

# Literature review of e-learning technology adoption in South African rural higher tertiary institutions for teaching and learning

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**Abstract.** This systematic literature review explores the adoption of e-learning in rural tertiary institutions in South Africa. Despite numerous studies on e-learning implementation in urban tertiary institutions, few have holistically considered bridging the digital divide gap by examining factors that hinder technology adoption in rural tertiary institutions. This review adhered to PRISMA guidelines and sourced information from the ACM Digital Library, Scopus, IEEE, and Springer to retrieve and analyse scholarly publications, including peer-reviewed journal articles, in South Africa between 2018 and 2024. The search results identified 65 relevant articles from ACM, 75 from Scopus, 70 from IEEE, and 90 from Springer. The study's research questions helped identify topics to explore regarding the adoption of e-learning technology in rural tertiary institutions in South Africa. Findings highlight the challenges hindering the adoption of e-learning in South Africa, including poor internet connections, resistance to change, inadequate infrastructure, insufficient funding, and limited training skills. We recommend that institutional management take timely and strategic actions to ensure the successful implementation of e-learning. Furthermore, the frequent training of staff and students in the use of e-learning systems encourages adoption and effective use.

**Keywords:** systematic literature review, technology adoption, rural tertiary institution, teaching and learning

## 1. Introduction

Technology integration in education has seen a significant evolution in recent decades [42, 59]. Initially, the use of technology in education was mainly confined to simple computer-assisted learning tools [10, 28, 60]. These early systems aimed to enhance traditional classroom teaching by offering additional learning resources digitally [15, 44]. However, as technology has advanced and teaching methods have evolved, education systems worldwide have moved towards more sophisticated, interactive, and personalised e-learning environments.

The swift development of e-learning has been fuelled by advancements in technology, shifting student needs, and a growing recognition of the value of flexible learning options [53, 55]. E-learning platforms have increased global access to education, eliminating barriers related to location and time [26, 29]. Learning Management Systems (LMS) like Moodle and Blackboard, MOOCs, virtual classrooms, and mobile learning apps have broadened opportunities for both remote and on-the-go education, allowing students to engage in real-time interactions or access course content at their convenience [17, 22].

In addition to bringing attention to the digital divide between urban and rural higher education institutions, the COVID-19 pandemic increased the demand for digital learning solutions worldwide

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[37]. Bridging this gap requires understanding how rural institutions are adopting e-learning technologies [3]. Expanding access to higher education for underprivileged communities is primarily made possible by rural tertiary institutions [14, 41]. A systematic review can help assess whether e-learning can enhance accessibility and quality in rural tertiary institution settings.

E-learning has not been successfully adopted in many rural ones [57]. Despite the projection of e-learning technology as the next educational revolution in South Africa's educational sector by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2021, several significant obstacles that still impede the successful adoption of e-learning in rural tertiary institutions in South Africa were identified in [1]. These include the absence of institutional policies to ensure the efficient use of the technology, the high cost of internet data, which impacts students' and lecturers' internet connectivity, load-shedding, and inadequate facilitating conditions.

The adoption of e-learning in South African rural tertiary institutions has had numerous effects [4]. Many studies [8, 21, 33] focus on e-learning adoption in urban universities, but fewer studies have provided a comprehensive analysis of its adoption in rural settings to bridge the digital divide gap between urban and rural tertiary institutions in South Africa [46, 48]. Furthermore, identifying the common barriers that hinder the adoption of e-learning technology in rural tertiary institutions is crucial to students, lecturers, and decision-makers.

According to a study by Selim [62], the adoption of e-learning by higher education institutions depends on four crucial success factors: lecturers, students, information technology, and university support. Over the years, many researchers have expanded these factors by adding different factors to foster the adoption of e-learning in rural tertiary institutions in South Africa [30].

A recent review (scoping, rapid, narrative, systematic, or meta-analysis) on the application of e-learning or the difficulties in adopting an electronic LMS (e-LMS) in South Africa's rural tertiary institutions was carried out by Bervell and Umar [11], Maluleke and Maake [35]. This review covered research published between 2007 and 2017, making it somewhat outdated since technologies are continually evolving. Although the issues raised in [11] remain relevant, given the exponential growth of Information and Communication Technology (ICT) and the haste with which rural tertiary institutions in South Africa are trying to obtain a competitive edge in adopting e-learning technology for teaching and learning purposes.

