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Prospects and Challenges to ICT Adoption in Teaching and Learning at Rural South African Universities: A Systematic Review

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ABSTRACT

This study aimed to systematically review the prospects and challenges associated with adopting Information and Communication Technology (ICT) in teaching and learning at rural universities in South Africa. To achieve this aim, a systematic review methodology was employed. The systematic review findings revealed a multifaceted landscape wherein opportunities for enhancing education through ICT exist alongside significant challenges. Prospects include the potential for technology to bridge educational gaps, increase accessibility, and provide innovative learning experiences. However, challenges such as inadequate infrastructure, limited connectivity, and varying levels of digital literacy pose significant impediments. The study emphasizes the need for targeted interventions to address these challenges, including infrastructure development, capacity building, and localized content creation. Additionally, recommendations for flexible learning models and collaborative partnerships are outlined to facilitate effective ICT adoption in the unique context of rural South African universities. Continuous research and evaluation are advocated to inform future strategies and ensure sustainable improvements in rural education through ICT integration.

KEYWORDS

ICT Prospects; ICT Challenges; ICT Adoption; Rural Universities; Teaching and Learning.

INTRODUCTION AND BACKGROUND

The adoption of Information and Communication Technology (ICT) in educational settings has become increasingly significant in shaping the learning landscape. The importance of ICT adoption and its potential impact on teaching and learning outcomes cannot be overstated. According to Sayaf et al. (2022) and Sharma and Srivastava (2020), ICT provides students and educators with access to a vast amount of information, including the Internet, which serves as a global repository of knowledge. This enables learners to explore diverse perspectives, access up-to-date information, and engage in self-directed learning. Furthermore, ICT tools offer a variety of instructional methods that cater to different learning styles (Qaddumi et al., 2021). Interactive simulations, multimedia presentations, and educational software can make complex concepts more understandable, engaging, and accessible.

Gupta et al. (2020) alluded that ICT also facilitates collaboration among students and educators worldwide through online platforms, video conferencing, and collaborative tools that enable students to connect with peers and experts from different cultures, fostering a global perspective and encouraging collaborative problem-solving. Moreover, ICT allows for personalised learning experiences tailored to individual needs and abilities (Goh & Sigala, 2020). As such, adaptive learning platforms and educational apps could be used to access a student's progress and provide targeted resources, ensuring that each learner can progress at their own pace. It also supports ongoing professional development for educators. Online courses, webinars, and collaborative platforms keep lecturers updated on the latest educational trends, teaching methodologies, and technology integration strategies (Goh & Sigala, 2020; Sayaf *et al*., 2022).

In addition, ICT streamlines administrative tasks such as grading, attendance tracking, and communication with parents, allowing teachers to focus more on instructional activities and student engagement (Liesa-Orús et al., 2020). As technology is an integral part of the modern world, incorporating ICT in education is perceived to help students develop essential digital literacy skills. These skills are crucial for success in both higher education and the workforce. In other words, the inclusion of interactive and multimedia elements in educational content captures student’s attention and enhances engagement (Qaddumi et al., 2021). Similarly, gamified learning platforms and virtual reality applications can make the learning experience more enjoyable and motivating (Fernández-Gutiérrez et al., 2020; Gupta *et al*., 2020).

Indeed, ICT adoption in education prepares students for the demands of the digital age. Familiarity with technology and digital tools equips them with the skills needed for future careers that increasingly rely on technological proficiency (Gupta et al., 2020; Hsu & Lin, 2020). Educational institutions could also utilize data analytics to gather insights into student performance, identify learning trends, and make informed decisions to improve teaching methodologies and curriculum design. Thus, the adoption of ICT in education has the potential to transform teaching and learning, making education more accessible, engaging, and tailored

to individual needs. It plays a crucial role in preparing students for the challenges of the modern world and promoting lifelong learning.

While the adoption of ICT in education offers numerous benefits, its implementation in the context of rural South African universities faces specific challenges. These challenges are believed to hinder the effective integration of technology into teaching and learning. Rural universities often lack robust ICT infrastructure, including reliable internet connectivity and electricity (Maphalala & Adigun, 2021; Dube, 2020). As such, insufficient infrastructure can impede the deployment of online learning platforms, video conferencing, and other technology-dependent resources. Lembani, Gunter, Breines, and Dalu (2020) emphasized that disparities in access to digital devices and the internet exacerbate the digital divide. Many students in rural universities in South Africa may not own personal devices like laptops or have consistent access to the internet, making it challenging for them to participate in online learning activities.

