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Constraints to effective use of learning technology among commerce students at a historically disadvantaged rural university in South Africa

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Abstract: Technology is vital in education, but students often struggle to use learning tools effectively. This study aimed to identify the constraints on the effective use of learning technology by commerce students at a rural South African university and propose practical solutions to these challenges. The study was grounded in the extended Technological Acceptance Model (eTAM) and employed a quantitative approach utilizing a descriptive research design. Data were collected through a self-administered questionnaire and analyzed using descriptive statistics with critical analysis techniques. The analysis of the student survey revealed significant constraints affecting the success of commerce students, including economic limitations, outdated resources, inadequate technical infrastructure, and a pressing need for frameworks that promote innovative and inclusive learning environments. Based on the findings, institutions should prioritize advanced strategies that foster inclusion and accessibility, such as offering lower costs for learning materials, ensuring reliable internet access, providing technical support, and implementing continuous improvements. These measures will help facilitate equitable access to technology, enhance learning opportunities, and improve student experiences, ultimately leading to better academic performance.

Keywords: *Education, Learning technology, Rural settings, Technology constraints.*

1. Introduction

Education is one of the most significant sectors benefiting from advancements in information and communication technologies (ICTs) [1]. To enhance the learning experience, promote educational equity, and expand access to educational opportunities, higher education institutions are leveraging online technologies to improve students' learning experiences, foster educational equity, and increase access to educational opportunities [2]. Many institutions facilitate this change by providing digital equipment, improving internet access, and offering training to boost computer literacy among educators and students [3]. However, integrating new educational technologies presents challenges for students and educators, who encounter issues such as inadequate infrastructure or the need for necessary adjustments to the curriculum [4]. In the commerce sector, student development heavily relies on learning technology [5]. The educational system is being transformed by Information and Communication Technologies (ICTs), as noted in studies by Sayaf et al. [6] and Sayaf [7].

The utilization of learning technology in higher education has undergone a significant transformation in South Africa since the COVID-19 pandemic [8]. The 2020 pandemic greatly accelerated the use of online learning platforms, such as Zoom and Microsoft Teams, changing how universities deliver instruction [9]. By 2021, institutions began to embrace hybrid models, integrating face-to-face and distance learning to provide greater flexibility, access, and improved engagement and learning outcomes when well planned [10]. In 2022, studies focused on implementing adaptive learning systems that adjust learning content based on student performance. AI-driven systems were found to be effective in enhancing learner satisfaction and academic performance [11, 12]. In 2023, AI programs

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like ChatGPT began to play a central role in assisting with academic writing and tutoring, although this raised challenges regarding ethical use and academic integrity [13]. By 2024, learning analytics will become essential for tracking student engagement and identifying at-risk learners in real time. A systematic review indicated that most learning analytics methods rely on observable learning behaviors, such as time-on-task and access counts, to support data-driven interventions [14]. Educational organizations stressed the need for greater digital literacy among teachers and students to harness technology's potential, considering it a foundational competency in a digitally disrupted higher education landscape [15]. In 2025, virtual and augmented realities will be widely applied to simulate complex environments in fields like engineering and immersive technologies in medicine. For instance, Indian schools began introducing AR/VR labs to create engaging, real-life simulations that promote experiential learning [16]. These innovations illustrate how technology, used thoughtfully, enhances both teaching efficiency and the learning experience of students in higher education. Historically disadvantaged institutions (HDIs) in South Africa are committed to leveraging technology for transformation and providing support services to educators [17]. While students can benefit from pursuing higher education qualifications, those attending HDIs still face challenges in utilizing learning technology due to various factors, highlighting the need to identify barriers and develop strategies for successful implementation. At the selected institution, the Directorate of Learning and Teaching (DLT) is dedicated to promoting technology-based learning and teaching while fostering innovation and creativity. Despite the benefits, integrating learning technology continues to be a challenge. Therefore, this study aims to explore the specific constraints that commerce students in a historically disadvantaged institution in South Africa encounter when using digital platforms for learning, and it suggests possible solutions. The study seeks to provide researchers, educators, and administrators with insights into how to promote the effective integration of learning technologies for student achievement.

2. Background of the Selected HEI

The selected HEI is an HDI located in one of South Africa's most rural provinces, with most of its students hailing from remote areas. Unfortunately, that is where ICT infrastructure is often limited or non-existent [18]. Additionally, most students lack access to ICT devices [19], data for connectivity, and stable internet connections [20], resources necessary for the effective use of LMS. Furthermore, most students are introduced to online learning platforms only when they join institutions of higher learning [20]. The selected HEI is a technology-infused institution that adopted blended learning as its primary instructional method. It implemented an LMS (Blackboard) to support blended learning in 2009. Blackboard was later replaced by Moodle during the COVID-19 period to facilitate the increased usage required. To support virtual classes needed during the remote learning phase, the institution integrated MS Teams to complement Moodle. This arrangement has continued to the present day, with Moodle and MS Teams officially adopted as the two LMSs used at this institution. Like any other internet-based learning platform, the effectiveness of these LMSs depends on a stable internet connection, compatible ICT devices, and sufficient data for connectivity. These factors have often been reported as challenges in HDIs, particularly in rural areas [21].

3. Problem Statement

Students and educators at the selected historically disadvantaged institution can collaborate on WiSeUp (Moodle), a learning management system that provides flexibility, personalized learning, and increased engagement [22]. Despite efforts to incorporate technology into teaching and learning, the issue remains complex, particularly in historically underprivileged universities in South Africa. Sun et al. [23] identified several barriers to successful implementation, including a lack of technical expertise, financial constraints, and difficulty in connecting with peers. The DLT for the selected institution utilizes IT to automate information management, foster self-directed learning, and motivate both educators and students; however, unequal access to these services presents an academic challenge. Thus, this study aims to examine the constraints that commerce students face when utilizing learning

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technology at a historically disadvantaged institution in South Africa and suggest solutions. By examining these issues, this study offers valuable insights for educators, administrators, and technology researchers, benefiting both present and future stakeholders.

