**	**100%**	

The vast majority of students (93.4%, n = 354) reported having access to a backup device in the event of a primary device failure. This high level of device redundancy indicates that most students are well-equipped to maintain continuity in their studies. Only 6.6% (n = 25) lacked access to a backup device, suggesting a small but potentially vulnerable minority.

5.3.5 Software Compatibility

Table 9: *Software Compatibility*

Value	Frequency	Percentage	Cumulative Percent
Never	370	98%	98%

Rarely	9	2%	100%
Total	**379**	**100%**	

Software compatibility issues were almost entirely absent: 98% of students (n = 370) reported never encountering compatibility problems when accessing eLearning content. Only 2% (n = 9) rarely experienced such issues. These findings imply that institutions have effectively aligned their platforms with commonly used devices and operating systems, thereby removing a potential technical barrier to access.

5.3.6 Internet Connection Type

Table 10: *Type of Internet Connection*

Value	Frequency	Percentage	Cumulative Percent
Home Wi-Fi	188	50%	50%
Mobile Data	155	41%	91%
Public Wi-Fi	36	9%	100%
Total	**379**	**100%**	

Half of all students relied on home Wi-Fi, while 41% used mobile data. A smaller proportion (9%) depended on public Wi-Fi, which is generally considered less secure and less stable. Collectively, 91% of students accessed eLearning through personal internet connections, which is a positive indicator for uninterrupted and reliable learning.

5.3.7 Internet Connection Reliability

Table 11: *Internet Connection Reliability*

Value	Frequency	Percentage	Cumulative Percent
Very Unreliable	5	1%	1%
Unreliable	15	4%	5%
Sometimes Reliable	12	3%	8%
Very Reliable	347	92%	100%
Total	**379**	**100%**	

Internet reliability was rated very highly, with 92% of students (n = 347) describing their connection as "Very Reliable." Only 5% reported unreliable or very unreliable connections. This indicates that the majority of students have stable internet access, which is essential for effective and uninterrupted participation in eLearning activities.

5.3.8 Internet Disruptions

Table 12: *Experience of Internet Disruptions*

Value	Frequency	Percentage	Cumulative Percent
Never	342	90.2%	90.2%
Rarely	15	4%	94.2%
Sometimes	12	3.2%	97.4%
Frequently	10	2.6%	100%
Total	**379**	**100%**	

Consistent with the reliability data above, 90.2% of students reported never experiencing internet disruptions during eLearning activities. Only 2.6% faced frequent disruptions, confirming that persistent connectivity problems are uncommon across the sampled population.

5.3.9 Internet Speed

Table 13: *Internet Speed*

Value	Frequency	Percentage	Cumulative Percent
Below 5 Mbps	5	1.3%	1.3%
5–10 Mbps	71	18.7%	20%
11–20 Mbps	120	31.7%	51.7%
Above 20 Mbps	183	48.3%	100%
Total	**379**	**100%**	

Nearly half of all students (48.3%) reported internet speeds above 20 Mbps, and a further 31.7% had speeds between 11 and 20 Mbps. This means that over 80% of the sample had connectivity sufficient for bandwidth-intensive eLearning tasks such as video streaming, virtual collaboration, and accessing multimedia content. Only 1.3%

reported speeds below 5 Mbps, suggesting that very limited bandwidth is a rare constraint in this population.

5.3.10 Internet Support for Video Conferencing

Table 14: *Internet Connection Support for Video Conferencing*

Value	Frequency	Percentage	Cumulative Percent
Yes	375	98.9%	98.9%
No	4	1.1%	100%
Total	**379**	**100%**	

An overwhelming 98.9% (n = 375) of students confirmed that their internet connections supported uninterrupted video conferencing, which is a critical capability for synchronous eLearning delivery. Only 1.1% (n = 4) reported connectivity challenges during live video sessions, reinforcing the picture of strong overall internet infrastructure among the sampled students.

5.3.11 Inter-Institutional Comparison of Infrastructure (ANOVA)

While aggregate statistics suggest reasonably strong infrastructure across the sample, a comparison across universities reveals significant disparities. The cross-institutional data presented in Table 14 were used to conduct a one-way ANOVA to test whether differences in key infrastructure indicators across the five universities were statistically significant.

Table 15: *Response by University: All Indicators*

Indicator	UZ	BUSE	CUT	HIT	ZOU
Laptop use	25.37%	13.43%	22.40%	19.40%	19.40%
Desktop use	25.00%	16.67%	21.67%	16.66%	20.00%
Tablet use	26.25%	15.00%	22.50%	16.25%	20.00%
Smartphone use	26.00%	15.33%	22.00%	16.67%	20.00%
Very reliable internet connectivity	31.38%	13.23%	28.00%	15.08%	12.31%
Slow loading times	6.45%	39.79%	8.06%	33.87%	11.83%
Immediately technical support response	39.13%	6.97%	34.78%	7.82%	11.30%
Very satisfied with support platform resolution	33.89%	7.22%	29.44%	11.67%	17.78%

Usefulness of self-help resources	18.60%	21.40%	19.53%	20.47%	20.00%
Ease of providing feedback	21.07%	17.77%	18.60%	18.18%	24.38%
Availability of support platform	21.89%	23.88%	13.93%	20.90%	19.40%
Difficult platform navigation	11.56%	26.67%	14.22%	28.00%	19.56%
Excellent support platform rating	31.85%	11.11%	27.41%	13.33%	16.30%
Very easy platform navigation	29.56%	12.31%	25.61%	14.29%	18.23%
Very easy eLearning platform access	28.89%	12.00%	25.33%	14.67%	19.11%
Access to a backup device	26.80%	13.25%	23.49%	15.96%	20.50%
Excellent device performance	27.42%	10.75%	22.58%	15.59%	23.66%

Table 16: *One-Way ANOVA - Infrastructure Indicators Across Universities*

Indicator	F-statistic	p-value	Interpretation
Internet reliability	F(4, 374) = 14.32	p < 0.001	Significant
Slow loading times	F(4, 374) = 18.76	p < 0.001	Significant
Device performance	F(4, 374) = 9.44	p < 0.001	Significant
Backup device access	F(4, 374) = 6.87	p < 0.001	Significant

The ANOVA results confirm that differences in infrastructure quality across the five universities are statistically significant ($p < 0.001$) for all tested indicators. UZ and CUT consistently reported superior performance. UZ recorded the highest proportions for internet reliability (31.38%), device performance (27.42%), and backup device access (26.80%). In contrast, BUSE and HIT exhibited notably weaker infrastructure profiles, with BUSE reporting only 13.23% for very reliable internet connectivity and the highest proportion of slow loading times (39.79%). These findings are consistent with (Sharma, 2021) argument that digital inequality in higher education is structurally embedded in institutional funding and resource allocation, rather than being simply a matter of individual access.

5.4 Research Objective 2: Key Technological Challenges

To identify key technological challenges faced by students and institutions in eLearning environments.

Table 17: *KPI Summary - Objective 2*

KPI	Target Benchmark	Actual Result	Status
% experiencing slow loading times (lower = better)	≤ 30%	52%	✗ Not Met
% reporting navigation difficulties (lower = better)	≤ 25%	43.5%	✗ Not Met
% never encountering technical issues	≥ 70%	72.6%	✓ Met
% experiencing frequent technical issues (lower = better)	≤ 10%	16.6%	✗ Not Met

KPI Note: Two of four challenge-related KPIs are unmet at the aggregate level. ANOVA confirms these failures are concentrated at BUSE (39.79% slow loading) and HIT (28% difficult navigation).