It is also evident that rural universities face financial constraints that limit their ability to invest in ICT infrastructure and training programs (Mukuna & Aloka, 2020). As such, limited budgets hinder the purchase of necessary hardware and software and the maintenance of ICT facilities. On the other hand, students and educators in rural universities may have limited exposure to and experience with technology. Consequently, insufficient training and low technological literacy among faculty members and students can hinder the effective use of ICT tools for teaching and learning. ICT resources and content may not always be culturally relevant or appropriately localized for the context of rural South Africa, but adapting digital content to align with local languages and cultural norms is crucial for effective learning (Motala & Menon, 2020; Oke & Fernandes, 2020).

Recently, rural areas have experienced frequent power outages, which can disrupt ICT-enabled teaching and learning activities. Thus, the lack of a consistent electricity supply poses a significant challenge for running computer labs, charging devices, and conducting online sessions (Mirata et al., 2020). In most cases, rural universities in South Africa lack adequate technical support and maintenance personnel for ICT infrastructure (Nwosu et al., 2023; Dube, 2020). Thus, the absence of skilled IT professionals in the vicinity can lead to delays in addressing technical issues and maintaining the systems. Resistance to change, both among educators and students, is a common challenge in any context. In rural South African universities, traditional teaching methods may be deeply ingrained, and there may be resistance to adopting new pedagogical approaches facilitated by ICT (Mpungose, 2023).

According to Zenda and Dlamini (2023), inconsistent policies and regulations related to ICT in education can pose challenges, and a lack of clear guidelines and support from government authorities may hinder the planning and implementation of ICT initiatives in rural universities. Rural areas may face security challenges, including theft and vandalism, which can affect the safety and security of ICT equipment and infrastructure (Zenda & Dlamini, 2023; Mirata *et al*., 2020). Thus, addressing these challenges requires a comprehensive and collaborative approach involving government agencies, educational institutions, and

community stakeholders. Efforts should focus on improving infrastructure, providing training programs, fostering community engagement, and ensuring that ICT initiatives are aligned with the specific needs and contexts of rural South African universities.

Rationale of the Systematic Review

The rationale behind investigating the prospects and challenges of ICT adoption in teaching and learning within rural South African universities lies in the imperative need to bridge the digital divide and enhance educational outcomes in these underserved areas. Given the increasing significance of technology in education, comprehending the specific dynamics, opportunities, and obstacles faced by rural universities in South Africa is crucial for making well-informed decisions, formulating policies, and effectively implementing ICT initiatives. Rural South African universities confront a multifaceted set of challenges and opportunities when it comes to adopting Information and Communication Technology (ICT) for teaching and learning (Zenda & Dlamini, 2023; Oke & Fernandes, 2020).

Despite the potential advantages, such as expanded access to information and improved instructional methods (Gupta et al., 2020; Hsu & Lin, 2020), these institutions encounter distinct barriers, including limited infrastructure, issues related to the digital divide, financial constraints, and resistance to change (Maphalala & Adigun, 2021; Dube, 2020). This research aims to investigate and elucidate the specific prospects and challenges associated with ICT adoption within the context of rural South African universities. By addressing this knowledge gap, the study seeks to provide insights that could inform policies, interventions, and capacity-building endeavours to facilitate the effective integration of ICT, thereby promoting equitable and high-quality education in these underserved regions by optimizing the use of technology for enhanced learning experiences. To guide the systematic review, this study seeks to answer the following research questions:

- What are the prospects of ICT adoption in teaching and learning within rural South African universities?
- What are the challenges of ICT adoption in teaching and learning within rural South African universities?

RESEARCH METHOD

The prospects and challenges of ICT adoption in teaching and learning within rural South African universities were the subject of a systematic literature search across relevant databases. The systematic review methodology involves establishing specific inclusion and exclusion criteria for literature selection (Pan et al. H & Yang, 2021; Park & Lee, 2020), including studies conducted globally with a special focus on South Africa. Articles, reports, and academic papers were scrutinized based on predetermined inclusion criteria, ensuring a rigorous selection process (see Table 1). The selected studies were then critically appraised, and relevant data were extracted for analysis.

Table 1.

Inclusion and Exclusion Criteria for the Systematic Review of the prospects and challenges of ICT adoption in teaching and learning within rural South African universities.