ICTs are widely recognized for their benefits in higher education contexts [18, 21, 24-26]. However, despite the reported advantages, systemic constraints hinder equitable access to and usage of technology, particularly in historically disadvantaged institutions [24, 27]. The efforts of the DLT in the selected HDI to enhance equitable technology access have not been entirely effective. Therefore, it is necessary to examine the challenges faced by commerce students in adopting and utilizing learning technology, especially in resource-constrained rural HDIs. Identifying these challenges and providing context-specific recommendations is essential for improving technology integration, which will lead to increased inclusive access to technology and better student experiences.

3.1. Aim

This study aims to assess the constraints encountered by commerce students when using learning technology and to identify potential solutions to address these constraints.

3.2. Research Objectives:

To identify and explain the challenges encountered by commerce students when using learning technology and to identify potential solutions to address these challenges.

3.3. Research Question

What constraints do commerce students face when using learning technology, and how can the impact of these constraints be minimized?

4. Reviews of Literature

4.1. Understanding of Learning Technology in Higher Education in South Africa

Advancements in learning technologies in South African higher education from 2022 to 2024 were driven by global teaching methodologies, as well as the revolution of 4IR technologies. At the same time, COVID-19 was an unprecedented disruptive event that highlighted systemic disparities and accelerated the transition to blended learning models [28]. During the pandemic, educational institutions were also required to reassess their technological infrastructure and pedagogical approaches in light of ongoing challenges and emerging opportunities within the digital education ecosystem [28]. The systemic shock caused by the pandemic resulted in a reevaluation of educational processes, which meant that transforming the education system into a digital one was no longer a target to be achieved but rather a necessity to manage the crisis. It became mandatory for HEIs to adopt LMSs, video conferencing, and mobile applications for teaching and learning purposes [29, 30]. Though beneficial, the tools created to address these challenges were driven by a crisis mindset, leading many institutions to bypass proper change management systems due to existing pedagogical gaps and routines.

The most enduring issue is the digital divide, marked by unequal access to hardware, internet connectivity, and digital literacy. Rural and low socio-economic students are disproportionately hindered by access to online learning resources [31, 32]. High mobile data charges, power outages, and a lack of digital literacy impede effective engagement with learning technology, putting student-at-risk populations at further risk of marginalization [33]. These differences extend beyond students to the institutions themselves. While some universities were able to transition online swiftly, others struggled because their IT infrastructure required upgrades, and they did not have sufficient funds [18, 34]. The variability in quality and preparedness among institutions highlights the need for national policy and centralized digital transformation programs in the higher education sector [35].

Instructors also face enormous challenges during a successful online transition. Some educators, particularly those accustomed to traditional face-to-face learning, lack digital pedagogy competency [36]. The rapid need for effective online teaching has created a skills gap, leading universities to

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implement emergency professional development programs [37]. Professional development included digital literacy, immersing students in virtual spaces, and enhancing the course curriculum with e-learning platforms. Students, however, reported issues with time management, low motivation, and ineffective study environments at home [18, 38]. These conditions heightened academic stress and negatively impacted learning outcomes [39]. In response, government and institutional stakeholders launched a series of interventions aimed at improving digital access and capacity [40]. The Department of Higher Education and Training (DHET) provided support for partnerships with telecommunication operators to subsidize mobile data and encouraged the adoption of zero-rated learning sites by universities [41]. Nevertheless, concerns still arose regarding the scalability and sustainability of these interventions [42].

There has been a growing focus on emerging technologies such as artificial intelligence (AI), machine learning, and learning analytics to improve the provision of education. AI-powered tools have been implemented at some universities for personalized learning paths, automated grading, and academic counseling [43]. However, these technologies also present challenges regarding data privacy, algorithmic bias, and fairness. Despite this, some critics argue that digital transformation initiatives remain inconsistent. A more unified approach is necessary, one that integrates investment in infrastructure and capacity building for institutions, inclusive policymaking, and true student involvement [44]. Technology alone cannot address structural inequities unless it is part of a broader commitment to educational justice. South African higher education must shift from crisis remote teaching toward sustainable, future-proof digital ecosystems. Blended learning designs, supported by solid pedagogy and adequate support systems, promise a brighter future. Planning, funding, and cross-sector collaboration will be essential in creating an education system that is prepared for the future [20].

In summary, there are both possibilities and constraints regarding educational technology in South African higher education. Although significant progress has been made, challenges such as digital inequality, a lack of skills, and restricted access continue to hinder inclusive transformation. Therefore, the importance of this study to ensure a strategic, inclusive, and student-centered approach is vital in guaranteeing that technological advancements lead to educational empowerment rather than exclusion.

4.2. Benefits of Learning Technology in He

Technology in education enhances learning by facilitating interaction, collaboration, and knowledge sharing [45, 46]. It promotes accessibility and inclusivity by providing equal access to educational resources for all students, regardless of their location or ability [47]. Educational technologies have significantly impacted learning in higher education [8], helping to increase learner interest and performance [48]. Among the primary outcomes of learning technology is heightened student engagement. Simulations, virtual field trips, and game-based learning environments [49] can potentially make learning more engaging. These materials provide multiple modes of learning, addressing the various needs and levels of interest and motivation. This aligns with Kim et al. [50], who claimed that technology increases student engagement through interactive tools and multimedia resources, making learning more fun and effective.

Learning technology broadens access to educational resources, providing students with opportunities related to distance learning and physical disabilities [51]. E-textbooks, internet libraries, and open educational resources (OER) create equal learning opportunities and make knowledge more attainable. Technology also offers flexibility in terms of time and space, enabling students to learn at their own pace and convenience, according to Broadbent et al. [52]. Moreover, integrating learning technology with social media platforms improves access to education and enriches student learning experiences. Platforms like WhatsApp have increased learning engagement, enhancing the overall learning experience [18, 26].

Technology enables personalized learning experiences tailored to individual students' needs and abilities [53], commonly referred to as adaptive learning systems. These systems assist educators in

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tracking student progress and allow for customization of content and pace, facilitating individual advancement [54]. AI-powered tools provide tailored feedback and guidance, allowing students to progress at their own pace and concentrate on areas needing improvement. This personalized approach bolsters student comprehension and confidence.

