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# Digital Learning, Educational Equity, and Sustainable Development in Rural Higher Education: A Qualitative Study of Learning Management System Use in South Africa

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**Abstract.** The research investigates how Learning Management System implementations affect educational equality and environmental sustainability at a South African rural university. The research investigates two main objectives: identifying all significant challenges undergraduate students face and evaluating the effectiveness of digital learning technologies in creating inclusive educational environments. The researchers used a postpositivist qualitative approach to collect data through semi-structured interviews with 15 undergraduate students who represented different faculties and academic levels. The researchers used thematic analysis to understand student experiences. The research results show two distinct ways in which the system helps and creates obstacles for users. The Learning Management System enabled students to access learning resources, which allowed them to learn at their own pace while maintaining their educational progress. The system provided advantages, despite digital infrastructure limitations, digital literacy gaps, and socioeconomic division among users. Students explained to the researchers that digital platforms increase existing inequalities because institutions fail to provide students with essential support. The additional research results demonstrate that implementing solutions aligned with cultural practices and maintaining data privacy protects student participation in educational activities. The study demonstrates that higher education institutions can achieve sustainable development through digital learning systems, which they should implement together with social inclusion initiatives and institutional development

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programmes. Digital learning technologies will create structural barriers to access because educational institutions lack proper equity-focused policies and dedicated funding programmes. The research presents student perspectives from a marginalised higher education background to examine how digital learning affects educational equity in the context of sustainable development.

**Keywords:** Digital divide; Educational equity; E-learning; Learning management systems; Post-positivism; Rural higher education; South Africa; Sustainable development

## 1. Introduction

Digital technologies now function as essential components of higher education. They create new methods for teaching and learning while establishing new standards for educational programmes and institutional methods to support student learning and institutional development. Through their global and African implementations, educational institutions utilise digital learning to create flexible educational opportunities which increase access to education while establishing educational systems that can endure social and economic disruptions (Warschauer, 2003; OECD, 2022). Sustainability in this context refers to all three areas of environmental sustainability, social equity, and ethical practices, which ensure educational institutions can provide students with valuable learning experiences over time (Sen, 1999; Ajani & Govender, 2025).

Higher education institutions use Learning Management Systems as their main digital platform to achieve their educational objectives. The LMS platforms deliver educational materials to learners and enable users to communicate with one another, while they enable teachers to deliver both hybrid and digital learning experiences, and educational institutions use LMS platforms to achieve their educational targets, which support United Nations Sustainable Development Goals that specifically relate to Goal 4 (United Nations, 2015; Lotriet & Twinomurizi, 2021). The assumption that people who work in educational institutions will achieve equal results through LMS implementation, driven by a desire for sustainable outcomes through digital technology, creates major challenges because educational institutions do not have equal access to digital resources, and their digital capabilities differ.

Digital divide research shows that people who lack access to digital tools face different barriers due to their economic status and geographic location (van Dijk, 2005a, 2006; van Deursen et al., 2021; Vassiakopoulou & Hustad, 2023). Research shows that rural areas face multiple digital disadvantages because their residents lack access to broadband networks, face high data usage costs for broadband internet, and experience regular maintenance problems with their existing infrastructure (Hale et al., 2010; Rey Moreno et al., 2016; Swart et al., 2023). The South African government has established two major policies through its National Development Plan and its 2022 review, which states that digital connectivity and education must serve as essential elements for advancing development and social inclusion (National Planning Commission, 2012, 2022).

The infrastructure in rural areas still falls short of urban standards due to limited broadband access and poor network performance, hindering students' effective use of digital learning resources (Swart et al., 2023; Wyrzykowski, 2023). The high expense of mobile data and persistent electricity shortages create infrastructure problems that especially harm educational institutions and rural communities (Competition Commission South Africa, 2019; Sutherland, 2021; Mabunda et al., 2023). The need for digital learning exists in low-income areas, where technology creates new educational inequalities because people lack access to the educational resources available in those areas (Mutsvairo & Ragnedda, 2019; Seeletso, 2022).

The digital vicious cycle concept explains how social disadvantage restricts people's access to digital resources, while their lack of digital skills creates barriers that lead to social exclusion (Warren, 2007). The digital cycle shows that students at rural universities experience financial difficulties, which create barriers to their use of digital resources, while they receive inadequate support from their educational institutions (Seretse et al., 2018; Okoye, 2021). The COVID-19 pandemic highlighted existing educational disparities worldwide, as rural students could not fully participate in emergency remote teaching and assessment, underscoring how fragile digital education systems can be when they face structural limits (Haffejee et al., 2024).