	Inclusion Criteria:	Exclusion Criteria:
Publication Type	Only articles, reports, and academic papers are included in the review.	Non-academic sources, such as non-peer-reviewed articles, blog posts, and forum discussions, are excluded.
Time Frame	Publications within four years, not older than 2020, are included.	Publications older than four years are excluded.
Database Source	Only studies sourced from academic literature databases such as Google Scholar, ScienceDirect, and PubMed are considered.	Non-academic sources such as grey literature, conference abstracts, blog posts, and forum discussions are not considered.
Language	Studies must be available in the English language.	Studies not available in English are excluded due to language limitations.
Duplicate Publications	If multiple publications report on the same study, only the most comprehensive or recent publication is included to avoid redundancy.	Noncomprehensive or outdated publications are excluded.

Using search strategies, study selection, quality evaluation, and data synthesis, the process of recording and publishing scholarly arguments was carried out with great care. PRISMA and other established reporting requirements must be scrupulously followed to maintain the rigour and openness of the research process. This, in turn, creates a strong foundation for effectively synthesizing and interpreting the existing literature on the prospects and challenges of ICT adoption in teaching and learning within rural South African universities. To facilitate this systematic review, reputable academic literature databases such as Google Scholar, ScienceDirect, and PubMed were utilized.

Six academic studies from ScienceDirect relevant to this study were consulted, while twenty-six and four were consulted from Google Scholar and PubMed, respectively. Accordingly, the inclusion criteria also limit literature sourcing on publications within a four years time frame (2020-2023). Thus, fifteen and ten publications were included from 2020 and 2022, respectively, while the study included eight and three from 2023 and 2021, respectively.

The literature search entails identifying relevant databases and conducting a systematic search using keywords related to the research objectives to comprehensively retrieve vital data from the databases (Fitria, 2022; Pan *et al*., 2021). As such, keywords like ICT prospects and challenges, ICT adoption, rural universities, teaching, and learning were utilized to obtain relevant information from previous literature. The screening was conducted by evaluating article relevance based on titles and abstracts, applying inclusion and exclusion criteria, and conducting the screening independently for reliability. Emphasis was placed on obtaining and assessing selected articles' methodological rigor and relevance, extracting key data such as study design, sample size, findings, and limitations. The conclusion summarizes the main findings, provides implications for policymakers, researchers, and practitioners, and identifies areas for further research and potential interventions.

LITERATURE REVIEW

Adopting Information and Communication Technology (ICT) in higher education has experienced significant advancements worldwide. These developments have been driven by the rapid evolution of digital technologies, with various trends and considerations influencing this landscape (Gupta & Yadav, 2022; Goh & Sigala, 2020). According to Fernández-Gutiérrez, Gimenez, and Calero (2020), higher education institutions globally are undergoing digital transformations to improve teaching, learning, and administrative processes. Integrating learning management systems, online collaboration tools, and virtual learning environments has become commonplace. The proliferation of online education and the emergence of Massive Open Online Courses (MOOCs) have reshaped the delivery of academic content (Bao, 2020; Jansen et al., 2020).

Institutions increasingly adopt blended learning models, combining traditional face-to-face instruction with online resources. Efforts are being made to address issues of accessibility and inclusivity in higher education (Maphalala & Adigun, 2021). Technology is being leveraged to provide education to a more diverse and geographically dispersed student population, although challenges related to the digital divide persist. The adoption of ICT has facilitated student-centric approaches, allowing for personalized learning experiences (Anthony et al., 2022; Maphalala & Adigun, 2021). Adaptive learning technologies, interactive content, and data analytics contribute to a more tailored educational journey for students.

Despite the positive impact, challenges exist, including resistance to change, faculty development needs, cybersecurity concerns, and the requirement for adequate infrastructure. Additionally, the effectiveness of certain technologies in improving learning outcomes continues to be a topic of discussion. In South Africa, ICT adoption in higher education reflects global trends and unique challenges specific to the country's education (Maphalala & Adigun, 2021; Dube, 2020). Accordingly, South Africa has implemented policies to promote the integration of ICT in higher education (Lembani et al., 2020). These policies aim to bridge the digital divide, increase access to educational resources, and enhance the quality of teaching and learning.

Challenges related to digital inequality persist in South Africa, with disparities in technology access and internet connectivity. Efforts are being made to address these gaps, but socio-economic factors can impede widespread ICT adoption (Maphalala & Adigun, 2021; Lembani et al., 2020). The COVID-19 pandemic has accelerated the adoption of online learning in South Africa, as institutions were compelled to transition to remote teaching rapidly. This shift has highlighted both opportunities and challenges, underscoring the need for robust digital infrastructure. South Africa's diverse linguistic and cultural landscape adds complexity to ICT adoption. Customizing digital content and tools to accommodate different languages and cultural contexts is an ongoing consideration (Fitria, 2022; Goh et al., 2020). Collaboration among higher education institutions, government bodies, and industry partners is crucial for successfully adopting ICT. These joint efforts can address challenges and harness the potential of technology for educational advancement.