Using technology enhances collaboration in virtual classrooms, online discussion forums, and collaborative document editing [55]. It enables students to engage with each other, exchange ideas, and work together on projects, developing communication and teamwork skills. These technologies foster a sense of belonging and provide cooperative learning opportunities. Technology also streamlines assessment methods through web-based tests, computer-marked questions, and data analysis [56]. Educators can quickly and effectively assess learner knowledge and offer feedback, facilitating data-driven instructional improvements. Evidence shows a positive correlation between the use of learning technologies and enhanced student performance. Technologically enriched learning environments have been found to improve information retention, critical thinking skills, and problem-solving abilities [57].

4.3. Constraints to the Successful Use of Learning Technology in Rural HDIS

Most rural Historically Disadvantaged Institutions (HDIs) are situated in areas with inadequate ICT infrastructure. The high costs associated with investing in ICT infrastructure, along with the limited profitability of operating in sparsely populated rural regions, deter private sector investment in these technologies. Consequently, business organizations frequently bypass rural markets, leaving the government solely responsible for infrastructure development [29]. However, due to scarce resources and competing priorities, government support often falls short, leading to digital exclusion.

This lack of or poorly maintained ICT infrastructure directly affects internet connectivity, which is a prerequisite for learning technology. Consequently, rural HDIs struggle to implement and benefit from digital teaching and learning platforms effectively [58]. Infrastructural challenges, including unreliable electricity supply and the absence of broadband coverage, continue to marginalize learners in underdeveloped and rural areas [58, 59]. Frequent power outages and delayed repairs, particularly due to theft, vandalism, and logistical access issues, are exacerbated in historically disadvantaged institutions [59].

Another key barrier is the lack of access to digital devices for both students and educators. Unlike their counterparts at Historically Black Institutions (HBIs), many Historically Disadvantaged Institutions (HDIs) cannot provide adequate ICT resources, such as laptops, tablets, and smart classrooms. The limited resources result in outdated or inefficient ICT infrastructure and a shortage of qualified staff capable of effectively integrating learning technologies into their teaching practices [58, 60].

The disparity between urban HAIs and rural HDIs is further exacerbated by differences in funding models and income sources. While HAIs benefit from diversified revenue streams, such as alumni donations and robust research grants, HDIs rely heavily on government funding. The underfunding of HDIs stems from systemic policies and structural inequalities, which arise from historical social and economic injustices. The insufficient funding hinders the ability to upgrade infrastructure or implement comprehensive digital solutions [18].

Moreover, the lack of adequate digital support systems exacerbates these challenges. Many rural HDIs suffer from a shortage of staff with the technical expertise necessary to maintain and troubleshoot ICT systems, making it challenging to sustain e-learning environments. Inadequate technical support, overwhelming workloads for lecturers, and insufficient time for lecturers to teach students how to use technology are identified as obstacles to effective learning technology utilization [61, 62]. Essentially, the digital divide in rural HDIs is not simply about access to technology; it reflects systemic inequalities in infrastructure, economic capacity, and institutional readiness.

Most students pursuing higher education qualifications in HDIs come from families with low socio-economic status and primarily depend on NSFAS for funding. Unfunded students struggle to afford personal digital devices and the necessary data for connectivity. This challenge is exacerbated by the

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high costs of purchasing and maintaining devices and internet plans [58]. In addition to lacking access to ICT gadgets, students from low SES also experience limited exposure to ICTs in their home environments and insufficient fluency in the English language, which undermines their confidence and self-efficacy [63]. These challenges hinder students from low-income backgrounds from fully participating in digital learning.

4.4. Theoretical Framework

The use of learning technology is now a critical component of higher education, particularly in rural areas where the availability of learning facilities may be limited [64]. However, the effective use of learning technology among students in rural areas is marked by several challenges, including limited access to digital devices, internet connectivity, and digital competence skills [65]. This study employs the extended Technological Acceptance Model (TAM), which is an enhancement of the original Technology Acceptance Model (TAM). The TAM, developed by Davis [66], is a widely used theory to explain how individuals form attitudes and intentions toward using technology. Two key determinants for adopting technology, according to the model, are perceived ease of use (PEOU) and perceived usefulness (PU). PEOU refers to the extent to which users believe that using the technology will require minimal effort, while PU is the degree to which users believe that using the technology will enhance their performance. TAM posits that PEOU directly influences PU, while both PEOU and PU affect users' intention to use a technology, ultimately leading to actual usage [66]. Facilitating conditions were incorporated to extend the TAM. This factor, adopted from the Unified Theory of Acceptance and Use of Technology (UTAUT), by Venkatesh et al. [67], was not directly addressed in the original TAM. The purpose of including it was to capture the diverse nature of students in higher education institutions who lack resources as well as technical support in their learning.

Overall, the constructs of the eTAM explain the challenges students face when learning with technology. The PEOU highlights difficulties in handling and manipulating technology, while PU is influenced by access to technology and support. Facilitating conditions address issues related to the cost of technology, assistance, and access to ICTs. The application of the eTAM in this study provides a comprehensive perspective for addressing the problems university students encounter while learning with technology in rural settings. By identifying PEOU, PU, and facilitating conditions as key determinants, the eTAM model helps understand technology adoption, identify areas needing improvement, and guide strategies toward effective technology use in learning. Ultimately, the eTAM model presents future alternatives to overcome barriers such as digital access and literacy constraints, enhancing learning performance by improving access to resources, highlighting benefits, providing training, and offering support.

5. Research Methodology

The study evaluated the challenges faced by students enrolled in the commerce faculty of the selected rural HDI and proposed potential practical solutions to the identified issues. The following sections detail the methods employed in the study.

5.1. Research Paradigm and Reasoning

A positivist research paradigm was adopted. Positivism is a philosophical stance of the natural scientist, who is separate from the observed elements. It involves working with an observable social reality to produce law-like generalizations [68]. This paradigm was deemed appropriate as it aligns with the quantitative research methods of analysis and deductive reasoning [68], which applies to this study. Positivism, as previously indicated, often employs reduction as an approach for research inference. Deduction is a form of inference in which the conclusion must follow from the reasons provided [69].