Sustainability requires educational equity that extends beyond access to digital educational resources. Digital learning systems need to establish their presence within educational institutions through their actual use in educational programmes, along with their support mechanisms, because institutions should customise their systems to match local needs and students' actual experiences (Ajani, 2025; Ajani & Govender, 2024). The core aspects of sustainable LMS implementation in rural universities are ethical factors, which include data protection measures and algorithm errors, and the local use of LMS systems (Ajani et al., 2026). Digital exclusion can be reduced through educational content which has zero data charges and through technology which enables offline access to learning and through community internet systems, while their success depends on ongoing funding and policy alignment and development of institutional abilities (Budree et al., 2017; McBurnie et al., 2020; Masonta, 2023; Learning Equality, 2025).

The existing research on digital inequality and higher education in South Africa has created a research gap, as it lacks studies that focus on students' actual experiences and views at rural universities and examine their daily use of Learning Management Systems. Existing research mainly examines policy, infrastructure, and institutional frameworks, which do not provide detailed information about how students use Learning Management Systems when they face limited digital resources (Reddick et al., 2024; van de Werfhorst et al., 2022). The research lacks this element, thereby limiting understanding of the practical operation of digital learning platforms and their connections to sustainability and equity initiatives.

The use of the Learning Management System at a university in rural South Africa. The study uses digital vicious cycle theory to analyse how LMS usage patterns emerge from existing digital access limitations, which shape the evolution of educational practices towards sustainable development and equal opportunity teaching methods. The research uses student opinions to move beyond traditional views, which see digital technology as either entirely transformative or entirely restrictive of educational possibilities in rural higher education. The study is guided by the following research objectives:

1. To examine the experiences of undergraduate students in rural South African universities in accessing and using the institutional Learning Management System (LMS), including the challenges posed by infrastructural, socio-economic, and digital literacy barriers.
2. To explore how digital literacy, prior schooling, and socio-economic factors influence equitable engagement with the LMS and the effectiveness of digital learning in rural higher education contexts.
3. To identify strategies and recommendations for promoting sustainable, contextually relevant, and ethically informed digital education, including the design of support systems, pedagogical practices, and infrastructure improvements.

## **2. Literature Review**

The discussion about digital education in universities involves complex issues related to equitable access, environmental preservation, and academic progress. The discussion centres on Learning Management Systems (LMSs), which serve as educational resources that can drive major social change and academic improvement. The literature review examines how South African universities adopt Learning Management Systems (LMSs) across three interrelated areas: ongoing digital access issues and the connection between digital education and equity and sustainability, and the specific conditions of rural South African universities.

### **2.1 The Persisting Digital Divide: Beyond Mere Access**

Researchers have expanded the definition of the digital divide to include digital literacy, essential skills, and actual technology use, which goes beyond initial digital access limitations (van Dijk, 2005a, 2006; van Deursen et al., 2021). Research by the European Commission (2022), OECD (2022), Swart et al. (2023), and Wyrzykowski (2023) shows that rural areas face three main challenges: lower broadband access, insufficient internet service, and high internet connection costs.

The electricity supply interruptions which rural South African students experience create multiple infrastructural barriers that prevent them from using technology effectively (Mabunda et al., 2023). Zero-rated platforms enable people to access the internet, but they create limited online spaces that do not address inequality (Romanosky & Chetty, 2018). The "digital vicious cycle" concept shows how social disadvantage and restricted digital access work together to prevent students from participating in school and learning from digital platforms

(Warren, 2007; van de Werfhorst et al., 2022). An effective solution requires comprehensive systems that address three main factors: basic systems, price levels, and digital education capacity (Vassiakopoulou & Hustad, 2023; Zheng et al., 2024).

## **2.2 Digital Education, Equity, and Sustainable Pedagogy**

Digital educational equity needs to extend beyond internet access because it requires students to achieve specific educational outcomes through their technology-based academic activities, mirroring Sen's (1999) Capability Approach. The LMS value extends beyond its basic existence because it functions as a tool which enables students to develop skills and control their learning process while achieving their academic targets (Lamberti et al., 2021; Giwad, 2024). Sustainable digital teaching focuses on three main factors: the environmental impact of information and communication technology (ICT) systems; the economic costs of maintaining digital services; and the social benefits and social justice of digital programmes (Lotriet & Twinomurinzi, 2021).

Sustainable development requires organisations to focus on designing and executing their operations. The implementation of offline-first technologies, context-aware learning strategies, and teacher training programmes is an essential component in creating inclusive digital education systems that provide resilient learning experiences (Learning Equality, 2025; Ajani & Govender, 2025; Maphalala & Ajani, 2024). The equal distribution of resources and environmental protection both depend on data-handling practices, including safeguarding personal information, ensuring algorithmic fairness, and developing culturally appropriate materials for learning management systems (Ajani et al., 2026; Braun & Clarke, 2023). The concept of "Sustainable Digital Pedagogy" is defined by three elements: technological, human, and environmental factors that together form educational pathways that meet accessibility requirements, ethical standards, and contextual educational needs.