This study methodically examines, assesses, and compiles the observations from all pertinent studies on the impact and challenges of e-learning technology adoption in South Africa's rural tertiary institutions between 2018 and 2024. One of the benefits of this study is to inform decision-makers about potential obstacles to implementing e-learning in rural tertiary institutions in the South African context and to provide current researchers in the field with an update on the current state of research on the impact of e-learning in these institutions.

## 2. Methodology

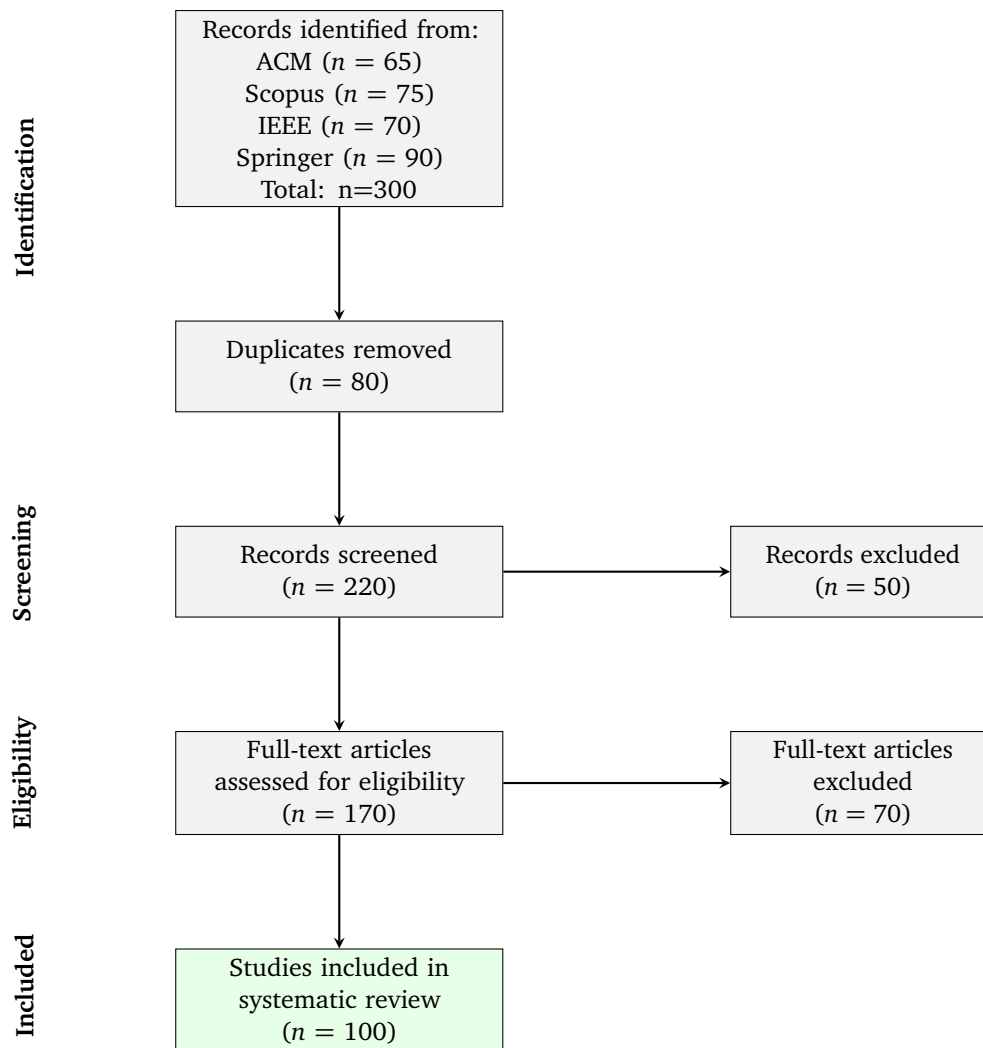
This section covered the following: Preferred Reporting Items for Systematic Reviews (PRISMA), the process of Systematic Literature Review (SLR) for screening articles, and validation of the review. The research questions (RQ) are as follows:

RQ1: What is the present status of research on the adoption of e-learning implementation in rural tertiary institutions?

RQ2: What e-learning issues were discovered in studies about South African rural tertiary institutions between 2018 and 2024?

To gather pertinent literature for analysis, the SLR methodology was carried out following the PRISMA guidelines, as illustrated in figure 1.