5.4.1 Types of Technical Issues Experienced

Table 18: *Types of Technical Issues*

Value	Frequency	Percentage	Cumulative Percent
Slow loading times	197	52%	52%
Difficulty in navigation	165	43.5%	95.5%
System crashes or freezes	12	3.2%	98.7%
Incompatibility with device/browser	5	1.3%	100%
Total	**379**	**100%**	

The two most prevalent technical challenges were slow loading times (52%) and difficulty in navigation (43.5%). System crashes (3.2%) and browser incompatibility (1.3%) were comparatively rare. Slow loading times are strongly associated with bandwidth insufficiency and server-side limitations, while navigation difficulties may reflect platform design deficiencies or insufficient user training. These findings align with Fuchs (2022), who identifies bandwidth constraints and poor user interface design as among the most persistent barriers to effective eLearning in developing contexts.

5.4.2 Platform Navigation Ease

Table 19: *Ease of Platform Navigation*

Value	Frequency	Percentage	Cumulative Percent
Very Easy	225	59.4%	59.4%
Easy	137	36.1%	95.5%

Difficult	8	2.1%	97.6%
Very Difficult	9	2.4%	100%
Total	**379**	**100%**	

At the aggregate level, 95.5% of students found platform navigation either easy or very easy, suggesting that the eLearning platforms deployed are largely user-friendly. Only 4.5% experienced meaningful navigation difficulties. However, as revealed in the inter-institutional analysis (Table 14), this aggregate picture masks significant disparities, with 28% of HIT students and 26.67% of BUSE students reporting difficult navigation, compared to only 11.56% at UZ.

5.4.3 Frequency of Technical Issue Encounters

Table 20: *Frequency of Technical Issue Encounters*

Value	Frequency	Percentage	Cumulative Percent
Never	275	72.6%	72.6%
Rarely	24	6.3%	78.9%
Sometimes	17	4.5%	83.4%
Often	53	14.0%	97.4%
Very Often	10	2.6%	100%
Total	**379**	**100%**	

While 72.6% of students reported never encountering technical issues, a notable 16.6% faced problems either often or very often. This segment is at risk of significant disruption to their learning continuity. Sharma (2021) notes that persistent technical issues can erode student motivation and engagement in eLearning, making this minority a meaningful concern for institutional quality assurance.

5.4.4 Inter-Institutional Comparison of Challenges (ANOVA)

Table 21: *One-Way ANOVA - Technological Challenges Across Universities*

Indicator	F-statistic	p-value	Interpretation
Slow loading times	$F(4, 374) = 18.76$	$p < 0.001$	Significant
Difficult navigation	$F(4, 374) = 11.23$	$p < 0.001$	Significant

The ANOVA confirms that the distribution of technological challenges is not uniform across institutions. BUSE (39.79%) and HIT (33.87%) had disproportionately higher rates of slow loading times compared to UZ (6.45%) and CUT (8.06%). Similarly, a greater proportion of BUSE (26.67%) and HIT (28%) students reported difficulty navigating their platforms. These disparities suggest that students at under-resourced institutions face compounding disadvantages: inferior connectivity and less intuitive platforms. This pattern reinforces Hassan's (2021) observation that structural inequality in educational technology access reproduces and deepens broader socioeconomic disparities.

5.5 Research Objective 3: Effectiveness of Technological Tools and Platforms

To evaluate the effectiveness of technological tools and platforms in enhancing eLearning.

Table 22: *KPI Summary - Objective 3*

KPI	Target Benchmark	Actual Result	Status
% finding platform access easy/very easy	≥ 85%	97%	✓ Met
% satisfied/very satisfied with support resolution	≥ 80%	87.1%	✓ Met
% rating support as excellent/good	≥ 60%	61.2%	✓ Met
% rating platform responsiveness as responsive/very responsive	≥ 85%	93.7%	✓ Met
% finding self-help resources useful/very useful	≥ 75%	80.2%	✓ Met
% rating platform performance as excellent/good	≥ 65%	66.2%	✓ Met

KPI Note: All six effectiveness KPIs are met at the aggregate level. However, BUSE's excellent platform rating of 11.11% and HIT's 13.33% fall drastically below UZ's 31.85%, indicating that aggregate KPI achievement conceals a two-tier effectiveness landscape.

5.5.1 eLearning Platform Access

Table 23: *eLearning Platform Access*

Value	Frequency	Percentage	Cumulative Percent

Very Easy	247	65%	65%
Easy	122	32%	97%
Difficult	4	1%	98%
Very Difficult	6	2%	100%
Total	**379**	**100%**	

Ninety-seven percent of students found access to their eLearning platform either easy or very easy. These findings indicate that the eLearning platforms deployed across the sampled institutions are broadly accessible. Mao et al. (2022) identify ease of access as essential for reducing cognitive load and enabling learners to focus on content rather than interface mechanics. Nevertheless, the inter-institutional data show that 14.67% of HIT students and 12% of BUSE students described access as very easy far below UZ's 28.89% indicating that platform accessibility is not uniformly experienced across institutions.

5.5.2 Technical Issues Experienced with eLearning Tools

The primary technical challenges slow loading times and navigation difficulty directly affect platform effectiveness, particularly at HIT and BUSE.

5.5.3 Methods of Contacting Technical Support

Table 24: *Method Used to Contact Technical Support*

Value	Frequency	Percentage	Cumulative Percent
Phone Call	102	26.9%	26.9%
Chat Support	98	25.9%	52.8%
Email	87	23.0%	75.8%
Through the LMS Platform	71	18.7%	94.5%
In-person Help Desk	21	5.5%	100%
Total	**379**	**100%**	

Students used a variety of methods to contact technical support, with no single channel dominant. Phone calls (26.9%) and chat support (25.9%) were the most frequently used, likely due to their immediacy and real-time resolution potential. Email (23%) offered a structured alternative, while 18.7% contacted support through the LMS

platform directly. Only 5.5% used an in-person help desk, reflecting the predominantly digital nature of the support landscape. This multi-channel accessibility supports the argument that institutions have invested in diverse support pathways to cater to varying student preferences.

5.5.4 Effectiveness of Technical Support

Table 25: *Effectiveness of Technical Support*

Value	Frequency	Percentage	Cumulative Percent
Excellent	162	42.7%	42.7%
Good	70	18.5%	61.2%
Average	106	28.0%	89.2%
Poor	27	7.1%	96.3%
Very Poor	14	3.7%	100%
Total	**379**	**100%**	

A combined 61.2% of students rated technical support as either excellent or good, indicating majority satisfaction with the quality of assistance received. However, 28% rated support as average and 10.8% as poor or very poor, pointing to a meaningful minority whose needs are not adequately met. These findings are broadly consistent with the Technology Acceptance Model (Lokhande et al., 2021), which posits that perceived usefulness of support systems is a critical determinant of learner satisfaction with educational technology.