## **2.3 Rural Higher Education in South Africa: Contextual Challenges**

Rural South African universities serve as a demonstration of how digital technology, socioeconomic factors, and infrastructure deficiencies create educational barriers. South Africa's National Development Plan 2030 and its national policy frameworks identify information and communication technologies (ICTs) as crucial elements in developing educational programmes that include all students. However, actual conditions indicate that local networks exhibit greater connectivity problems, higher costs, and incomplete access to ICT services (National Planning Commission, 2012, 2022; Seretse et al., 2018; Rey-Moreno et al., 2016). During the COVID-19 pandemic, digital support systems proved their limitations when disadvantaged students were unable to access online learning materials, leading to increased dropout rates (Okoye, 2021; Haffejee et al., 2024).

The proposed solution to these problems involves using context-aware methods. Community-owned networks, together with self-directed learning programmes and restorative teaching approaches, create a framework that connects local situations with digital technology and sustainable development goals (Pather &

Rey-Moreno, 2018; Maphalala & Ajani, 2024; Simmonds & Ajani, 2022). Research shows that teacher training programmes and curriculum development, and Learning Management System (LMS) implementation must consider the cultural practices of rural communities (Ajani, 2025; Ajani & Govender, 2024).

## **2.4 Research Gap**

Existing research on digital inequality in higher education includes insufficient studies that examine how rural students experience LMS-based learning. This study investigates three main areas: their operational systems and their digital learning methods but does not establish how these systems affect students' daily digital learning activities. The existing gap needs to be addressed because it limits current understanding of how LMS systems align with equity and sustainability goals, especially in schools in rural areas that lack resources (Reddick et al., 2024; van de Werfhorst et al., 2022).

## **2.5 Summary**

Digital learning systems have the power to transform education, yet they face limitations imposed by the existing conditions that dominate higher education in rural South Africa. Digital learning systems need equitable and sustainable solutions which combine infrastructure development with human resource training and teaching methods, ethical standards, and environmental sustainability. The present study seeks to address the identified research gap by examining rural undergraduate students' experiences with LMS use, thereby providing empirical insight into how digital learning platforms can both empower and constrain educational participation.

The Sustainable Digital Pedagogy method establishes itself as a main theme that connects digital access with capability development and environmental sustainability, while creating a framework that explains how LMS functions affect student control and educational outcomes across different social and educational environments.

## **3. Methodology**

### **3.1 Research Design**

Using a post-positivist approach, this qualitative research study investigated how undergraduate students experienced Learning Management System technologies at a South African rural university. The researchers chose a qualitative research design to study how students handle digital learning tools because the research site experienced both economic and structural inequalities. Qualitative research allows researchers to examine social complexities as they unfold in real life and to understand how people make sense of their daily experiences (Creswell & Creswell, 2018).

The post-positivist approach recognises that social reality exists because individuals perceive and interpret their environment, yet research can generate trustworthy results through structured research methods (Phillips & Burbules, 2000). The research study used this approach to gather student voices and maintain control over the research process through precisely defined procedures

that handled all data collection and analysis activities. The research design enabled the researchers to achieve their study goals, which included examining how students used Learning Management Systems to achieve educational equity in resource-limited environments.

The study used a qualitative case study method to investigate one rural public university. The researchers conducted a thorough analysis of digital learning methods at one university in a specific geographical area, but they recognised that their findings had analytical value rather than statistical generalizability (Yin, 2018).

### 3.2 Research Participants and Sampling

The study involved fifteen undergraduate students enrolled at a rural South African university (Table 1).

**Table 1: Participant Demographic Information**

Participant Code	Age Range (Years)	Gender	Faculty	Level of Study
P1	18-20	Female	Education	First year
P2	21-23	Male	Humanities & Social Sciences	Second year
P3	21-23	Female	Science, Agriculture & Engineering	Second year
P4	24-26	Male	Commerce, Arts and Law	Third year
P5	18-20	Female	Education	First year
P6	21-23	Female	Humanities & Social Sciences	Second year
P7	24-26	Male	Science, Agriculture & Engineering	Third year
P8	21-23	Female	Commerce, Arts and Law	Second year
P9	18-20	Male	Education	First year
P10	24-26	Female	Humanities & Social Sciences	Third year
P11	21-23	Male	Science, Agriculture & Engineering	Second year
P12	27 and above	Female	Commerce, Arts and Law	Fourth year
P13	24-26	Male	Education	Third year
P14	21-23	Female	Humanities & Social Sciences	Second year
P15	27 and above	Male	Science, Agriculture & Engineering	Fourth year

The researchers selected participants through purposive sampling, a standard qualitative research method for identifying cases that contain valuable information about the studied phenomenon (Patton, 2015). The researchers required participants to be registered undergraduate students who had used the institutional Learning Management System for at least one academic year.