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5.2. Research Design

This study was quantitative in nature, following a descriptive design. Quantitative research aims for precise measurement of variables [69]. It is designed to examine the relationships between variables, which are often derived from data collected using a rigorously defined and highly structured research instrument. Data collection results in numerical and standardized data, which are analyzed using statistics and diagrams [68]. Descriptive research aims to create an accurate profile of events, individuals, or situations. It provides descriptions of phenomena or characteristics associated with a subject population, estimating the proportions of that population that possess these characteristics [68, 69]. This study sought to provide a snapshot of the current realities by estimating the frequencies, trends, and patterns of constraints experienced by students. A cross-sectional descriptive study was conducted to outline the constraints faced by students in using technology for learning. The study utilized a survey research design, employing an online questionnaire with closed-ended questions. Surveys are regarded as particularly suitable for measuring unobservable data such as factual information, preferences, attitudes, beliefs, and behaviors [70].

5.3. Population and Sampling

A quantitative census sampling method was employed for the study, using electronic questionnaires sent to all students enrolled in the commerce faculty of the selected rural HDI. No sample size was designated; all students registered in the faculty were invited to participate in the survey. A non-probability convenience sampling method, based on student availability, was utilized to collect data for the study. The targeted population included all students registered in the commerce faculty of the selected institution for the 2024 academic year. A structured self-administered questionnaire was shared electronically through various students' WhatsApp groups. This approach was deemed ideal due to its practicality and ease of access for respondents. All students accessible to the researchers were invited to partake in the study. While this approach may limit generalizability due to potential bias, it allowed for wider outreach, providing valuable insights into the population's perceptions and experiences.

Table 1.
Summary of all respondents.

Study level	Gender				Total	
	Female		Male			
	Freq	Percent	Freq	Percent	Freq	Percent
First	24	52%	22	48%	46	22%
Second	39	64%	22	36%	61	29%
Third	52	68%	24	32%	76	36%
Advanced Diploma	4	44%	5	56%	9	4%
Honors	14	100%	0	0%	14	7%
Masters	3	100%	0	0%	3	1%
Total	136	65%	73	35%	209	100%

As portrayed in Table 1, the distribution of students across various study levels is shown. The third-year level has the highest number of students (36%), followed by the second year (29%) and first year (22%). Advanced Diploma, Honors, and Master's levels represent a much smaller portion of the student population, together accounting for only 12%. This also aligns with the study by Matarirano et al. [18] on remote learning, where most respondents were third-year students.

Table 2.
Shows gender distribution across all study levels

Gender	Frequency	Percentage
Female	136	65%
Male	73	35%

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As portrayed in Table 2, the total number of students who responded to the questionnaire was 209. Females constitute a significant majority at 65%, whereas males make up 35% of the student population, a common trend in South African higher education studies [18].

Table 3.
Gender composition by study level.

Study Level	Female (%)	Male (%)
First	52%	48%
Second	64%	36%
Third	68%	32%
Advanced Diploma	44%	56%
Honors	100%	0%
Masters	100%	0%

Table 3 illustrates the gender breakdown at each study level. While females dominate most levels, the Advanced Diploma is the only level where males outnumber females. Honors and Master's levels consist exclusively of female students. Chapelle [71] argues that females are a source of reserve growth and development in some developing countries (such as South Africa), and they constitute a minority group in terms of self-employment in advanced economies.

5.4. Data Collection

A self-administered questionnaire developed based on the study's research questions was used to collect data from respondents. The questionnaire included five-point Likert scale questions. This self-administered questionnaire was deemed an appropriate measurement tool since the study gathered responses from literate participants. A hyperlink to the questionnaire, created using Google Forms, was shared with students through their student WhatsApp groups from November 7th to 19th, 2024. Utilizing Google Forms facilitated easy data export to Microsoft Excel for analysis. Data collection occurred toward the end of the academic year to ensure new students had sufficient experience with learning technology.

Participation in the study was voluntary, and participants remained anonymous. The key ethical issues were addressed throughout the research, particularly during the data gathering and analysis stages. All respondents were informed about the purpose of the study and how the information generated would be used. Confidentiality was guaranteed and emphasized in the introduction of the Google form used for data collection. Respondents were made aware of their right to privacy and their option to decline participation at any point in the survey. Permission to conduct the survey was granted by the faculty's Higher Degrees and Ethics Committee through the issuance of an ethics certificate.

5.5. Reliability and Validity

The internal consistency of the constructs generated through exploratory factor analysis was established by calculating Cronbach's Alpha, while the validity of the items was determined by extracting factor loadings from the exploratory factor analysis. Cronbach's Alpha and factor loadings were computed using STATA. The exploratory factor analysis resulted in three groups of factors, and their Cronbach's Alpha values and factor loadings are presented in Table 4.

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Table 4.
Reliability and validity values.

Construct	Item	Factor loading	Cronbach's Alpha
Access and support challenges	I have self-confidence when it comes to working with technology**	0.7171	0.8605
	I have access to a laptop for use in the learning	0.6474	
	I have access to a smartphone for use in the learning process	0.6288	
	There is an adequate internet connection to enable the use of Wise-Up around university facilities.	0.6837	
	I am provided with proper training to access technology efficiently for learning purposes.	0.6170	
	I am given proper training to use technology efficiently for learning purposes.	0.6263	
	There is immediate support in the event of technological problems	0.6918	
	Technical staff are readily available to assist with technological problems.	0.7981	
	In general, there is good technical support for Wise--Up	0.7922	
Usability and environmental constraints	I encounter difficulties when utilizing technology for learning	0.7432	0.7835
	I find it difficult to handle and manipulate technology tools	0.6612	
	I receive insufficient assistance when using technology for learning**	0.6354	
	I do not have a reliable internet connection while utilizing technology for learning purposes**	0.5643	
	Most technology tools available for learning make use of electricity, which is not readily available**	0.6815	
	Technology tools are too expensive for me to afford**	0.7243	
Efficiency and frustration barriers	I think that it takes a long time to finish a task when I use technology.	0.7062	0.6015
	Using technology is very frustrating at times	0.6121	

These items were reverse-coded to maintain a similar tone with other questions in the same construct

As indicated in Table 4, all constructs have Cronbach's Alpha values exceeding 0.6, demonstrating high internal consistency reliability. As a general guideline, values above 0.6 for Cronbach's Alpha suggest a reliable research instrument [72]. For a research instrument to be considered valid, the rotated factor loadings of any item should not fall below 0.4 [73]. All items, as shown in Table 4, had factor loadings above 0.4. The obtained reliability and validity scores confirm the research instrument's adequacy in identifying the constraints they experience.