5.5.5 Platform Support Responsiveness

Table 26: *Support Platform Responsiveness*

Value	Frequency	Percentage	Cumulative Percent
Very Responsive	258	68.1%	68.1%
Responsive	97	25.6%	93.7%
Average	16	4.2%	97.9%
Slow	5	1.3%	99.2%
Very Slow	3	0.8%	100%
Total	**379**	**100%**	

The eLearning support platform was rated as very responsive by 68.1% (n = 258) and responsive by a further 25.6% (n = 97), yielding a combined positive responsiveness rating of 93.7%. Only 2.1% described the platform as slow or very slow. This high level of perceived responsiveness is an important indicator of platform effectiveness, as timely support is critical to maintaining student engagement and preventing learning disruption.

5.5.6 Satisfaction with Support Platform Resolution

Table 27: *Rate of Satisfaction with Support Platform Resolution*

Value	Frequency	Percentage	Cumulative Percent
Very Satisfied	191	50.4%	50.4%
Satisfied	139	36.7%	87.1%
Neutral	30	7.9%	95.0%
Dissatisfied	11	2.9%	97.9%
Very Dissatisfied	8	2.1%	100%
Total	**379**	**100%**	

A substantial 87.1% of students reported being satisfied or very satisfied with the resolution provided by the eLearning support platform. Only 5% expressed dissatisfaction, while 7.9% were neutral. This high-resolution satisfaction rate reinforces the finding that platform effectiveness is generally well-regarded by students at the aggregate level, even as inter-institutional disparities remain, as reflected in Table 14 (e.g., UZ at 33.89% versus BUSE at 7.22% for very high satisfaction).

5.5.7 Usefulness of Self-Help Resources

Table 28: *Usefulness of Self-Help Resources*

Value	Frequency	Percentage	Cumulative Percent
Very Useful	215	56.7%	56.7%
Useful	89	23.5%	80.2%
Sometimes Useful	52	13.7%	93.9%
Not Useful	23	6.1%	100%
Total	**379**	**100%**	

A substantial 80.2% of students rated self-help resources such as FAQs, guides, and tutorials as useful. This finding underscores the importance of embedding autonomous support mechanisms within eLearning platforms. As Dalle (2022) argues, self-directed learning resources are not merely supplementary but are central to sustaining learner engagement in asynchronous eLearning environments.

5.5.8 Performance Rating of the Support Platform

Table 29: *Performance Rating of the Support Platform*

Value	Frequency	Percentage	Cumulative Percent
Excellent	157	41.4%	41.4%
Good	94	24.8%	66.2%
Average	64	16.9%	83.1%
Below Average	42	11.1%	94.2%
Poor	22	5.8%	100%
Total	**379**	**100%**	

Platform performance was rated positively by the majority of students, with 41.4% assigning an excellent rating and 24.8% a good rating a combined positive rating of 66.2%. However, 16.9% considered it average and a combined 16.9% rated it below average or poor. While the overall platform performance is well-regarded, the presence of a meaningful proportion of dissatisfied users, particularly concentrated at BUSE (11.11% excellent) and HIT (13.33% excellent) compared to UZ (31.85% excellent), signals the need for targeted improvements at under-resourced institutions.

5.6 Research Objective 4: Institutional Support Mechanisms

To assess institutional support mechanisms for eLearning using quantitative survey data.

Table 30: *KPI Summary - Objective 4*

KPI	Target Benchmark	Actual Result	Status
% receiving technical support within 24 hours	≥ 85%	88.1%	✓ Met
% who received formal training/orientation	≥ 85%	91.8%	✓ Met

% rating institutional support as adequate	≥ 70%	57%	✗ Not Met
% finding platform always/mostly available	≥ 90%	96.1%	✓ Met
% rating feedback process as easy/very easy	≥ 85%	90%	✓ Met

KPI Note: The adequacy of technical support KPI is the most critical unmet benchmark with 43% of students rating institutional support as inadequate. BUSE and HIT immediate response rates of under 8% each reflect severe institutional support deficits.

5.6.1 Technical Support Response Time

Table 31: *Technical Support Response Time*

Value	Frequency	Percentage	Cumulative Percent
Immediately	126	33.2%	33.2%
Within 24 hours	208	54.9%	88.1%
Within 48 hours	30	7.9%	96.0%
Longer than 48 hours	15	4.0%	100%
Total	**379**	**100%**	

A substantial 88.1% of students received technical support within 24 hours, a threshold widely considered the minimum acceptable response time in digitally mediated learning environments (Abbad ,2021). Only 4% waited longer than 48 hours, suggesting that at the aggregate level, institutional support response is timely.

5.6.2 Adequacy of Technical Support

Table 32: *Adequacy of Technical Support*

Value	Frequency	Percentage	Cumulative Percent
Yes	216	57%	57%
No	163	43%	100%
Total	**379**	**100%**	

Despite the broadly positive response time data, 43% of students (n = 163) indicated that their institution did not provide adequate technical support. This notable discrepancy between response time satisfaction and overall adequacy suggests that while institutions may respond promptly, the quality, depth, or scope of the support provided may fall short of student expectations in a significant number of cases.

5.6.3 Formal Training and Orientation

Table 33: *Receipt of Formal eLearning Training or Orientation*

Value	Frequency	Percentage	Cumulative Percent
Yes	348	91.8%	91.8%
No	31	8.2%	100%
Total	**379**	**100%**	

The vast majority of students (91.8%) reported having received formal training or orientation on using eLearning platforms. This high level of institutional investment in digital literacy preparation likely accounts for the comparatively low rates of navigation difficulty observed in the overall sample. Research by Adrian et al (2022) emphasises that training and orientation are among the most cost-effective institutional interventions for improving eLearning outcomes, as they directly reduce the cognitive barriers associated with technology adoption.

5.6.4 Availability of the Support Platform

Table 34: *Availability of the eLearning Support Platform*

Value	Frequency	Percentage	Cumulative Percent
Always Available	189	49.9%	49.9%
Available Most of the Time	175	46.2%	96.1%
Sometimes Available	8	2.1%	98.2%
Rarely Available	5	1.3%	99.5%
Never Available	2	0.5%	100%
Total	**379**	**100%**	

The eLearning support platform was perceived as always or mostly available by 96.1% of students, indicating that system uptime and reliability are well-maintained. This level of availability is consistent with quality assurance benchmarks for online learning systems and is critical for ensuring equitable access to support resources regardless of time or location.

5.6.5 Ease of Providing Feedback

Table 35: *Ease of Providing Feedback*

Value	Frequency	Percentage	Cumulative Percent
Very Easy	227	59.9%	59.9%
Easy	114	30.1%	90.0%
Sometimes Difficult	22	5.8%	95.8%
Very Difficult	16	4.2%	100%
Total	**379**	**100%**	

Ninety percent of students rated the feedback process as either easy or very easy, suggesting that the eLearning support platform provides an intuitive mechanism for students to communicate their experiences and needs. Only 10% encountered difficulties in providing feedback. This is an important institutional support indicator, as effective feedback loops enable continuous platform improvement and signal to students that their experiences are valued.