The study sample included students from different academic programmes and at various levels of academic progress, enabling researchers to examine students from multiple fields of study with varying lengths of experience with the Learning Management System. The researchers collected basic demographic information about participants, including age, gender, and faculty affiliation, as displayed in Table 1 above. The study achieved greater analytical depth by linking participants' experiences to both academic and social contexts.

The research required 15 study participants because qualitative research demands a deep understanding rather than numerical representation. Researchers continued data collection until they achieved thematic saturation, which occurred when researchers ceased to discover new information during additional interviews (Guest, Bunce and Johnson, 2006).

### **3.3 Research Instruments and Data Collection**

Researchers used semi-structured individual interviews to gather data, which effectively enabled participants to provide complete accounts while allowing researchers to ask new questions as they arose (Kvale & Brinkmann, 2015). The research team created an interview guide based on the research objectives and existing study materials on digital inequality, educational technology, and higher education research in Global South countries (Warren, 2007; van Deursen et al., 2021; Lotriet & Twinomurizi, 2021).

The interview questions focused on key indicators aligned with the study variables, including access to digital infrastructure, patterns of LMS use, perceived educational benefits, barriers to engagement, and the perceived relationship between digital learning, equity, and sustainability. The institution used English as its official language of instruction, so researchers conducted all interviews in English without requiring translation services.

Researchers conducted face-to-face interviews with participants in private locations on campus, and each interview lasted from forty-five minutes to sixty minutes. The interview setup allowed researchers to build relationships with participants while enabling participants to share their experiences without restrictions. The researchers used audio recordings of interviews, with participants' approval, to create word-for-word transcripts that ensured interview accuracy.

The research team established data collection credibility through an evaluation of the interview guide by educational technology experts who specialised in qualitative research. The research team made minor adjustments to enhance alignment and clarity of the research questions.

### **3.4 Data Analysis**

The researchers used Braun and Clarke's (2006, 2023) thematic analysis framework to analyse their data. Researchers chose this method because it provides flexible analytical capabilities for identifying meaning patterns in qualitative data while maintaining theoretical separation from other research

methods. The research process involved six stages: data exploration, initial coding, theme identification, theme evaluation, theme definition and naming, and final analytic narrative development.

The research team used NVivo software to electronically analyse all transcripts, allowing them to systematically code and manage their data. The researchers applied inductive coding methods, which enabled them to identify themes that emerged from the data instead of using pre-existing themes. Researchers studied both semantic and latent meanings to understand what participants said, as well as the fundamental beliefs and environmental factors that affected their experiences.

The research team established trustworthiness through various approaches. The researchers established credibility through extensive engagement with the data, including multiple coding methods and careful analysis of participants' direct quotations. Researchers established dependability through their method of maintaining a complete record that showed the process they used to analyse data and develop research themes. The researchers achieved transferability through their detailed summary of the research context, along with participant information and the institutional research environment, which allowed readers to evaluate how the study results applied to similar situations (Lincoln & Guba, 1985).

### **3.5 Ethical Considerations**

The researchers received ethical approval from the institutional ethics committee before beginning data collection. The researchers provided all study participants with complete information about the study objectives, their option to participate, and their right to terminate participation at any time without penalty. The researchers obtained written informed consent from every study participant.

The researchers maintained participant confidentiality and anonymity by using pseudonyms and eliminating all identifiable data from study transcripts and reports. The research team kept audio recordings and transcripts in a secure location accessible only to team members. The study required extensive data privacy measures because it used digital technologies that required protection and because educational technology research has particular ethical implications (Ajani et al., 2026).

The researchers-maintained awareness of power dynamics throughout their research while using reflexivity to reduce study bias and build an authentic representation of participants' experiences.

## **4. Results and Findings**

The research results from semi-structured interviews (**Appendix 1**) with 15 undergraduate students at a rural South African university. The researchers used reflexive thematic analysis, following Braun and Clarke's (2006, 2023) iterative method, which identified recurring themes in participant accounts while maintaining awareness of contextual and organisational factors. The analysis

produced four connected themes (Table 2), which demonstrate that access depends on infrastructure limitations and on digital literacy to enable fair participation; that the Learning Management System provides both educational advantages and boundaries; and that institutions need to provide contextually appropriate, sustainable support.