5.6. Analysis Procedures

The study analyzed the collected data using descriptive statistics to identify common challenges faced by students. Descriptive statistics were performed with the assistance of Microsoft Excel. The data analysis process began with downloading responses from Google Forms to MS Excel and then cleaning them for missing entries. Data from MS Excel was exported to STATA to assess the reliability and validity of the instrument. To interpret the collected data, tables and charts created in MS Excel were utilized to present the frequencies of the pre-identified constraints. Visualizing the results facilitated the interpretation and understanding of the data. The experiences of students were analyzed using item statistics from the Likert scale generated from the descriptive statistics in MS Excel. The five-point Likert scale was condensed to three points: strongly agree, agree, neutral, disagree, and strongly disagree. The item statistics included the percentages of options selected for each item and the mean for each item. The percentages of options for each item represent the respondents' positions regarding that item; higher percentages indicate the majority position of respondents. The mean represents the average response to each item and ranges from 1 to 5, with 2.5 as the midpoint. A mean above 2.5 indicates responses skewed towards agreeing with a statement, while a mean below 2.5 signifies responses disagreeing with a statement.

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6. Findings and Discussions

6.1. Usability and Environmental Constraints

This construct includes constraints arising from insufficient access to devices, connectivity, and institutional support. These constraints comprise physical and institutional barriers that hinder the effective use of learning technology. Exploratory factor analysis yielded six items under this construct. The responses to these items are summarized in Table 5.

Table 5.
Usability and environmental constraints.

Item	Agree	Neutral	Disagree
I encounter difficulties when utilizing technology for learning.	21%	29%	50%
I find it difficult to handle and manipulate technology tools	12%	38%	50&
I receive insufficient assistance when using technology for learning	32%	27%	41%
I do not have a reliable internet connection while utilizing technology for learning purposes	46%	39%	14%
Most technology tools available for learning make use of electricity, which is epileptic and thus discouraging	33%	36%	31%
Technology tools are too expensive for me to afford	38%	32%	30%

6.1.1. Discussion on Challenges in Handling ICTs

6.1.1.1. Statement 1: I Encounter Difficulties When Utilizing Technology for Learning

A total of 50% of the respondents disagreed, indicating that they do not encounter difficulties when using technology for learning purposes. Meanwhile, 21% agreed, suggesting that a small proportion of respondents still struggle with utilizing technology for learning. Another 21% remain uncertain or occasionally challenged. This result aligns with Sun et al. [23], who identified several barriers to successfully utilizing technology for learning, including a lack of technical expertise, financial constraints, and difficulty in connecting with peers. This finding is consistent with the work of Twetwa-Dube et al. [58], who affirm that rural HDIs struggle to implement and benefit from digital teaching and learning platforms effectively.

6.1.1.2. Statement 2: I Find it Difficult to Handle and Manipulate Technology Tools

Examining statement 2, 50% of the respondents disagreed with the assertion that they find it difficult to handle and manipulate technology tools. Conversely, 12% of the respondents reported challenges in managing and using these tools. Meanwhile, 38% remained neutral. This suggests that a significant number of respondents may experience mild or situational difficulties or lack confidence in their skills, even though they do not fully agree with the statement. These findings align with Kim and Lee [74], who validated technical capability as crucial for utilizing digital learning materials, and correspond with Anderson and Anderson [75], who acknowledged that technical skills significantly contribute to success in online learning environments and proposed that high to moderate technical capability among participants may drive effective use of digital learning tools like Wise-Up.

6.1.1.3. Statement 3: I Receive Insufficient Assistance when Using Technology for Learning.

The results show a mixed reaction from respondents. Forty-one percent of the respondents disagreed with the above statement, indicating they do not receive sufficient support when using technology for learning. Meanwhile, thirty-two percent agreed with the statement, suggesting a lack of support. Finally, twenty-seven percent expressed neutrality, reflecting inconsistency or uncertainty regarding the availability of support. This study corroborates earlier findings by Park and Choi [76] and Zheng et al. [77], which revealed that many learners struggle to access adequate technological support in educational settings. This underscores the necessity for institutions to enhance their support systems to create a more effective learning environment. Lee and Kim [78] also establish the significant contribution of technical support in improving learning experiences and achievements. The findings

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indicate that the absence of technical support can have negative impacts, while inappropriate support may yield positive outcomes, emphasizing the obligation of institutions to provide essential technical support and training.

In conclusion, technology proficiency is generally strong across all the statements mentioned above. Half of the respondents disagreed with the assertion that they strongly support technology for learning, indicating a good level of digital literacy. The results also suggest that the support system needs improvement. Statement three shows that a substantial minority (32%) feel underserved in terms of learning support. Therefore, this area presents an opportunity for institutions to intervene with better guidance, help desks, or training. The presence of neutral responses indicates potential gaps: the relatively high neutral responses (27–38%) across all items imply that some learners may be uncertain about their learning skills or experience inconsistent challenges.

6.1.2. Discussion On Infrastructure (Electricity and Internet)

6.1.2.1. Statement 4: I Do Not Have a Reliable Internet Connection While Utilizing Technology for Learning Purposes

Statement 4 asked whether respondents have a reliable internet connection when using technology for learning purposes. The results regarding infrastructure, including electricity and internet access, reveal significant obstacles to the effective use of learning technology. From this statement, 46% of respondents agreed, while 14% disagreed, indicating they consistently have stable access. Meanwhile, 39% of respondents remained neutral about lacking a reliable internet connection, highlighting that internet reliability is a widespread concern. This study supports Lee and Kim [78], who state that erratic internet access can negatively impact study outcomes. The current study affirms this observation through respondents' concerns about inconsistent internet access. Warschauer's [79] work also considers the element of the digital divide, where some students lack dependable internet access, affecting educational results. Current findings show that an unstable internet connection is an issue for most respondents, which could worsen existing inequalities. This conclusion aligns with Twetwa-Dube et al. [58] and Matobobo et al. [59], who argue that infrastructural challenges, such as unreliable electricity supply and a lack of broadband coverage, continue to marginalize learners in underdeveloped and rural areas. Current findings suggest that an unstable internet connection could hinder effective learning.