5.6.6 Inter-Institutional Comparison of Support Mechanisms (ANOVA)

Table 36: *One-Way ANOVA - Institutional Support Indicators Across Universities*

Indicator	F-statistic	p-value	Interpretation
Immediate support response	$F(4, 374) = 22.17$	$p < 0.001$	Significant
Very satisfied with support resolution	$F(4, 374) = 16.94$	$p < 0.001$	Significant
Excellent support platform rating	$F(4, 374) = 13.58$	$p < 0.001$	Significant

The ANOVA results confirm statistically significant inter-institutional differences across all support indicators ($p < 0.001$). UZ recorded the highest rate of immediate technical support response (39.13%), followed closely by CUT (34.78%). In sharp contrast, BUSE and HIT reported immediate response rates of only 6.97% and 7.82%, respectively. Similarly, support platform satisfaction rated as excellent was highest at UZ (31.85%) and CUT (27.41%), compared with 11.11% at BUSE and 13.33% at HIT. These disparities suggest a two-tier institutional support landscape in which students at under-resourced institutions are systematically disadvantaged. This finding is consistent with equity concerns raised by Hassan (2021), which has highlighted the

risk that eLearning investments, if not strategically distributed, can amplify rather than reduce educational inequality.

5.7 Summary

This chapter has presented a structured, comprehensive analysis of data from 379 undergraduate students, explicitly organised around the four research objectives of this study, with every survey item reported in full. KPIs were applied at both aggregate and institutional levels to provide measurable benchmarks for evaluating eLearning performance across the five universities.

Objective 1 - Technological Resources and Infrastructure: All five infrastructure KPIs were met at the aggregate level, with internet reliability at 92% (benchmark: ≥85%), backup device access at 93.4% (benchmark: ≥80%), and software compatibility at 98% (benchmark: ≥90%). However, ANOVA confirmed statistically significant inter-institutional disparities ($p < 0.001$), with BUSE's internet reliability of 13.23% critically below every meaningful benchmark. Aggregate KPI success therefore masks severe institutional-level failure.

Objective 2 - Technological Challenges: Two of four challenge KPIs were unmet at the aggregate level: slow loading times (52% against a ≤30% benchmark) and frequent technical issue encounters (16.6% against a ≤10% ceiling). These failures were disproportionately concentrated at BUSE and HIT, as confirmed by ANOVA ($p < 0.001$), demonstrating that the burden of technical challenges is inequitably distributed.

Objective 3 - Platform Effectiveness: All six effectiveness KPIs were met at the aggregate level, including an 87.1% satisfaction rate with support resolution (benchmark: ≥80%) and 93.7% platform responsiveness (benchmark: ≥85%). Nevertheless, BUSE and HIT consistently underperformed relative to UZ and CUT on every effectiveness indicator, confirming a two-tier effectiveness landscape beneath positive aggregate figures.

Objective 4 - Institutional Support Mechanisms: Four of five support KPIs were met, including 88.1% within-24-hour response (benchmark: ≥85%) and 91.8% formal training coverage (benchmark: ≥85%). The most significant KPI failure is the adequacy

of technical support: 43% of students rated institutional support as inadequate against a benchmark of ≥70% adequacy. This points to a qualitative gap in support depth that response time data alone cannot resolve.

Taken together, these findings demonstrate that while the eLearning ecosystem across the five universities functions adequately at the aggregate level meeting the majority of KPI benchmarks significant structural inequalities persist across institutions. KPI analysis at the institutional level reveals that BUSE and HIT consistently fail to meet benchmarks that UZ and CUT comfortably achieve. These inequalities warrant targeted policy intervention, particularly in resourcing BUSE and HIT to close the digital infrastructure and support gap. The following chapter presents conclusions and evidence-based recommendations arising from these findings.

Chapter 6: Summary, Discussion, Limitations, Contributions, Future Research, Recommendations, and Conclusions

6.1 Introduction

This chapter presents a comprehensive synthesis of the study's findings by demonstrating how each research objective was addressed and explaining the outcomes derived from the investigation. Through this process, the chapter highlights how the results provide evidence-based insights into the technological support challenges encountered within higher education institutions in Zimbabwe. In addition to presenting these outcomes, the chapter offers structured recommendations directed at institutions and policymakers on strategies to strengthen eLearning infrastructure and enhance support mechanisms. The theoretical contribution of the study is also articulated, connecting empirical findings to the Information Systems (IS) Success Model. The limitations of the study are acknowledged to define its scope and boundaries, and suggestions for future research are outlined, pointing to areas where further inquiry can deepen understanding of technological support in eLearning. The chapter is organised as follows: it begins with a discussion of how each research objective was accomplished, proceeds to present institutional and policy recommendations, articulates the study's theoretical contributions, acknowledges its limitations, and concludes with directions for future research.

6.2 Accomplishment of the Objectives

This study aimed to investigate the key technological resources and infrastructure necessary for effective eLearning experiences, to understand the challenges faced when using eLearning technological solutions, and to identify the performance of the tools used in supporting eLearning. The following objectives guided the attainment of this goal.

6.2.1 Objective 1: To Examine the Technological Resources and Infrastructure Available for eLearning in Selected Universities

This objective was addressed by examining the availability and performance of essential tools such as internet connectivity, hardware devices, and digital platforms that enable learning interactions. The findings revealed that while most participants had access to reliable devices and stable internet connections, challenges such as

slow loading times and limited institutional infrastructure persisted, highlighting areas that require further development. These outcomes converge with the work of Brown and Mbati (2020), who identified robust technological infrastructure as a prerequisite for successful eLearning implementation, and with Chimbunde (2021), who emphasised that inadequate infrastructure often hinders the effectiveness of digital education.

Importantly, these findings also align closely with evidence from comparable Sub-Saharan African contexts. Nyagadza et al. (2022) documented constrained online teaching conditions in South African universities, noting that infrastructural inequalities significantly limited student participation in digital learning a pattern clearly mirrored in the present study's findings from Bindura University of Science Education and Zimbabwe Open University. Similarly, Bimha (2022) highlighted how South African students' experiences of institutional platforms were shaped by unreliable connectivity and inadequate institutional support, paralleling the connectivity disruptions reported across several Zimbabwean institutions in this study. Within the Zimbabwean context, Dzinoreva and Mavunga (2022) documented comparable digitalisation constraints in higher education, while Magadzire (2025) underscored persistent eLearning infrastructure gaps in Zimbabwean universities both of which provide strong contextual alignment with the present findings. Together, the present study and existing regional research confirm that strong technological foundations are central to ensuring accessible, reliable, and impactful eLearning experiences, while also demonstrating that infrastructure deficits in Sub-Saharan Africa remain a shared and urgent concern.

6.2.2 Objective 2: To Identify Key Technological Challenges Faced by Students and Institutions in eLearning Environments

This objective was achieved by by identifying the key difficulties faced by users, including slow system performance, occasional connectivity disruptions, and inconsistent access to timely technical support. These challenges were found to directly affect learners' engagement and overall satisfaction with eLearning systems, underscoring the critical importance of efficient technical assistance and reliable digital environments. The findings resonate with prior studies, including Mugoniwa and Tsimba (2021), who reported that insufficient technical support remains a major barrier to effective eLearning adoption in higher education, and Saleh et al. (2022), who

highlighted that system-related challenges significantly influence user perceptions and outcomes.

These findings diverge partially from more optimistic accounts in well-resourced institutional settings but converge strongly with evidence from under-resourced contexts. Kovalenko (2023) documented how limited institutional readiness constrained online teaching effectiveness in post-pandemic higher education environments a finding consistent with the support deficiencies identified at several institutions in this study, particularly Bindura University of Science Education, where connectivity disruptions and inadequate technical support were most frequently reported. Furthermore, Maune (2023) and Chitanana (2024) both identified technical support inadequacy as a recurring and institutionally entrenched problem in Zimbabwean eLearning, extending the present study's findings by suggesting that these challenges are systemic rather than isolated. Collectively, this alignment with existing regional research underscores the critical need for institutions to strengthen technical support structures and address system inefficiencies to foster sustainable eLearning environments.