**Table 2: Summary of Research Findings**

<b>Research Focus</b>	<b>Emerging Theme</b>	<b>Sample Participant Quote</b>
How do students access and use the LMS?	Conditional Access and the Infrastructural Barrier	<i>"I have to budget for data like I budget for food. Some weeks, the data runs out before the assignments are downloaded."</i> (Participant 7)
What factors enable or constrain effective use?	Digital Literacy as a Precondition for Equity	<i>"I knew how to use WhatsApp, but the LMS was different... I spent hours just trying to find where the lecturer posted the lecture notes."</i> (Participant 4)
What is the perceived impact on learning?	The LMS as a Double-Edged Sword for Learning	<i>"It's just a dumping ground for PDFs. There is no discussion, no 'life'. It feels like a one-way street."</i> (Participant 2)
What institutional responses are needed?	The Imperative for Contextually Relevant Support	<i>"Who has access to my activity data? And are these systems built for someone like me?"</i> (Participant 15)

The LMS student experience research shows that student capabilities and institutional factors combine to create conditions which determine digital sustainability and institutional equity at South African universities.

#### **4.1 Conditional Access and Infrastructural Constraints**

All fifteen interviewees described their LMS access as conditional because it was unstable and failed to provide uninterrupted access. Students established access conditions that depended on three main factors: controlling mobile data costs, access to electricity, and network services. Thirteen participants identified mobile data costs as a regular obstacle, demonstrating that access to digital learning resources depends on a person's socio-economic status, as shown in South African policy documents and academic research (Competition Commission South Africa, 2019; Swart et al., 2023).

Participant 7 explained that schools budget their data expenditure as if it were food, because school operations stop when their data supply runs out. Students at the school needed to choose between using their academic data and their personal communication data, according to Participant 1, who explained that students had to make this decision. The student identified obstacles that their analysts discovered through research, showing that two main factors created geographical gaps in digital access between urban and rural areas: uneven broadband coverage and insufficient competition among telecommunications providers in rural areas (Wyrzykowski, 2023).

Load shedding emerged as a particularly disruptive factor affecting assignment workflows. Eleven participants reported interruptions in the submission process due to sudden power outages, resulting in loss of progress during file uploads. Participant 12 stated that assignment uploads should continue until power outages force students to pause work due to submission deadlines. Participant 5 described his academic work schedule as dependent on the electricity supply schedule rather than his normal study times. Infrastructural instability created difficulties for students, leading to resource shortages that affected their online learning processes, mirroring the experience of other resource-constrained environments (Mabunda et al., 2023).

#### **4.2 Digital Literacy, Prior Schooling, and Unequal Readiness**

The main theme of the research identified digital literacy as an ability which people acquire based on their previous educational experiences. The LMS's first experience with 10 participants revealed three main reactions: confusion, anxiety, and trial-and-error, especially among students who had studied in schools that lacked computer access. Participant 4 explained that their school did not provide students with computer access. The school assumes that students arrive with all the necessary knowledge to use these computers. The LMS was easier for students from better-funded schools to navigate than for their classmates, according to Participant 11.

These findings show that digital literacy develops through educational advantages which build over time, which explains why educational institutions should not only provide students with device access. The analysis showed that students framed their personal problems as obstacles, even though their actual obstacles stemmed from educational inequalities in schools and from insufficient institutional support. The LMS operated as a gatekeeping system, granting access to users with prior digital skills, because it served as a system that developed digital skills for users.

Students who needed to adopt LMS learning methods without proper support faced sustainability challenges because universities lacked organised methods for developing digital skills. The findings from this study support the need to integrate digital skills development into study programmes, as students need these skills for academic success (Lotriet & Twinomurinzi, 2021).

#### **4.3 The LMS as an Enabling Constraining Learning Environment**

The participants described the LMS system as a learning tool that provides students with two main advantages: it centralises educational materials and allows students to access their studies at different times. Students used their access to recorded classroom sessions and downloadable presentation materials because they attended separate classes, which made it difficult for them to reach their classes. The recording system allowed students who missed classes to access the class material, creating a situation in which students who did not use it could not keep up with the class content.

The system offers two main instructional advantages, yet it imposes substantial limitations on teaching. Eight participants reported using the LMS system for two

purposes: sharing course materials and working with other students. The system operates as a platform where teachers deliver educational resources, while they exit the platform according to Participant 2, who operates the system. Participants found that discussion forums were underused, limiting students' opportunities to work together in learning activities.