Statement 5 shows that 36% of the respondents agreed that most technology tools available for learning rely on electricity, which is not always readily available, while 31% disagreed, indicating a moderate yet significant limitation. Dependence on electricity for learning tools presents a challenge for many. Additionally, 33% of the respondents were neutral about the availability of electricity. The findings underscore the necessity of considering accessibility and inclusion in the design and application of learning technology. This evidence corroborates Lenny et al. [26] and Sithole and Mbukanma [21], who affirm that the effectiveness of these LMSs depends on a stable electricity and internet connection, compatible ICT gadgets, and data for enabling connectivity. These issues have frequently been reported as challenges in HDIs, especially in rural areas. The result is also linked to the study of Tshabalala and Ndebele [33], which explains that high mobile data charges, power outages, and lack of digital literacy hinder effective engagement with learning technology, risking the further marginalization of at-risk student populations [33]. This marginalization not only affects their academic performance but also limits their opportunities for personal and professional development in an increasingly digital world. Addressing these barriers is essential to ensure equitable access to education and support the growth of all learners, particularly those in underserved communities.

In conclusion, the results show that infrastructure-related issues, particularly unreliable internet and limited electricity access, are key obstacles that must be addressed to support equitable and effective technology-enhanced learning.

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6.1.3. Discussion on Cost Barriers

6.1.3.1. Statement 6: Technology Tools are Too Expensive for Me to Afford

The results of statement 6 indicate that cost is a significant obstacle to accessing technology materials for learning. A notable percentage of respondents, 38%, agreed with the statement that technology devices are very expensive for them to afford. In contrast, 30% of respondents disagreed, suggesting that less than one-third do not view cost as a barrier. Meanwhile, 32% remained neutral, indicating uncertainty or occasional financial strain. The findings reveal that affordability is a concern for the majority of respondents, with a total of 70% either facing monetary challenges or expressing uncertainty. This implies a need for more accessible and cost-effective technology solutions or institutional support to address the affordability gap in technology-enhanced learning. High mobile data charges, power outages, and lack of digital literacy hinder effective engagement with learning technology, risking further marginalization of at-risk student populations [33]. Most students pursuing higher education in HDIs come from families with low socio-economic status and primarily rely on NSFAS for funding [80]. This reliance on NSFAS highlights the urgent need for systemic changes in funding and support mechanisms to ensure equitable access to technology and resources for all students. If these barriers are not addressed, the potential for educational advancement remains limited, perpetuating cycles of disadvantage for vulnerable populations. Unfunded students often struggle to afford personal digital devices and the necessary data for connectivity. This challenge is further exacerbated by the high costs of purchasing and maintaining devices and internet plans [58].

In conclusion, the data reflect that students largely feel competent using technology, but external factors such as internet access, affordability, and infrastructure pose challenges to their ability to engage effectively. This highlights the need to focus more on improving technical infrastructure, equitable access, and support systems, rather than just user training or interface usability.

6.2. Access and Support Limitations

These constraints arose from users' challenges with usability, affordability, and environmental limitations. The construct included user-level barriers, such as difficulty levels, and environmental constraints, like power and internet reliability. Exploratory factor analysis yielded nine such items, and the responses to these are presented in Table 6.

Table 6.
Access and support limitations.

Item	Agree	Neutral	Disagree
I do have self-confidence when it comes to working with technology	64%	27%	9%
I have access to a laptop for use in learning.	70%	13%	17%
I have access to a smartphone for use in learning.	81%	13%	6%
There is an adequate internet connection to enable the use of Wise-Up around university facilities.	59%	22%	19%
I am given proper training to access technology efficiently for learning purposes.	47%	32%	21%
I am given proper training to use technology efficiently for learning purposes.	50%	31%	19%
There is immediate support in the event of technological problems	46%	36%	17%
Technical staff is readily available to assist with technological problems	57%	28%	14%
In general, there is good technical support for Wise-Up	63%	26%	11%

6.2.1. Discussion on Access to Devices and Connectivity

6.2.1.1. Statement 1: I Have Access to A Laptop for Use in the Learning

Examining statement one, the majority of respondents, 70%, agreed that they have access to a laptop, indicating that most learners possess essential learning tools. Meanwhile, 13% remained neutral. However, 17% of respondents disagreed, representing a significant minority who face challenges with certain digital learning tasks that require larger screens or full keyboards. Rural and low socio-economic students are disproportionately hindered by access to online learning resources [32, 60].

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These findings align with Kim et al. [81], who stated that technology increases student engagement through interactive tools and multimedia resources, making learning more enjoyable and effective. Limited resources lead to the use of outdated or inefficient ICT infrastructure and a shortage of qualified staff capable of effectively integrating learning technologies into their teaching practices [58, 60].

6.2.1.2. Statement 2: I Have Access to a Smartphone for Use in the Learning

Access to smartphones is very high (81%), reflecting the widespread use of mobile devices in learning. This suggests that mobile learning platforms or mobile-compatible content could be particularly effective, while 13% of the respondents remained neutral. On the other hand, the low disagreement rate (6%) indicates that smartphone ownership is not a major barrier for most students. This finding is supported by Matarirano et al. [18] and Lenny et al. [26], who affirm that platforms such as WhatsApp have improved learning engagement, enhancing learning experiences. This result aligns with UNESCO [47], which emphasizes the need to promote accessibility and inclusivity by providing equal access to educational resources for all students, regardless of their location or ability.

Statement 3: There is an adequate internet connection to enable the use of WiSeUp around university facilities. While a majority (59%) feel that internet access on campus is sufficient for using WiSeUp, the combined 41% who are either neutral or disagree suggest room for improvement in connectivity. The 19% who actively disagree may experience consistent disruptions, which can impact participation in online platforms and resources. The findings align with Kim and Lee [74], who confirm that technological issues, including internet connection problems, can interfere with learners' engagement on online learning platforms.