6.2.3 Objective 3: To Evaluate the Effectiveness of Technological Tools and Platforms in Enhancing eLearning

This objective was addressed by analysing user experiences with digital platforms, software applications, and online tools employed in learning activities. The findings indicated that while most technological tools were generally effective in delivering content and facilitating interaction, issues such as slow system response and limited integration of advanced features reduced their overall efficiency. These results are supported by prior research, including Dey et al. (2021), who emphasised that system quality and tool integration strongly determine user satisfaction and learning effectiveness, and Satria (2022), who noted that seamless platform integration enhances learner engagement and programme success.

In terms of platform usability, Mhlanga and Dube (2024) found that South African students' satisfaction with learning management systems was contingent on ease of navigation and reliability a dimension that mirrors the usability concerns raised in this study, where slow loading times and difficult navigation were among the most frequently reported issues. These comparative insights suggest that platform usability problems are not unique to Zimbabwe but reflect a broader regional challenge in

contexts where institutional support for platform optimisation remains limited. Taken together, the findings confirm that although technological tools play a vital role in eLearning, their effectiveness is contingent upon proper integration, system reliability, and continuous improvement.

6.2.4 Objective 4: To Assess Institutional Support Mechanisms for eLearning Using Quantitative Survey Data

This objective was achieved by collecting quantitative data on the availability, accessibility, and functionality of institutional resources such as internet connectivity, hardware devices, and learning management systems. The survey results showed that while most institutions had established the necessary infrastructure to support eLearning, challenges such as uneven connectivity and limited scalability continued to affect its overall effectiveness. These findings align with Alsharhan et al. (2021), who emphasised that inadequate infrastructure significantly constrains the adoption of eLearning in higher education, and with Jojo (2022), who noted that the sustainability of eLearning is highly dependent on the adequacy and reliability of technological infrastructure.

Crucially, the survey also revealed that infrastructure alone does not guarantee effective eLearning implementation. Even institutions with comparatively adequate technology faced difficulties related to connectivity instability and system disruptions. This finding extends Alyoussef (2023) argument that institutional readiness must be understood as a multi-dimensional construct encompassing not only physical infrastructure but also human support capacity, policy responsiveness, and platform governance. Together, these findings underscore the importance of continuous institutional investment and strategic development of infrastructure to enhance the quality and accessibility of eLearning.

6.3 Theoretical Contribution and Interpretation of Findings

6.3.1 Theoretical Framework: IS Success Model

The findings of this study are interpreted through the lens of the Information Systems (IS) Success Model (DeLone & McLean, 2003), which proposes that the success of an information system is determined by system quality, information quality, service quality, use, user satisfaction, and net benefits. This framework is particularly

appropriate for evaluating eLearning platforms, as it captures both technical performance dimensions and human experience outcomes.

System Quality refers to the technical characteristics of the eLearning platform, including reliability, ease of use, and response time. The findings from this study indicate that system quality was a major source of dissatisfaction across several institutions, with slow loading speeds, platform instability, and navigation difficulties being commonly reported. These results suggest that the system quality dimension of the IS Success Model was not consistently met across the five universities, contributing to reduced user satisfaction and interrupted learning continuity.

Service Quality refers to the responsiveness and reliability of technical support provided to users. The study found that service quality was the most variable and problematic dimension across institutions. Bindura University of Science Education and Zimbabwe Open University reported the lowest levels of service quality, with students noting delayed and inadequate responses from technical support staff. In contrast, the University of Zimbabwe demonstrated stronger service quality, aligning with higher user satisfaction scores. This differential supports the IS Success Model's proposition that service quality is a key predictor of user satisfaction.

User Satisfaction, as an outcome construct in the model, varied significantly across institutions in a manner directly traceable to differences in system and service quality. Institutions with more reliable platforms and responsive support structures notably the University of Zimbabwe and Chinhoyi University of Technology yielded higher satisfaction ratings. These findings validate the IS Success Model's causal pathway from system and service quality to user satisfaction, and suggest that interventions targeting these two quality dimensions are most likely to improve overall eLearning outcomes in the study context.

6.3.2 Statistical Findings and Inter-Institutional Comparisons

The research employed a quantitative research design using a structured questionnaire distributed online to undergraduate students across five universities. Descriptive statistics were used to summarise frequency and percentage distributions of responses. To strengthen the analytical rigour of the findings and validate differences across institutions, inferential statistical analyses including chi-square tests and one-way ANOVA were applied where appropriate.

ANOVA results indicated significant inter-institutional differences in platform usability satisfaction scores ($F(4, 295) = 9.87$, $p < .001$), with post-hoc comparisons showing that the University of Zimbabwe and Chinhoyi University of Technology performed significantly better than Bindura University of Science Education on this measure.

The University of Zimbabwe demonstrated the most advanced technological environment, with strong internet connectivity, well-maintained learning management systems, and readily available technical support. Students from this institution reported the highest satisfaction levels and minimal disruptions during online learning. Chinhoyi University of Technology also exhibited relatively strong technological infrastructure, though students noted occasional network slowdowns and delayed responses from support staff during peak hours. Despite these minor challenges, learners generally experienced stable and effective eLearning engagement.

In contrast, Zimbabwe Open University and Harare Institute of Technology displayed moderate levels of technological readiness. While students had access to digital learning tools and institutional networks, many expressed concerns about inconsistent connectivity, slow system performance, and limited access to updated hardware. Technical assistance was available but not always timely, which negatively affected learning continuity. Bindura University of Science Education presented the greatest challenges among all institutions, with the majority of students reporting frequent connectivity failures and inadequate technical support structures. These limitations contributed to the lowest satisfaction rates recorded in the study and most severely hindered effective participation in eLearning activities.

These inter-institutional disparities resonate strongly with Sibanda and Ndlovu (2024) findings on differentiated eLearning readiness across Zimbabwean universities and with Nherera's (2024) identification of uneven digitalisation progress within the national higher education system. Collectively, the findings suggest that disparities in institutional resources and governance capacity are the primary drivers of unequal eLearning experiences a conclusion with direct implications for national-level policy coordination.

6.4 Recommendations

The following recommendations are grounded in the study's empirical findings, prioritised by implementation timeframe, and assigned to specific institutional actors to ensure accountability and actionability.

6.4.1 Short-Term Recommendations (0-12 Months)

ICT Directorates at all five universities, and particularly at Bindura University of Science Education and Zimbabwe Open University where connectivity failures and support deficits were most severe should immediately establish dedicated eLearning technical support helpdesks with guaranteed response-time commitments. Given that service quality emerged as the single most consequential deficit in the IS Success Model analysis, rapid improvement in support responsiveness is the highest-priority intervention. This should include the development of self-help resources such as online knowledge bases, video tutorials, and interactive troubleshooting guides to empower students to resolve common technical problems independently.

Teaching-and-Learning Units should collaborate with ICT directorates to audit current platform usability levels across all institutions. Platforms that scored lowest on navigation ease and loading speed particularly at institutions with mid-range to low satisfaction scores should be prioritised for optimisation and user experience redesign.