While global trends in ICT adoption shape the higher education landscape in South Africa, the country faces unique challenges that necessitate tailored strategies and collaborative efforts to ensure equitable access and effective integration of technology in the learning environment. Thus, a systematic review addressing these gaps would contribute to a more nuanced understanding of ICT adoption in rural South African universities, inform policy and decision-making processes, and provide a foundation for future research and interventions tailored to the specific needs of these institutions.

Synthesis of Literature Findings

The prospects of ICT adoption in teaching and learning at rural South African universities are significant; however, the realization of these prospects is hindered by several challenges, as discussed below:

Access to Technology

Government initiatives and private partnerships are crucial in addressing infrastructure gaps, particularly in improving technology accessibility in education. Governments should invest in developing and enhancing essential infrastructure in rural areas, such as reliable internet connectivity and electricity supply (Ndebele & Mbodila, 2022; Oke & Fernandes, 2020). This lays the foundation for successful technology implementation in education. Governments should also establish funding programs to improve ICT infrastructure in educational institutions, providing financial support for necessary hardware and software (Ndebele & Mbodila, 2022). Additionally, governments can formulate and implement policies that promote and prioritize the integration of technology in education, including guidelines for infrastructure development, digital literacy programs, and the use of mobile technologies (Rena & Mbukanma, 2023; Ndebele & Mbodila, 2022; Mukuna & Aloka, 2020).

Similarly, private sector entities can contribute significant financial resources to help educational institutions overcome infrastructure challenges through grants, sponsorships, or partnerships that focus on improving technology access in remote areas (Ndebele, 2022). Technology-oriented companies can collaborate with educational institutions to provide

affordable and suitable technology solutions, such as discounted hardware, software, or other necessary tools. Private partnerships can also include capacity building, such as organizing training programs and workshops to enhance the digital skills of educators and students.

Mobile technologies are particularly advantageous due to their widespread use and accessibility, even in remote areas. Using mobile devices for educational purposes can bridge the digital divide and provide learning opportunities to a larger population (Sayaf et al., 2022; Goh & Sigala, 2020). They often offer cost-effective solutions compared to traditional computer-based setups, making them a viable option for resource-constrained environments. Mobile devices are versatile tools supporting various educational applications, from interactive learning materials to communication platforms (Aruleba & Jere, 2022; Gupta et al., 2020). They can facilitate both formal and informal learning. Thus, the collaboration between government initiatives and private-sector partnerships is essential for addressing infrastructure gaps in education. The strategic use of mobile technologies can further enhance accessibility and contribute to the effective integration of technology in teaching and learning, particularly in rural areas. This collective effort is crucial for establishing an inclusive and technologically empowered education system.

Conversely, **r**ural areas often face infrastructure limitations that hinder their access to modern technology (Maphalala & Adigun, 2021; Dube, 2020). One significant issue is limited or inconsistent access to high-speed internet. This lack of connectivity inhibits communication, access to online resources, and participation in the digital economy. Additionally, residents in rural areas may not have the same access to modern devices such as smartphones, tablets, or computers due to cost and limited availability. Furthermore, unreliable power supply and poor telecommunication infrastructure further restrict connectivity. Lack of awareness and education about the benefits of technology can also contribute to resistance or disinterest in adopting modern devices (Fitria, 2022). Affordability is a significant factor for residents who may be unable to afford the upfront costs associated with technology. Moreover, remote and challenging terrains make it difficult to lay down the necessary infrastructure for connectivity (Motala & Menon, 2020; Oke & Fernandes, 2020). Limited access to digital education and training programs results in lower levels of digital literacy among rural residents (Maphalala & Adigun, 2021). To address these challenges, coordinated efforts are needed from government bodies, private organizations, and local communities. Initiatives such as infrastructure improvement, device subsidies, and the implementation of educational programs can help bridge the digital divide between rural and urban areas.