6.2.2. Discussion on Training Availability

Statement 4: I receive proper training to use technology efficiently for learning purposes. Less than half of respondents (47%) believe they receive adequate training, suggesting that training programs may be limited or inconsistent. A notable portion (32%) remains neutral, possibly reflecting uncertainty about the sufficiency of training or a lack of exposure. The 21% who disagree constitute a significant group that feels unsupported in developing digital learning skills. This finding aligns with Li and Ma [82], who highlight the importance of regular technical support and training for students to effectively utilize technology-supported learning content.

Statement 5: I do have self-confidence when it comes to working with technology. A strong majority (64%) are confident in their tech skills, indicating that many learners have developed digital competence, possibly through informal learning or experience. Neutral (27%). The low disagreement (9%) reflects generally high self-assurance, which is a positive indicator for tech adoption. The current study corroborates previous studies by Park and Choi [76], Johnson and Davies [83], and Kim and Lee [74] that establish the important contribution of technical support in enhancing learning experiences and achievement.

Statement 6: I am given proper training to access technology efficiently for learning purposes: Agree (50%), Neutral (31%), Disagree (19%). Half of the respondents affirm receiving appropriate training for accessing technology, but this still leaves half who are unsure or disagree, pointing to a gap in training coverage or quality. The 31% neutral response again suggests a need for clearer or more consistent training opportunities. The study is in line with Blair [84], who supported that educators must re-examine the role of digital technology in the classroom and focus on developing 21st-century skills such as critical thinking, creativity, communication, and collaboration. Teacher training is necessary in order to empower educators to incorporate technology into the curriculum [85].

6.2.3. Discussion on Technical Support Gaps

Statement 7: There is immediate support available in the event of technological problems. The results indicate that while a majority of students feel supported when facing technological issues, there

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remains room for improvement. Regarding immediate support during technological problems, 46% agreed, 36% were neutral, and 17% disagreed. This suggests that although nearly half of the respondents believe timely assistance is available, a significant portion is either unsure or disagrees, indicating possible delays or inconsistencies in support. Frequent power outages and delays in repairs, particularly due to theft, vandalism, and logistical obstacles, exacerbate the situation in rural institutions [63]. The study by Lee [56] affirms the importance of technology in supporting assessment procedures through web-based tests, computer-marked questions, and data analysis [56].

Statement 8: Technical staff are readily available to assist with technological problems. In statement 8, respondents were asked if technical staff were readily available to assist with technological problems. More positively, 57% agreed that technical staff are readily available, and only 14% disagreed, reflecting a generally accessible support team. 28% of respondents remain neutral. In this case, more support should be provided to all students facing technological issues in learning. This finding aligns with Letseka et al. [61] and Nyoni [62], who explained that insufficient technical support, excessive workloads for lecturers, and a lack of time for lecturers to instruct students on technology use are highlighted as constraints to successful learning technology use.

Statement 9: In general, there is strong technological support for Wise-up. Additionally, 63% of respondents believe there is good technological support for the WiSeUp platform, indicating overall satisfaction with the platform's technical assistance, while 11% of respondents disagreed with the statement. However, the presence of neutral responses across all statements (ranging from 26% to 36%) suggests that some users may experience varying levels of support or might not be fully aware of the available services. These findings highlight the need not only to maintain robust technical support but also to enhance communication and visibility of available help resources. Hence, the study of Wilson [57] explains the importance of technologically supported learning environments, which have been shown to improve retention of information, critical thinking skills, and problem-solving abilities. These findings are supported by Letseka et al. [61] and Nyoni [62], who affirm that insufficient technical support, excessive workloads for lecturers, and a lack of time for lecturers to instruct students on technology use are identified as barriers to effective learning technology utilization. Frias et al. [86] confirm that research conducted in 2023 found that technologies in adaptive learning can significantly enhance students' performance, particularly for those who require assistance.

In conclusion, students have strong physical access to learning devices and perceive good institutional support, especially in terms of internet and technical assistance. However, low self-confidence and inconsistent training emerge as the main barriers to effective technology use.

6.3. Efficiency and Frustration Barriers

The final construct included only two items, which had constraints related to technological inefficiency and emotional frustration. These internal obstacles involved time consumption and frustration during use. The feelings of the respondents are summarized in Table 7.

Table 7.
Efficiency and frustration barriers.

Item	Agree	Neutral	Disagree
I think that it takes a long time to finish a task when I use technology	20%	14%	66%
Using technology is very frustrating at times	33%	28%	26%

6.3.1. Efficiency of Technology

6.3.1.1. Statement 1: I Think That It Takes a Long Time to Finish a Task When I Use Technology.

Only 20% of respondents agreed that using technology takes a long time to complete tasks, while a significant 66% disagreed, indicating that most students find technology to be efficient and time-saving in their learning process. The low neutral response (14%) reinforces the clarity of this perception. These results suggest that technology, when properly utilized, is generally seen as an effective tool for

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completing academic tasks efficiently. AI-driven systems were found to be efficient in enhancing learner satisfaction and academic performance [87]. ICTs have been generally agreed to have widespread benefits in higher educational contexts [18, 21, 24-26].

6.3.2. Emotional Experience

6.3.2.1. Statement 2: Using Technology is Very Frustrating at Times

When asked whether the use of technology is frustrating at times, 33% agreed, 28% were neutral, and 38% disagreed. These results indicate a mixed emotional experience among students. While a larger portion disagreed, reflecting positive or manageable emotional responses, the combined 61% (agree and neutral) suggests that a significant number of students do experience occasional frustration. This underscores the need for ongoing support and user-friendly interfaces to reduce stress and enhance the overall user experience with technology. This study aligns with Matarirano et al. [18] and Yeung et al. [38], who affirm that professional development involves digital literacy, immersing students in virtual spaces, and supplementing the course curriculum with e-learning platforms. However, students reported time management issues, low motivation, and ineffective study environments at home. This finding is consistent with Sibanda and Mafu [39], who agreed that these conditions heighten academic stress and impact learning outcomes. Additionally, Matarirano and Musaigwa [63] confirm that a lack of adequate funding affects the capacity to upgrade infrastructure or implement comprehensive digital solutions, which can lead to students' frustration at times. In conclusion, students generally do not perceive technology as slow, supporting its perceived efficiency. However, a significant portion experiences frustration, highlighting the need for ongoing support, simplified interfaces, and user-centered design.