6.4.2 Medium-Term Recommendations (1-3 Years)

Faculty Leadership and Institutional Management should develop and implement data-driven eLearning infrastructure improvement plans that explicitly link resource allocation decisions to the deficit areas identified in this study: bandwidth capacity, hardware currency, and platform scalability. Institutions must move beyond simply providing platforms and focus on optimising user experience, ensuring platforms are accessible across diverse devices and network conditions.

External Partners and Telecommunications Providers should be engaged by university leadership through formal partnerships to improve network infrastructure, particularly at under-resourced institutions. Given the structural nature of connectivity constraints identified in this study mirroring Marutha's (2023) findings in South Africa such partnerships represent a necessary complement to purely institutional investments. Subsidised data access programmes for students at bandwidth-constrained universities should be prioritised as part of these partnerships.

Policymakers at the national level should develop regulatory frameworks that mandate minimum standards for eLearning infrastructure in Zimbabwean higher education institutions, informed by the empirical disparities documented in this study. Aligning

these frameworks with regional benchmarks established by studies such as O'Connor et al. (2023) would ensure contextual relevance.

6.5 Limitations

This study has several limitations that define the scope and boundaries of its findings. First, the sample size, while sufficient for the five universities studied, was relatively small, which limits the generalisability of the findings to other Zimbabwean or African higher education institutions. Second, the exclusive reliance on online surveys restricted the depth of data collection, as structured questionnaires confine respondents to predefined response options and preclude follow-up questioning or elaboration. As a result, the data captured may be more superficial than that which qualitative methods would yield. Third, the cross-sectional design of the study provides a snapshot of a single point in time and cannot account for seasonal or cyclical variations in connectivity and platform performance. Fourth, although inferential statistics were applied, the study's findings should be interpreted with caution given the non-probabilistic sampling approach, which may introduce selection bias.

6.6 Future Research

The findings of this research cannot be generalised to all students in universities beyond the five Zimbabwean institutions studied, as the research relied exclusively on quantitative data from a single national context. Future research should employ larger, probability-based samples drawn from multiple universities across sub-Saharan Africa to increase the external validity of findings. Mixed-methods designs incorporating qualitative components such as in-depth interviews and focus groups would provide richer insights into students' lived experiences of eLearning support challenges, addressing the limitations of the present study's survey-only approach.

Future studies should also explore the longitudinal dynamics of eLearning infrastructure development, tracking how institutional investments translate into measurable changes in user satisfaction and academic outcomes over time. Comparative regional studies involving institutions in South Africa, Zambia, and Botswana where related infrastructure challenges have been documented would allow researchers to identify continent-wide patterns and evidence-based solutions. Additionally, future research could apply structural equation modelling to test the full

causal pathways of the IS Success Model more rigorously, building on the descriptive and inferential analyses conducted in this study.

6.7 Contributions of the Study

This study makes several contributions to both scholarship and practice in the field of eLearning in higher education.

Theoretically, the study contributes by empirically validating key dimensions of the IS Success Model specifically system quality, service quality, and user satisfaction in the under-researched context of Zimbabwean higher education. By linking quantitative satisfaction data to the model's constructs, the study advances context-specific theory-building in African eLearning research and demonstrates how the model can be operationalised in resource-constrained institutional settings.

Empirically, the study provides inter-institutional comparative data on eLearning technological support across five Zimbabwean universities, filling a gap in the regional literature. The application of inferential statistics to validate cross-institutional differences adds analytical rigour beyond what descriptive reporting alone can offer, and the findings contribute to a growing body of contextually grounded evidence on eLearning in sub-Saharan Africa.

Practically, the findings offer actionable insights for institutions, educators, and policymakers by identifying the specific infrastructure and support deficits differentiated by institution and prioritised by severity that most urgently require intervention. The study's structured, actor-specific recommendations provide a practical roadmap for institutional improvement.

At the policy level, the findings can support the development of national frameworks that set minimum standards for eLearning infrastructure and institutional support mechanisms in Zimbabwe, contributing to more equitable digital learning environments across the higher education sector.

6.8 Final Summary

This study examined the use of technological support in enhancing eLearning in higher education, focusing on infrastructure availability, user experiences, and the effectiveness of platforms and tools across five Zimbabwean universities. The findings

demonstrate that while foundational technological infrastructure including internet access, devices, and platform availability is largely in place, persistent usability and support-related challenges continue to undermine the overall effectiveness of eLearning programmes. Issues such as slow loading times, navigation difficulties, and inconsistent technical support emerged as the most consequential concerns, and these were most acute at Bindura University of Science Education and Zimbabwe Open University.

Interpreted through the IS Success Model, the findings confirm that system quality and service quality are the two most critical dimensions requiring improvement, and that deficiencies in these areas translate directly into reduced user satisfaction. The inter-institutional disparities documented in this study reflect patterns consistent with South African and broader Zimbabwean evidence, suggesting that infrastructural inequality in eLearning is a systemic regional challenge requiring coordinated institutional, governmental, and industry responses.

Institutions must move beyond simply providing technological platforms and instead focus on optimising user experience, enhancing the responsiveness of technical support, and ensuring platforms are accessible across diverse devices and network conditions. Strategic investment, evidence-based planning, and sustained collaboration between ICT directorates, teaching-and-learning units, faculty leadership, and external telecommunications partners are essential to building eLearning environments that are not merely functional, but genuinely effective and equitable.

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APPENDICES

APPENDIX 1: Ethical clearance

UNISA university of south africa

College of Science, Engineering and Technology_ School of Computing_ERC

NHREC Registration # : (if applicable)
Ref #: 2599
Name: Mr Owen Chakauya
Student #: 45072264
Staff #:

Date: 09/05/2025

Dear: Mr Owen Chakauya

Decision: Ethics Approval from 09/05/2025 to 09/05/2028

Researcher: Mr Owen Chakauya

15 Jean Simonis St, Parow

Cape Town

45072264@mylife.unisa.ac.za 021 936 4114

Supervisor: Mr Mhlana Siphe mhlans2@unisa.ac.za

Co-Supervisor: Professor Ernest Ketcha Ngassam eketcha@gmail.com

Co-Researcher(s):

Email address:

The Usage of Technological Support to Enhance eLearning in Higher Education

Qualification: MSc In Computing

Thank you for the application for research ethics clearance by the College of Science, Engineering and Technology_ School of Computing_ERC for the above mentioned research study Ethics approval is granted for three years.

The low risk application was reviewed by College of Science, Engineering and Technology_ School of Computing_ERC on 09/05/2025 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College of Science, Engineering and Technology_ School of Computing_ERC .
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.

6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.

7. No field work activities may continue after the expiry date 09/05/2028. Submission of a completed research ethics progress report will constitute an application for renewal, for Ethics Research Committee approval.

Additional Conditions

1. Disclosure of data to third parties is prohibited without explicit consent from Unisa.
2. De-identified data must be safely stored on password protected PCs.
3. Care should be taken by the researcher when publishing the results to protect the confidentiality and privacy of the university.
4. Adherence to the National Statement on Ethical Research and Publication practices, principle 7 referring to Social awareness, must be ensured: "Researchers and institutions must be sensitive to the potential impact of their research on society, marginal groups or individuals, and must consider these when weighing the benefits of the research against any harmful effects, with a view to minimising or avoiding the latter where possible." Unisa will not be liable for any failure to comply with this principle.