The LMS functions as a dual-character tool, presenting multiple advantages and disadvantages. Sustainable digital pedagogy research shows that technological solutions achieve their full potential only when integrated with educational methods that support diverse learning needs (Maphalala & Ajani, 2024; Ajani & Govender, 2025). The analytical evaluation identified institutional practices that prioritised operational efficiency over user interaction as the main barrier to educational sustainability through technological systems.

#### **4.4 Contextual Support, Ethics, and Sustainability Concerns**

The final theme concerned the need for support systems that are contextually responsive, ethically grounded, and sustainable. The participants required structured training programmes that included technical support facilities in their area and clearer communication about LMS system requirements. Participant 6 suggested compulsory first-year workshops, while Participant 10 emphasised peer-mentoring models as more culturally accessible.

Data privacy emerged as a specific concern, most explicitly raised by Participant 15, who questioned the visibility and use of student activity data within the LMS. The participant stated about his activities, "I don't know who is watching what I click", and "whether it can be used against me." The analysis shows that four participants directly expressed their concern, but it connects their concern to broader discussions about surveillance, algorithmic governance, and ethical sustainability within digital education (Ajani et al., 2025).

The issues which need to be resolved demonstrate that sustainable development consists of more than building systems and managing expenses, since it requires establishing trust relationships, maintaining transparency, and delivering culturally appropriate solutions. LMS implementation becomes an extractive process when the project fails to consider ethical issues alongside environmental conditions, as this approach creates a digital system that organisations perceive as foreign rather than their own.

#### **4.5. Summary of Findings**

The findings show that students experienced LMS system performance through their personal choices, which connected with existing institutional rules. Students identified immediate obstacles, including data costs and insufficient skills; however, the investigation revealed fundamental systemic problems in infrastructure, instructional methods, and institutional structures. The need for sustained investments in human resources, ethical oversight, and location-based educational methods emerges as a fundamental requirement for achieving equitable digital change in rural higher education institutions, with sustainability serving as a connecting principle.

In conclusion, the results provide a picture of digital learning that is closely linked to the problems of structural inequality. The LMS did not serve as an unbiased instrument; instead, it became a place where broader societal problems, such as economic inequality, poor infrastructure, and unequal prior educational backgrounds, were reflected in the education system. The LMS, while offering some practical advantages, was mainly dependent on the institution's readiness and capacity to overcome these basic barriers through targeted, ethical, and contextually grounded interventions to realise its potential as a contributor to fair and sustainable education.

## 5. Discussion

The researchers investigated how digital education interacts with equal educational opportunities and sustainable development at a university situated in a South African rural area. The research results show that Learning Management Systems are acquired and used through an interconnected system that students access. The discussion synthesises the main study's findings with existing literature to demonstrate how digital learning outcomes apply to Global South discussions of digital higher education in rural areas.

The research identified three primary elements as its major findings. The LMS system provided access only to certain users who faced financial limitations, including data costs and interruptions to electricity supply and internet connectivity. The digital literacy levels, which differed across users, created hidden barriers that prevented users from participating in essential activities. The LMS system offered students multiple learning options but limited their ability to interact with others and gain a deeper understanding of the material. The digital learning programmes remained operational through institutional funding but lacked adequate institutional backing for ethical and educational design practices.

The current research findings closely match those from other regions of the Global South. Research findings from rural universities in Kenya, Nigeria, India, and Bangladesh indicate that LMS systems replicate existing offline educational disparities unless institutions fund both infrastructure and digital skill development (Budree et al., 2017; Okoye, 2021; Reddick et al., 2024). Research conducted in Latin America and Southeast Asia found that LMS systems provide advantages to students who already possess digital skills, thereby creating social divisions in educational access (Lamberti et al., 2021; Zheng et al., 2024). The current research shows that LMS systems used in rural areas of the Global South continue to face existing limitations rather than delivering rural educational transformation.

Digital learning, educational equality, and environmental sustainability interact through a process of mutual influence. Digital learning platforms provide users with access to educational content, but educational equity determines which users can access them, while sustainability determines how long users can continue to access these benefits. The system breaks down when it weakens.

The study highlights three financial elements of performance: data spending, system performance, and platform upkeep. The LMS system costs that students had to cover during load shedding demonstrate how educational institutions shifted their operational expenses onto students. Students at rural schools in India and Sub-Saharan Africa must bear hidden expenses that make online learning unaffordable yet unworkable (McBurnie et al., 2020; OECD, 2022).

Social sustainability focuses on activities which include people and help them develop life skills. The research found that students needed specific skills to use LMS functions, which they had not acquired in their basic education. People can achieve valued outcomes through real freedom when they develop capabilities in line with Sen's capability approach, which holds that development should measure people's actual capabilities rather than their access to resources (Sen, 1999). The adoption of LMS systems becomes socially unfeasible due to systems that do not provide organised digital skill development for all users (van Deursen et al., 2021).