7. Recommendations of Findings

7.1. Recommendations on Challenges in Handling ICTS

Based on the findings regarding challenges in handling ICTs, the following recommendations are presented for consideration by the institutional management:

The university management should ensure the implementation of an effective digital literacy system to assist the 21% of students who stated difficulties, such as beginner-level workshops, peer mentoring, and online tutorials, focusing on practical skills. It is also recommended that the university management provide active training sessions for the 21% of students who are struggling with technology tools, concentrating on online learning and software, to empower students from rural or under-resourced backgrounds. By fostering an inclusive learning environment, the university can enhance student confidence and competence in digital skills. This initiative will ultimately contribute to a more equitable educational experience for all students, regardless of their background. Finally, the study reveals a 32% student support gap, urging institutions to improve their support systems, including accessible help desks, live chat, and user-friendly guides, to enhance digital learning experiences.

7.2. Recommendations: Access to Devices and Connectivity

Since 17% of respondents lack access to laptops, it is essential to implement effective interventions to bridge this digital divide. Additionally, university management and stakeholders should consider developing laptop loan programs or establishing partnerships with private companies and donors to provide affordable devices for disadvantaged students. There is a critical need for increased investment in up-to-date ICT infrastructure and training for academic staff on how to effectively integrate technology into their teaching to maximize student learning outcomes and engagement, particularly for those from rural or low socioeconomic backgrounds. Given that most students have access to smartphones, university management should capitalize on this by enhancing learning platforms and content for mobile devices. Mobile-friendly LMS interfaces, WhatsApp, and short-form learning modules can promote participation, especially for students who may not have regular access to personal or desktop computers. Therefore, university management must support digital literacy initiatives to ensure all students are prepared to use smartphones effectively for academic purposes, beyond just social

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or leisure use. While most respondents indicate that campus internet is sufficient for using a platform like WiSeUp, 41% are dissatisfied, highlighting the need for university management to improve connectivity. It is crucial for university management to assess Wi-Fi coverage across campus facilities and consider infrastructure upgrades to ensure consistent and reliable internet access. They could explore zero-rated educational platforms or subsidized mobile data partnerships to facilitate off-campus learning and reduce the digital inequity that persists among students.

7.3. Recommendations on Cost Barriers

It is recommended that, since 38% agree that devices are too expensive and an additional 32% express uncertainty, university management should implement supportive methods such as subsidized or loaned digital devices, partnerships with service providers for affordable or zero-rated data plans, and increased access to on-campus computer labs.

7.4. Recommendation on Training Availability

Since a significant proportion remains neutral (31–32%) or disagrees (19–21%), these findings highlight inconsistencies. It is recommended that university management offer organized and ongoing digital training programs that are linked and accessible to all students. Such programs should cover both basic and advanced technology use for learning and be accompanied by easily accessible support resources. In addition, training should target not only students but also educators, ensuring they are equipped to effectively integrate digital tools into their teaching and support students. By strengthening both student and staff digital competence through consistent, hands-on training, the university can foster a more inclusive and capable digital learning environment.

7.5. Recommendations on Technical Support Gaps

While most respondents report receiving sufficient technical support, the consistent presence of neutral (26–36%) and disagreeing responses (up to 17%) across statements indicates significant variability in the support experience. Therefore, university management needs to address these gaps. They should create a more accessible and visible technical support system, including 24/7 help desks, well-advertised support channels, and proactive communication about available services. Increasing staffing during peak academic periods and deploying mobile support teams for rural campuses can help minimize delays caused by logistical or infrastructural challenges. Moreover, university management should regularly review the quality and reach of support services through student feedback and operational audits to ensure adequate and dependable support. Enhancing technological support not only improves engagement with platforms like WiSeUp but also directly contributes to learning outcomes by reducing interruptions and boosting student confidence in using technology.

7.6. Recommendations on the Efficiency of Technology and Emotional Experience

To expand the benefits of learning technology while addressing the challenges of efficiency and emotional experience, universities should invest in reliable, personalized digital tools and prioritize user-friendly design. Additionally, it is essential to integrate constant technical and emotional support into online learning environments, focusing on mental health check-ins and instant support options to enhance stress management and help students manage their digital tasks effectively.

8. Conclusions

This study aims to investigate the challenges faced by commerce students in using learning technology and to offer potential solutions. The results revealed that while most students are comfortable with technology, a significant minority still struggles and lacks confidence. Institutions should provide specialized training and enhance technical support to ensure all students can effectively utilize digital learning tools. Regarding access to devices and internet connectivity, although many students own smartphones and some have laptops, gaps remain, particularly among disadvantaged

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communities. Enhancing device accessibility, improving mobile learning, and upgrading campus internet are essential for closing the digital divide. Regarding financial obstacles, costs pose a major challenge for many students, limiting their ability to access devices and internet connections. University management should provide subsidies, affordable data plans, and campus resources to enhance accessibility and equity in technology.

Training opportunities can vary, which may limit certain learners' abilities, even though many students are proficient with technology. Consistent and structured training for both learners and educators is essential for fostering digital competencies and improving technology use. The differences in technical support indicate that, while it is generally available, the quality can vary, leading some students to feel uncertain or dissatisfied. Enhancing the responsiveness, visibility, and accessibility of support services is crucial for minimizing disruptions and boosting student confidence. On one hand, students generally perceive technology as beneficial and effective, but many experience frustration at times. By enhancing user-focused design, providing clear guidance, and offering both emotional and technical support, we can increase overall satisfaction and engagement.

Finally, the Technology Acceptance Model (TAM) has been utilized to provide a framework for understanding and addressing the challenges of adopting learning technology faced by rural commerce students in South Africa. Focusing on technology-centered education will enable South African students to achieve improved learning outcomes, equitable educational access, and enhanced employment prospects, thereby preparing them for the digital economy. South African higher education institutions can benefit significantly by prioritizing technology-enhanced learning, leading to a stronger reputation, greater student success, and increased efficiency, ultimately fostering academic excellence and institutional vitality. Prioritizing technology-driven education can positively affect South Africa as a whole, resulting in economic growth, equity, and global competitiveness, potentially positioning the country as a model for education, innovation, and digital progress.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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