Page et al. [56] claims that PRISMA is a minimal set of evidence-based reporting requirements for systematic reviews and meta-analyses. The study took the following steps to ensure a comprehensive and precise analysis.



**Figure 1:** PRISMA flowchart for the selected literature search and systematic review processes.

For its review procedures, this study used four reliable databases: IEEE, Springer, Scopus, and the ACM Digital Library. These databases were selected due to the abundance of excellent research that was relevant to the study. Several thousand educational journals from various fields within the field of education were indexed by Scopus, which is renowned for its thoroughness and rigour.

These journals included international and regional journals from a wide range of publishers, from major academic publishers to smaller, specialised publishers. When creating a trustworthy literature review, researchers employ rigorous techniques to minimise the risk of data distortion. Through pilot searches, they verify search strings and adjust them to maximise recall and precision. A thorough search is ensured by including synonyms and variants, which accommodate various terminologies across databases.

Three major steps were taken in the systematic review process to choose relevant articles for the current investigation. Before obtaining related terms from databases, a set of keywords was first determined.

The Boolean operators “OR” and “AND” were used to identify key terms from the chosen research questions during the identification phase. For example, “higher education” OR “higher institution” OR “university” OR “tertiary institution” OR “tertiary education” AND “e-learning” OR “online learning” OR “virtual learning” OR “web-based learning systems” OR “online education” OR “internet learning” were the keywords related to e-learning that this paper used.

From four databases, a total of 300 studies were retrieved, and duplicate articles were excluded

from the libraries. We eliminated 80 studies during this screening process. Throughout the screening process, a total of 220 articles were examined in full text.

The Rayyan platform was crucial to the screening and selection of the articles because it improved researcher collaboration and effectively managed a large number of articles. During the screening stage, the titles, abstracts, and keywords of the 220 studies were thoroughly examined.

Exclusion criteria were used to eliminate studies published before 2018, articles unrelated to e-learning in tertiary institutions, papers not published in South Africa and studies written in languages other than English. Consequently, 50 studies were eliminated, as indicated in table 1.

**Table 1**

Reviewed studies distribution.

Source	Query request	Title and abstract included	Full articles reviewed	Full articles included
ACM	65	50	40	25
Scopus	75	48	35	25
IEEE	70	52	45	23
Springer	90	70	50	27
Total	$n = 300$	$n = 220$	$n = 170$	$n = 100$

During the inclusion phase, the researchers evaluated a total of 170 articles. To ensure the articles met the inclusion requirements and were suitable for use in the current study, the researchers carefully reviewed each article's title, abstract, and main content during this phase. The following are the criteria for inclusion and exclusion:

- Inclusion criteria: peer-reviewed primary studies from South Africa, English-language articles, and publications released between 2018 and 2024 are all required.
- Exclusion criteria: study publications older than 2018, papers published outside South Africa, research articles that are not related to the impact of technological development, Articles published that are not Scopus-indexed, abstract-only papers and commentaries. Following the thorough examination, a total of 70 articles did not meet the inclusion criteria and were excluded.

In the context of this systematic review, we acknowledge that biases may be introduced due to the limited database exploration, exclusion of non-English literature, unclear selection criteria, variations in data extraction techniques, and the potential for subjective assessments.

To overcome the constraints imposed by biases in database searches, a comprehensive search was conducted using reputable databases, including the ACM Digital Library, IEEE, Springer, and Scopus. Focusing exclusively on English-language research can help avoid linguistic biases. However, it may also miss important insights from studies with different linguistic backgrounds, which could limit the generalizability of our findings. It is essential to remember that translating non-English studies requires a substantial amount of resources and expertise, and there is a risk that subtleties may be lost in translation and errors may be introduced.