The LMS serves as an educational platform which supports sustainable digital teaching through its dual function of providing educational benefits. The platform enables students to learn through its recorded lectures, online learning system, and online classroom resources, yet these features do not change teaching methods. The students were asked to interact about their studies, using specific terminology to describe what they needed from their instructors and educational facilities.

The Global South research institutions initially used LMS systems for educational purposes, which later evolved into management systems (Budree et al., 2017; Ajani & Govender, 2025). The method of shallow system integration produces short-term efficiency gains but causes students to abandon their studies, leading to lower knowledge-sharing rates. Digital teaching needs to move away from content transfer, which requires learning activities that promote student conversations and collaboration while giving them control of their classroom time (Lotriet & Twinomurizi, 2021).

The findings show that a decolonised digital learning system needs to be established. Digital systems, according to a decolonised digital framework, require contextual factors to take precedence over their technological features. The design process involves creating LMS systems that enable users to learn during internet outages, support multiple languages, and consider students' personal experiences as vital knowledge sources.

The approach aligns with scholarship that questions the uncritical application of Global North digital systems in areas facing resource shortages (Simmonds & Ajani, 2022; Ajani, 2025). Decolonised digital teaching systems use technology as a fundamental component of local knowledge systems, cultural customs, and physical environments. The social value of this approach increases the likelihood that users will adopt it over the long term.

The study's findings have limited generalisability because the researchers investigated only one rural institution. The study's results provide deep qualitative insights that researchers can use to analyse similar rural higher education institutions in underfunded areas across the Global South. The research requires future development through comparative studies that examine multiple locations or through studies that assess digital skills development over different time periods.

The research results establish multiple practical applications despite limitations in the literature. Institutions should develop comprehensive systems that connect their infrastructure investments with digital literacy initiatives, as well as their instructional methods and ethical governance practices. The system will fail to achieve its objectives because implementing a learning management system will create new barriers that educational institutions must address.

Conversely, the study shows that rural higher education institutions use Learning Management Systems that depend on financial, social, and educational factors that shape their learning environment. Organisations need to develop immersive digital learning systems that require the availability of digital content, alongside equity initiatives and sustainability practices, to achieve their equitable and sustainable development goals. The learning management system functions as an enabling infrastructure when all system components work together. The system becomes a tool that perpetuates social disparity when its components do not work together. Digital system implementation poses a primary challenge for rural universities, which must establish local methods grounded in ethical principles and inclusive, sustainable development practices.

## **6. Implications and Recommendations**

Higher education institutions planning to establish Learning Management Systems in remote areas with limited resources must understand the study's findings, which identify crucial barriers to their efforts. All digital learning projects should now be viewed as social educational programmes which require institutional policies to establish their operation across all academic institutions.

The study results, together with existing Global South research, provide evidence that LMS systems need simultaneous funding for infrastructure development, affordable data access, and stable electricity supply in order to achieve financial viability and prevent social discrimination (van Dijk, 2005b; Swart et al., 2023; Reddick et al., 2024). According to the OECD 2022 report and the National Planning Commission 2022 guidelines, universities and governments must include digital learning strategies in their development planning processes, treating internet connectivity and digital access as critical educational resources.

The study results show that academic institutions need to establish digital literacy as an essential academic competency which students must acquire. The first academic year should include structured digital literacy programmes that offer credit and become integrated into the curriculum. Students need training programmes that match their diverse educational backgrounds to gain practical

experience with LMS functions, online academic activities, and online communication standards (van Deursen et al., 2021; Chen et al., 2025). The research indicates that organisations need to develop their capabilities through continuous programmes, as this process will help them maintain social sustainability and prevent educational inequality from recurring in online learning settings (Lamberti et al., 2021; Lotriet & Twinomurinzi, 2021).

Educational institutions need to implement digital teaching methods that promote sustainable, interactive learning processes, according to research. The lecturers need specialised training to use Learning Management System tools for collaborative learning, formative assessment, and student interaction, rather than just transferring information. Research shows that student participation and educational outcomes improve when programmes use structured discussion forums and peer review activities, and when blended synchronous learning methods are used in similar educational settings (Budree et al., 2017; Ajani & Govender, 2025). The decolonised digital framework will enhance pedagogical relevance and long-term sustainability when it incorporates local contexts, multilingualism, and student decision-making authority (Simmonds & Ajani, 2022; Ajani, 2025).