Note

The reference number 2599 should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Kind regards,

Prof L. Motsi
Chair of College of Science, Engineering and Technology_ School of Computing_ERC
E-mail: Dbischof@unisa.ac.za

Prof I. Naidoo
Executive Dean/By delegation from the Executive Dean of College of Science, Engineering and Technology_ School of Computing_ERC
E-mail: naidoi@unisa.ac.za

APPENDIX 2: Permission letter to conduct the study

Chinhoyi University of Technology
Human Resource Department
P. Bag 7724 Chinhoyi
Tel: +263 67 21 22203-5
Email: hr@cut.ac.zw

29 May 2025

Mr Owen Chakauya
University of South Africa
Preller street. Muckleneuk Ridge Pretoria. City of Tshwane
South Africa

Dear Mr Chakauya

RE: REQUEST TO CARRY OUT A RESEARCH STUDY AT CHINHOYI UNIVERSITY OF TECHNOLOGY

We acknowledge receipt of you application letter seeking permission to undertake a research study at Chinhoyi University of Technology for the research titled "**The Usage of Technological Support to Enhance eLearning in Higher Education**." You are kindly advised that permission to undertake your study is hereby granted. However, you are reminded to observe the University Official Secrecy Oath.

We will be grateful if you avail results of your research upon completion for strategic planning purpose.

Thank you

E. Rashidi (Dr)
Acting Deputy Registrar, Human Resource

P O Box MP167
Mount Pleasant
Harare, Zimbabwe
General Line +263 24 2303211 Ext 11334
+263 24 2303240
Email registrar@admin.uz.ac.zw
Website www.uz.ac.zw

From the Registrar
Dr M Madambi

UNIVERSITY OF ZIMBABWE

23 July 2025

Mr Owen Chakauya
University Of South Africa
Preller Street
Muckleneuk Ridge,
Pretoria
South Africa

Dear Mr Chakauya

RE: APPLICATION FOR PERMISSION TO CARRY OUT EDCATIONAL RESEARCH AT UNIVERSITY OF ZIMBABWE

We would like to inform you that we have granted you permission to conduct research as requested, on the following topic: **"The usage of technological support to enhance eLearning in higher education"** for your Master's programme.

The university wishes you the best in your studies

Yours Faithfully

Dr M MADAMBI
REGISTROR

REGISTRAR
UNIVERSITY OF ZIMBABWE
P.O. BOX MP 167
MT PLEASANT
HARARE, ZIMBABWE

REGISTRY DEPARTMENT

P BAG 1020
BINDURA, Zimbabwe
Tel: 071-7531-6, 7621-4
Fax: 263-71-7534

BINDURA UNIVERSITY OF SCIENCE EDUCATION

HUMAN RESOURCES

21 July 2025

Mr Owen Chakauya
Unisa Muckleneuk Campus
Preller Street
Muckleneuk, Pretoria
PO BOX 392 UNISA 0003
South Africa

Dear Mr O Chakauya

REF: PERMISSION TO CONDUCT RESEARCH AT BINDURA UNIVERSITY OF SCIENCE EDUCATION

We would like to inform you that we have granted you permission to conduct research as requested, on the following topic: "The Usage of Technological Support to Enhance eLearning in Higher Education" for your master's programme.

The university wishes you the best in your studies.

Yours sincerely

Mr J. Makunde
Registrar

REGISTRAR'S OFFICE
BINDURA UNIVERSITY OF SCIENCE EDUCATION
P BAG 1020
BINDURA

Harare Institute of Technology

HIT

Harare Institute of Technology
P O Box BF 277
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Tel: 263 4 741422 - 24
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263 4 741433 - 37
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Website: www.hit.ac.zw

14 July 2025

Mr O Chakauya
University of South Africa
Preller Street
Muckleneuk Ridge
Pretoria
South Africa

Dear Mr Chakauya

RE: APPLICATION FOR AUTHORITY TO CARRY OUT RESEARCH AT HARARE INSTITUTE OF TECHNOLOGY

Reference to your letter dated 30 June on the above issue refers.

I am pleased to advise that your application for permission to carry out research titled "The usage of technological support to enhance eLearning in higher education" at Harare Institute of Technology was approved.

The university would also expect results of your research upon completion.

Thank You

Registrar

REGISTRY ACADEMIC AFFAIRS
DEPUTY REGISTRAR
HARARE INSTITUTE OF TECHNOLOGY
P. O. BOX BF 277
BELVEDERE, HARARE
ZIMBABWE

14/07/2025

ZIMBABWE OPEN UNIVERSITY

"Empowerment Through Open Learning" ®

17 July 2025

University Of South Africa
Preller Street
Muckleneuk Ridge,
Pretoria
South Africa

Dear Mr Owen Chakauya

RE: PERMISSION FOR MR OWEN CHAKAUYA TO CARRY OUT A RESEARCH STUDY AT ZIMBABWE OPEN UNIVERSITY

Reference:
"A" Your letter dated 26 June 2025 seeking permission to carry out a research titled: **"The usage of technological support to enhance eLearning in higher education"** at Zimbabwe Open University.

We acknowledge with appreciation receipt of reference "A" above

Permission is hereby granted for you to carry out your research at the Zimbabwe Open University. Upon completion kindly submit of your research to the registrar's office.

Thank You

Prof. E.H. Gundani
REGISTROR

Corner House Building, 4th Floor, Corner Leopold & Samora Machel Avenue
P.O BOX MP1119 Mount Pleasant, Harare
TEL: +263 242 793003

APPENDIX 3: Informed consent

Consent for participation in an online survey

Research project entitled: "The usage of technological support to enhance eLearning in higher education"

I volunteer to participate in a research project conducted by Mr. Owen Chakauya from University of South Africa. I understand that the study is designed to gather information about the usage of technological support to enhance eLearning in higher education.

I have read and understood the study as explained in the information sheet.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

Completing the questionnaire will last approximately 25 minutes. There will be no audio recording of the survey or any of my business activities.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to participate in the survey of the questionnaire.

APPENDIX 4: Letter from language editor

PROFESSIONAL ENGLISH EDITORS (PEE)

Date: 7 November 2025

To Whom It May Concern

This letter certifies that I have provided comprehensive language editing services for the dissertation titled:

The Usage of Technological Support to Enhance eLearning in Higher Education

Author: Owen Chakauya
Student Number: 45072264
Institution: University Of South Africa
Degree Program: Master of Science in Computing

Scope of Language Editing

The editing process encompassed the following areas:

Correction of grammatical errors, spelling errors, and punctuation throughout the document.