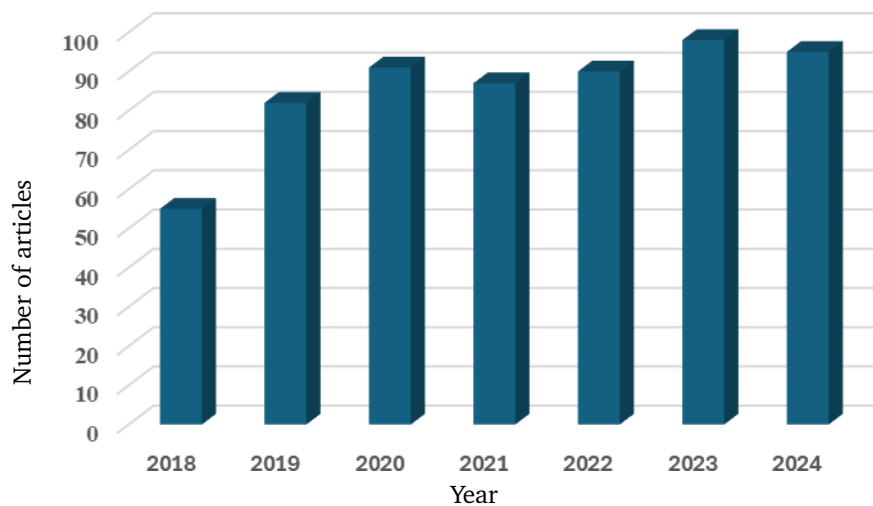
### 3. Results and discussion

This section presents the results of our study, organised according to the research questions outlined in the introduction.

#### 3.1. RQ 1: What is the present status of research on the adoption of e-learning implementation in rural tertiary institutions?

A few studies were conducted in 2018 that examined the adoption of e-learning at rural tertiary institutions (figure 2). The majority of studies on e-learning in rural tertiary institutions were

published from 2020 to 2024 [5, 7].



**Figure 2:** Distribution of reviewed articles according to year.

After the main topic was identified, a more thorough investigation was conducted. A deeper understanding of the subtleties and specific focal points embedded within the main topic was made possible through investigation. The authors, the topic of the articles, and the year of publication are presented in table 2.

Table 2: Characteristics of the selected studies.

Authors	Article title	State, province	Year
Afolabi and Ajani [2]	South African rural students' adoption and use of learning management systems	Durban, KwaZulu-Natal	2023
Burtsev [13]	Adoption of Learning Management Systems at South African Learning Institutions	Cape Town, Western Cape	2021
Matarirano et al. [40]	External factors affecting blackboard learning management system adoption by students: Evidence from a historically disadvantaged higher education institution in South Africa	Mthatha, Eastern Cape	2021
Zwane and Mudau [70]	South African Rural University Students' Experiences of Open Distance E-Learning Support	Pretoria, Gauteng	2024
Mutambara and Bayaga [49]	Rural-based Science, Technology, Engineering and Mathematics teachers' and learners' acceptance of mobile learning	KwaZulu-Natal	2020
Dube [19]	Rural online learning in the context of COVID 19 in South Africa: Evoking an inclusive education approach	Free State	2020
Madimabe and Omodan [34]	Investigating the Effects of E-Learning as a Method of Curriculum Dissemination for Rural TVET College Students	Free State	2021
Van der Merwe [65]	Lecturers' Adoption of Blackboard As a Learning Management System At a South African Higher Education Institution	Pretoria, Gauteng	2021
Oyetade, Zuva and Harmse [54]	Technology Adoption in Education: A Systematic Literature Review	Vaal, Gauteng	2020

*Continued on next page*

Table 2 – continued from previous page

Authors	Article title	State, province	Year
Zhou, Smith and Al-Samarraie [68]	Digital technology adaptation and initiatives: a systematic review of teaching and learning during COVID-19	Pretoria, Gauteng	2023
Aruleba, Jere and Matari-rano [9]	Technology Adoption Readiness in Disadvantaged Universities during COVID-19 Pandemic in South Africa	Fort Hare, Eastern Cape	2024
Ngandu [52]	Adoption of Learning Management Systems among Information Technology educators at a Rural South African University: an Activity Systems Perspective	Cape Town, Western Cape	2022
Sims [63]	Online education and learning management system usage in a South African Economic and management faculty during COVID-19	Cape Town, Western Cape	2024
Maluleke [36]	Usage of Blackboard Learn for Teaching and Learning in the Historically Disadvantaged Institution: Challenges and Prospects	Polokwane, Limpopo	2024
Chomunorwa and Mugobo [15]	Challenges of e-learning adoption in South African public schools: Learners' perspectives	Cape Town, Western Cape	2023
Kilfoil [31]	Moving beyond the hype: A contextualised view of learning with technology in higher education	Pretoria, Gauteng	2023
Mhlongo et al. [44]	Challenges, opportunities, and prospects of adopting and using smart digital technologies in learning environments: An iterative review	Pretoria, Gauteng	2023
Pillay and Jarbandhan [58]	Technological Adoption and Doctoral Supervision during the COVID-19 Pandemic	Stellenbosch, Western Cape	2023
Temoso and Myeki [64]	Estimating South African Higher Education Productivity and Its Determinants Using Färe-Primont Index: Are Historically Disadvantaged Universities Catching Up?	Bloemfontein, Free State	2023
Marongwe and Garidzirai [38]	Together but Not Together: Challenges of Remote Learning for Students Amid the COVID-19 Pandemic in Rural South African Universities COVID-19	Johannesburg, Gauteng	2022
Ng'ambi et al. [51]	Technology enhanced teaching and learning in South African higher education – A rearview of a 20 year journey	Cape Town, Western Cape	2024
Hlatshwayo [25]	Online Learning during the South African Covid-19 Lockdown: University Students Left to Their Own Devices	Johannesburg, Gauteng	2022