The study's findings demonstrate that ethical standards and governance frameworks are crucial for maintaining digital learning systems. Educational institutions must establish explicit policies on data protection, algorithm transparency, and student data rights to build trust with users who will operate their platforms (Ajani et al., 2025; Braun & Clarke, 2023). The study recommends participatory governance systems that allow students to shape LMS tools through their input, as this approach improves both authenticity and local adaptability. The study results show that rural higher education institutions need to establish environmental sustainability through synchronised efforts that connect policy development and teaching methods, infrastructure development, and ethical standards, rather than relying on separate technological solutions.

## **7. Conclusion**

The study investigated how the use of the Learning Management System affected equity and sustainability at a South African rural university by analysing students' experiences with system access and utilisation, as well as institutional support. The study investigated whether the institutional adoption of learning management systems accomplished its goal of promoting inclusive and sustainable education or whether it maintained existing power imbalances through digital technology.

The findings demonstrate that the LMS functioned as a conditional resource rather than a uniformly enabling one. Students used the platform to access study materials and track their learning progress, but encountered multiple obstacles due to high data charges, power outages, and inadequate institutional facilities. The study identified digital literacy as its most important discovery. Students who accessed the LMS system through their prior educational experiences and digital technology exposure demonstrated that digital literacy remained insufficient for

achieving equitable access and that outside assistance was required. The absence of organised digital literacy training led students with existing digital skills to dominate LMS usage, resulting in increased, rather than decreased, academic division. The findings of this research show that current LMS systems support educational activities but create barriers that prevent equitable access and sustainable development.

The study demonstrates that remote regional higher education institutions need to establish complete institutional frameworks for sustainable digital education. University administrators need to expand platform purchases into comprehensive infrastructure development, encompassing reliable systems, digital literacy programmes integrated into the curriculum, interactive LMS teaching methods, and responsible management practices. Future research should analyse this study across multiple rural educational institutions, using longitudinal studies to assess how student outcomes develop over time as capacity development activities continue. The research will investigate methods for creating digital systems that provide equitable access and support sustainable development.

### **8. Limitations of the Study**

The researchers acknowledge the multiple limitations of their work, which affect how results should be understood. First, the study used qualitative methods and a single rural university as its research site, which limits the applicability of the results to other rural and urban higher education institutions with different institutional environments, resource distributions, and student population characteristics. The study relies on self-reported experiences, as participants reported them through their learning management system and digital literacy abilities, because recollection difficulties and social acceptance needs affected how they described their experiences.

The research includes student perspectives, which provide valuable information, but the study lacks essential data from academic staff, institutional leadership, and technical support staff who experienced operational challenges across policy, teaching, and infrastructure systems. The research design presents data from a single point in time, omitting information on how institutional support, digital skills, and infrastructure enhancements evolved over the research period. The research needs to use multi-site approaches which incorporate various research methods and track developments over time to study sustainable and fair digital learning systems in rural higher education environments.

### **Conflict of Interest**

The authors declare no conflicts of interest.

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## Appendix 1

### Interview Guide

**Study Title:** Experiences of Undergraduate Students with Learning Management Systems in Rural South African Universities

**Purpose:** To explore student experiences, challenges, and perceptions regarding the use of the institutional Learning Management System (LMS) and the factors affecting equitable and sustainable digital learning.

**Participant Pseudonym:** .....

**Date of Interview:** .....

**Mode:** [Face-to-Face / Online]

**Duration:** \_\_\_\_\_ minutes

#### Section A: Background Information

1. What is your age?
2. What is your gender?
3. Which faculty and year of study are you in?

#### Section B: Access and Infrastructure

5. How do you usually access the LMS (device, internet connection)?
6. How often do you experience disruptions due to electricity outages, load shedding, or internet connectivity issues? Can you describe how these affect your LMS use?
7. Do you face any financial barriers in accessing the LMS, such as data costs? Please provide examples.

#### Section C: Digital Literacy and Skills

8. How confident are you in using the LMS?
9. In what ways did your prior schooling prepare you (or not) to use digital learning platforms?
10. Have you received any formal training or guidance from the university on using the LMS?

#### Section D: LMS Features and Learning Experience

11. Which features of the LMS do you find most useful for your learning? Why?
12. Are there features you find difficult to use or ineffective? Please explain.
13. How interactive or engaging do you find the LMS for discussions, assignments, and group work?

#### Section E: Privacy, Ethics, and Support

14. Are you aware of who can access your data on the LMS? Does this concern you?
15. What kind of support (technical, pedagogical, or ethical guidance) would improve your experience with the LMS?

**Section F: Overall Perceptions and Recommendations**

16. How has the LMS affected your academic progress and learning outcomes?
17. What changes would you recommend making the LMS more accessible, equitable, and sustainable?