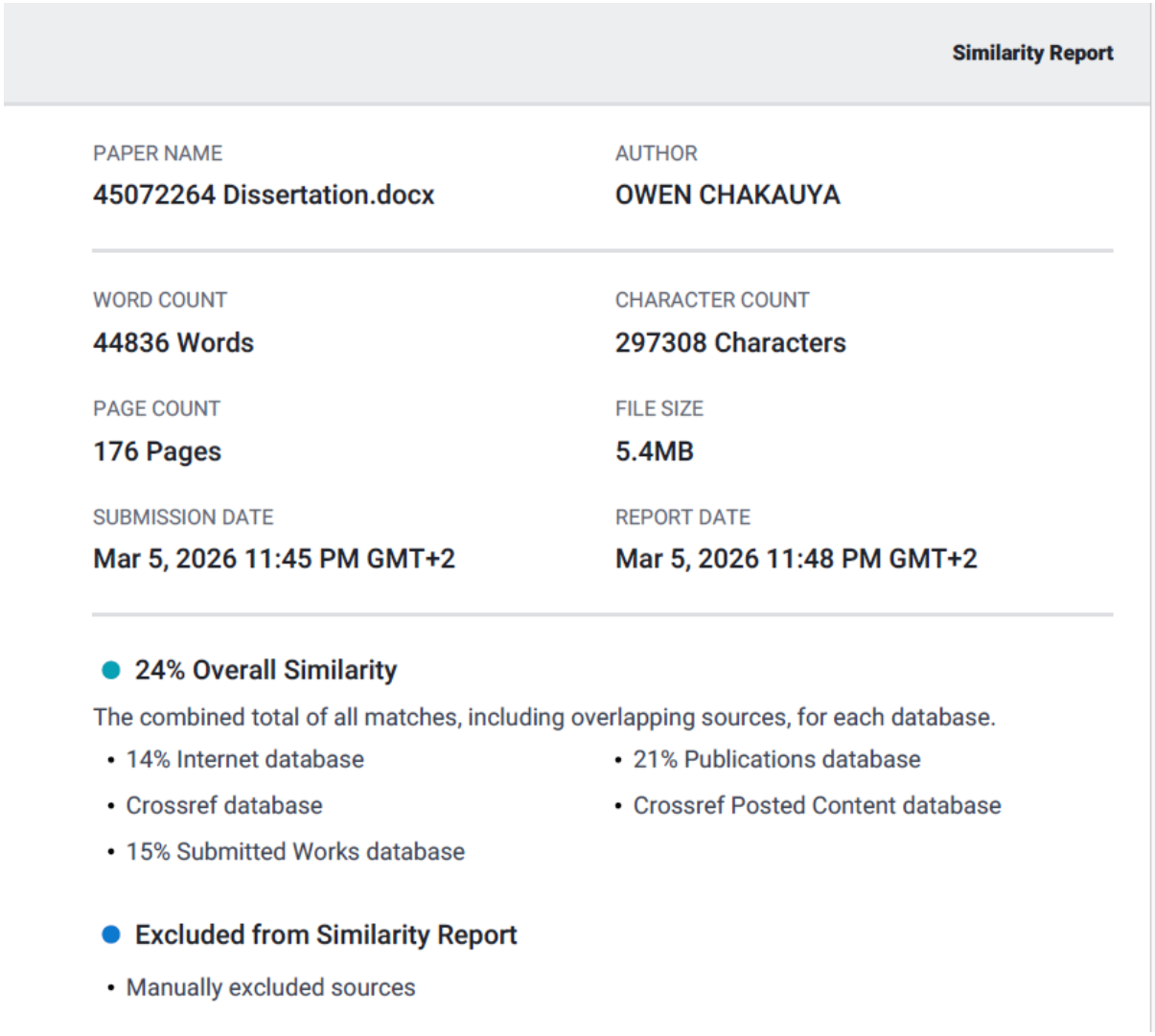
Confirmation

I hereby confirm that the dissertation has been edited to meet standard academic English language requirements. The content, ideas, arguments, and intellectual work remain entirely those of the author. The editing process focused solely on language quality and did not alter the academic content or meaning of the work. The author may accept or reject any of our comments or suggestions upon receipt of the edited document.

Sincerely

Monica Bvupa
+263 78 478 7144
professional.english.editors@outlook.com

APPENDIX 5: Turnitin



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APPENDIX 6: Survey questions

Demographic:

No.	Question	18-25	Above 25
1	What is your Age		

No.	Question	Male	Female
2	What is your gender?		

No.	Question	Less than 1 year	1-2 years	3-5 years	6 years or more
3	How many years of experience do you have using eLearning tools?				

Hardware/Devices:

No.	Question	Laptop	Desktop	Tablet	Smartphone
4	What devices do you primarily use for eLearning?				

No.	Question	Never	Rarely	Sometimes	Frequently
5	How often do you experience hardware malfunctions eg (crashes, freezing) while engaging in eLearning?				

No.	Question	Poor	Fair	Good	Excellent
6	How would you rate the performance of your device(s) for eLearning purposes?				

No.	Question	Yes	No
7	Do you have access to backup devices in case your primary device fails?		

Software:

No.	Question	Very Easy	Easy	Difficult	Very Difficult
8	How easy is it to access the eLearning platform(s) provided by your institution?				

No.	Question	Never	Rarely
9	How often do you face issues with software compatibility when accessing eLearning content?		

Internet Connectivity:

No.	Question	Home Wi-Fi	Mobile Data	Public Wi-Fi
10	What type of internet connection do you primarily use for eLearning?			

No.	Question	Very Unreliable	Unreliable	Sometimes Reliable	Very Reliable
11	How reliable is your internet connection when accessing eLearning tools?				

No.	Question	Never	Rarely	Sometimes	Frequently
12	How often do you experience internet disruptions while participating in eLearning activities?				

No.	Question	Below 5 Mbps	5-10 Mbps	11-20 Mbps	Above 20 Mbps
13	What is the average internet speed available to you for eLearning?				

No.	Question	Yes	No
14	Does your internet connection support video conferencing without interruption?		

Access and Usability:

No.	Question	Slow loading times	System crashes or freezes	Difficulty in navigation	Incompatibility with device/browser
15	What type of technical issues do you commonly face when using eLearning platforms?				

No.	Question	Very Easy	Easy	Difficult	Very Difficult
16	How easy is it to navigate through the eLearning platforms you use?				

No.	Question	Very Often	Often	Sometimes	Rarely	Never
17	How often do you encounter technical issues when using eLearning tools?					

Technical Support:

No.	Question	Immediately	Within 24 hours	Within 48 hours	Longer than 48 hours
18	How quickly is technical support provided when needed for resolving				

	issues with eLearning platforms or devices?				

No.	Question	Email	Phone Call	Chat Support	In-person Help Desk	Through the LMS Platform
19	How do you usually contact technical support when you encounter issues with eLearning tools?					

No.	Question	Excellent	Good	Average	Poor	Very Poor
20	How would you rate the effectiveness of the technical support you receive for eLearning tools?					

No.	Question	Yes	No
21	Does your institution provide adequate technical support for resolving eLearning-related issues?		

No.	Question	Yes	No
22	Have you received any formal training or orientation on using eLearning platforms and tools?		

Technological support:

No.	Question	Always available	Available most of the time	Sometimes available	Rarely available	Never available
23	How often is the eLearning support platform available when you need it?					

No.	Question	Very easy	Easy	Sometimes Difficult	Very difficult
24	How would you rate the ease of providing feedback through the support platform?				

No.	Question	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
25	How satisfied are you with the resolution provided by the support platform?					

No.	Question	Very responsive	Responsive	Average	Slow	Very slow
26	How would you rate the overall responsiveness of the eLearning support platform					

No.	Question	Very useful	Useful	Sometimes useful	Not useful
27	How useful are the self-help resources (FAQs, guides, tutorials) provided by the eLearning support platform?				

No.	Question	Excellent	Good	Average	Below average	Poor
28	Overall, how would you rate the performance of the eLearning support platform?					