Research from 2018 to 2024, focusing on rural tertiary institutions in South Africa, reveals that the evaluation of e-learning implementation remains limited, fragmented, and often lacks a comprehensive or integrative framework. However, key themes have emerged from the available studies, which reflect both progress and persistent gaps.

Most evaluations focus on individual components such as student satisfaction, access, or technical readiness rather than assessing e-learning holistically. There is a lack of consistent use of integrative evaluation models that combine pedagogical, technological, infrastructural, psychological, and socio-

economic dimensions. This fragmented approach has hindered the development of comprehensive understandings of e-learning effectiveness in rural contexts.

In terms of predominant focus areas, studies have extensively examined digital divide issues, highlighting poor internet connectivity, lack of electricity, and limited access to devices in rural areas. Evaluations often assess institutional and staff readiness, but overlook deeper integration issues, such as curriculum alignment and adaptive learning models. Research has also documented student struggles with digital literacy, limited interaction, and high dropout rates in online courses.

Regarding theoretical and evaluation frameworks, few studies employ well-established integrative models such as the TPACK (Technological Pedagogical Content Knowledge), Community of Inquiry (CoI), or the ADDIE instructional design model. Evaluations are often descriptive and lack the depth needed for strategic decision-making or long-term planning.

Nevertheless, emerging research trends show promise. Some recent studies are beginning to adopt multi-dimensional frameworks, combining technology, pedagogy, and socio-cultural contexts. Action research and case studies are being increasingly used to gather insights directly from educators and students in rural contexts.

A significant concern is the underrepresentation of rural institutions in the literature. There is a notable research bias toward urban institutions, resulting in a limited body of knowledge explicitly focused on rural tertiary institutions. This lack of localised research has made it difficult to develop tailored e-learning strategies that address rural-specific challenges.

Finally, evaluative research often highlights policy and institutional support gaps, revealing a disconnect between national e-learning policies and their implementation at rural campuses. There is limited evidence of feedback loops where evaluation outcomes influence policy adjustments or strategic investments in rural settings.

### **3.2. RQ 2: What e-learning issues were discovered in studies about South African rural tertiary institutions between 2018 and 2024?**

Cultural attitudes towards technology within an institution can greatly impact its adoption. Resistance to change, often rooted in fear of the unknown or reluctance to alter established practices, can be a significant barrier. This resistance can stem from both staff and students who may be comfortable with traditional methods or sceptical about the benefits of new technologies.

According to Rogers's diffusion of innovations theory [23], the perceived attitudes toward innovation, such as its relative advantage, compatibility, and complexity, influence its adoption rate. Therefore, fostering a positive attitude towards technology and demonstrating its benefits is essential for overcoming resistance.

Research conducted from 2018 to 2024, focusing on rural tertiary institutions in South Africa, reveals the challenges associated with the adoption of e-learning implementation in these institutions. From the SLR conducted in this study, the following findings were identified.

Financial limitations pose a significant challenge to the adoption of technology in higher education. The cost of acquiring, maintaining, and upgrading technology can be prohibitive for many institutions, especially those in developing countries or those with limited budgets. According to Buabeng-Andoh [12], the availability of funds significantly impacts an institution's ability to adopt new technologies, as financial resources are needed not only for initial purchases but also for ongoing support and training.

Closely related to financial constraints is the lack of data, Wi-Fi, and access to digital devices, which negatively affects the new type of learning, according to most consulted sources. Research by Muhuro and Kang'ethe [47] found that many institutions face limitations due to unpredictable or non-existent network coverage characteristics in rural areas, which hinder the broader adoption of blended learning.

Another significant challenge concerns the lack of adequate training. Successful technology adoption necessitates that both instructors and students receive sufficient training to use new tools and systems. Insufficient training can result in the underuse or improper use of available technologies,

potentially undermining the benefits these technologies are intended to provide. The results of this study indicate that certain institutions struggle to upskill academic staff and students in familiarising them with new technologies, and are significantly less prepared for the new type of learning, a finding strongly emphasised by du Plessis et al. [18].

Furthermore, reduced interaction and less in-person engagement present considerable problems for online learning. The growth of vital interpersonal, teamwork, and communication skills may be impacted by the lack of physical classrooms and face-to-face interactions with peers and teachers. To address this, educators must employ tactics and tools that promote participation, facilitate deep connections, and foster online learning communities [19].

Additionally, a lack of immediate feedback and individualised support is another issue that can occur in online education and e-learning. Students can communicate directly with teachers in a traditional classroom, ask questions, and get prompt answers. Nevertheless, communication and response times may be slower in online settings, which could hinder prompt question answering or clarification [54].

Finally, instructional design presents a notable challenge. Defined by Wagner [66] as the systematic development of instructional specifications based on learning and instructional theory, effective instructional design is crucial for ensuring the quality of instruction. Typically, a unit that assists teachers with technical and pedagogical matters provides this type of design, although instructors are sometimes required to develop it themselves. A study conducted by Temoso and Myeki [64] highlighted problems arising from a lack of adequately qualified staff members to support instructors with pedagogical and technical issues.

### 3.3. Possible solutions and comparative analysis

Based on the review conducted in this study, several solutions are proposed to facilitate the easy adoption of e-learning technology in rural tertiary institutions in South Africa.

The first consideration involves addressing cultural attitudes and resistance to change. Research by Lassoued, Alhendawi and Bashitialshaaer [32] suggests that the majority of institutions have chosen traditional instruction for many years without considering new teaching approaches. However, technology enables innovative teaching strategies, such as blended learning, interactive multimedia presentations, and e-learning. Educators can utilise various digital tools and resources to design engaging and customised learning experiences for students.

Equally important is the provision of adequate financial resources. According to research by Dube [19], data should be accessible to students and lecturers in rural areas, as suggested by the results of this study. Given the available data, it can be agreed that this could facilitate the blended learning process for students and lecturers, particularly if in-person lectures are not an option. Additionally, a study by Marwala [39] emphasises that a complete transition to this new type of learning, at the very least, requires access to devices, data, and Wi-Fi. In this context, Lassoued, Alhendawi and Bashitialshaaer [32] asserts that educational institutions must leverage advancements in communication technology to offer their programs to students who want to pursue higher education at any time and from any location.

Facilitating conditions through training and professional development also emerge as critical solutions. Numerous authors have mentioned the lack of technical support in e-learning environments [21, 43, 57, 61]. Furthermore, a study by Coopasami, Knight and Pete [16] noted the lack of support staff, whereas work done by Yakubu and Dasuki [67] is more specific, pointing to a lack of technical staff knowledge, empathy, and response. To create visually appealing and user-friendly systems, technical staff must collaborate with instructors, as noted by Gupta et al. [24].

Improving ICT infrastructure represents another essential solution. Several authors draw attention to ICT infrastructure challenges, which include inadequate internet and network connections, as well as software and hardware typically found in computer labs. Research by Ansong, Boateng and Boateng [6] suggested that the adoption rate of e-learning is significantly influenced by the ICT infrastructure available. In contrast, difficulties using the LMS are caused by a lack of devices

[43]. The study by Mutisya and Makokha [50] supports this finding, pointing to the absence of computers on campus as one of the most significant barriers to e-learning adoption. Furthermore, other authors [27, 45] also pointed out that a lack of relevant software and computer hardware, along with inadequate or non-existent ICT facilities, play a significant role in hindering the adoption of e-learning technology in rural tertiary institutions. Problems with campus network and bandwidth were also identified by Eze, Chinedu-Eze and Bello [20], Mncedisi Christian Maphalala and [45].

Finally, instructional design and support require attention. A study by Zozie and Chawinga [69] found that training is necessary in other areas, like audio and video, even though a range of media is used. Incompatibilities occur when learning hubs circumvent requirements for hardware and software when utilising particular tools, such as video streaming [24].

Understanding these solutions requires consideration of the broader context, including comparisons between rural and urban settings. While urban cities generally benefit from strong ICT infrastructure, device availability, and institutional support, they also encounter unique challenges such as digital fatigue, inequity among disadvantaged groups, and over-dependence on commercial platforms.

**Table 3**

Comparison of e-learning implementation in rural areas with urban cities.

Aspect	Rural areas		Urban cities		Changes in recent years	Recommended actions
	Advantages	Problems	Advantages	Problems		
Internet connectivity	Gradual expansion of mobile networks	Limited broadband, unstable connections	Widespread broadband, 4G/5G access	High cost of data for some groups	Connectivity improved overall, but rural gaps remain	Expand rural broadband subsidies; invest in satellite internet
Access to devices	Growing mobile phone penetration	Few households with laptops/tablets	High availability of laptops, PCs, tablets	Digital divide persists for low-income learners	Device ownership increased, but rural lag continues	Implement device loan programs and shared digital labs
Cost of e-Learning	Mobile-first learning lowers some costs	Affordability remains a barrier	Institutions subsidise platforms and resources	High subscription costs for advanced tools	Costs declining, but affordability gap persists	Introduce government-supported open e-learning platforms
Digital literacy	Training programs starting in schools	Limited ICT skills among teachers and students	Higher baseline ICT competence	Older learners still struggle with adaptation	Digital literacy improving in both contexts	Invest in teacher ICT training in rural schools
Infrastructure	Use of community centres or hubs	Electricity shortages, poor infrastructure	Reliable electricity, modern classrooms	Overcrowding and infrastructure stress	Infrastructure slowly improving	Hybrid models using solar-powered hubs in rural areas
Content localisation	Growing adoption of mobile learning apps in local languages	Lack of localised content, cultural mismatch	Abundant resources in global languages	Sometimes neglects local cultural needs	Localisation improving with EdTech startups	Develop context-sensitive curricula for rural learners
Flexibility and accessibility	Remote access reduces travel burden	Lack of continuous access limits usage	Anytime access with stable internet	High pressure always to be online	Access improved, but rural still disadvantaged	Encourage offline-friendly apps with downloadable content
Engagement and motivation	Interactive apps attract first-time learners	Isolation, lack of peer community	Peer networks enhance collaboration	Online fatigue, distractions	Motivation challenges present in both contexts	Blend online with community-based peer learning
Teacher support	Some NGOs provide teacher e-training	Teachers lack confidence in digital teaching	Teacher training is more structured	Resistance from some traditional educators	Teacher readiness is improving slowly	Provide continuous digital pedagogy support programs
Policy and support	Increasing government interest in rural ICT	Limited policy execution, funding delays	Stronger institutional support, private partnerships	Bureaucratic challenges in scaling	Policy focus has shifted toward inclusivity post-COVID	Strengthen rural-targeted e-learning policies and funding

In contrast, rural areas often face infrastructural barriers, limited connectivity, and affordability constraints; yet, they also present emerging opportunities through community-driven models, mobile-first adoption, and localised e-learning innovations. Table 3 presents a comparative analysis of e-learning in rural areas and urban cities, examining their advantages, problems encountered, recent changes, and recommendations.

#### 4. Conclusion

Academic institutions are adopting E-learning as a result of its widespread expansion. Course management, accessibility, and flexibility all encourage enrolment. Academic institutions are making significant investments in information technology infrastructure and place a high value on e-learning. According to prior research, the future of higher tertiary institutions lies in e-learning. By optimising time and resources, institutions can enhance creativity while cutting costs. Students benefit from increased access to information, flexible scheduling, and better work-study balance, which can boost their productivity. Instructors gain the advantage of conducting lectures from home, employing innovative teaching techniques, and easing their workload.

Timely and strategic actions must be taken by institutional management to guarantee the successful implementation of e-learning. Training staff and students in the use of e-learning systems is vital to encourage adoption and effective use. Moreover, maintaining a robust and user-friendly e-learning system with regular updates is essential. In summary, technology is key to improving student engagement, satisfaction, and academic success by offering interactive, personalised, and accessible learning experiences. Technology can be used to help lecturers create inclusive, dynamic learning environments that help students realise their full potential.

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