Digital Literacy

The implementation of training programs to enhance digital literacy is crucial in today's technology-driven world. Workshops provide a hands-on approach with practical exercises, discussions, and demonstrations (Boateng & Tindi, 2022; Jansen et al., 2020). They can cover various topics, such as basic digital skills, online safety, and digital collaboration tools. Online courses offer flexibility and can cover a wide range of topics, from basic computer skills to

advanced digital tools (Mirata et al., 2020). Platforms like Coursera, edX, and Khan Academy offer relevant courses. It is important to foster a collaborative learning environment using digital tools through forums, discussion groups, and collaborative projects. Perhaps, interactive e-learning modules should be developed with multimedia elements, quizzes, and simulations to cater to different learning styles.

It was suggested that digital literacy training should be integrated into the existing curriculum, not added as an extra burden (Mpungose, 2023; Motala & Menon, 2020). Thus, ongoing professional development programs should be offered to keep educators updated. Mentorship programs can be established to support peers, and webinars and guest speakers can provide valuable insights. Hands-on projects should be encouraged to reinforce learning and show the relevance of digital literacy. Regular assessments should be implemented to evaluate the effectiveness of the training programs. By combining these approaches, institutions can create comprehensive and effective training programs for educators and learners.

On the other hand, the lack of digital literacy skills among faculty and students is a common concern in education. Digital literacy effectively uses digital tools and technologies to find, evaluate, create, and communicate information (Faloye & Ajayi, 2022). The rapid evolution of technology can make it challenging for faculty and students to keep up. One way to address this is to implement continuous professional development programs for faculty and integrated student digital literacy courses (Aruleba et al., 2022). These programs can help keep them informed about the latest tools and trends. It is important to note that individuals have varying prior exposure to digital technologies when entering educational institutions. Conducting pre-assessment surveys to understand the existing digital literacy levels of both faculty and students can help tailor training programs to their specific needs. Another obstacle is the lack of access to digital resources and tools, which can hinder the development of digital literacy skills.

To bridge this gap, educational institutions should ensure they have the necessary infrastructure and resources, such as computer labs, high-speed internet, and licensed software (Farias-Gaytan et al., 2023). Faculty may also need more training in incorporating digital literacy into their teaching methods (Meng et al., 2023; Oke, & Fernandes, 2020). Therefore, institutions should invest in faculty development programs focusing on integrating digital literacy. These programs can provide workshops, online courses, and mentorship opportunities. Some individuals may resist incorporating digital tools due to a fear of change or a preference for traditional teaching methods. To overcome this resistance, it is important to promote a culture of openness to change and demonstrate the benefits of digital tools. Additionally, digital literacy skills may not be explicitly integrated into the curriculum.

By incorporating digital literacy into the curriculum across various subjects and disciplines, students can develop these skills organically as part of their overall education. Assessing digital literacy skills can be challenging and may not receive enough emphasis. Designing assessments that evaluate digital literacy skills and incorporating them into grading systems can incentivize both faculty and students to focus on improving these skills (Qaddumi

et al., 2021; Sharma & Srivastava, 2020). Addressing these issues requires a holistic approach that involves collaboration between educational institutions, educators, students, and policymakers. Hence, regularly reassessing the digital literacy needs and updating training programs accordingly is essential in the ever-evolving digital landscape.

Curriculum Integration

A phased approach to curriculum integration involves gradually incorporating Information and Communication Technology (ICT) into educational curricula. This approach helps educators and institutions adapt to technological changes without overwhelming stakeholders (Ajani, 2023; Makrakis, & Kostoulas-Makrakis, 2023). Faculty development programs are essential in providing teachers with the skills and knowledge needed to integrate ICT into their teaching methods effectively. These programs may include training sessions, workshops, and ongoing support to ensure educators feel confident using technology. Emphasizing the benefits of ICT in enhancing learning outcomes is crucial in promoting acceptance among educators and students. By showcasing how technology facilitates interactive and engaging learning experiences, provides access to a wide range of resources, and encourages collaboration, stakeholders can be motivated to embrace technological integration (Oke & Fernandes, 2020; Park & Lee, 2020). Hence, a phased approach to curriculum integration, along with faculty development programs and a focus on the positive impacts of ICT, can facilitate a smoother transition towards incorporating technology in education.

On the contrary, integrating Information and Communication Technology (ICT) into the curriculum may encounter resistance or challenges, particularly in aligning with established teaching methods. A significant factor is the insufficient training of many educators in effectively utilizing ICT tools, leading to resistance when teachers feel unprepared or lack confidence in incorporating technology into their teaching practices (Ajani, 2023; Makrakis, & Kostoulas-Makrakis, 2023). Additionally, the absence of necessary technological infrastructure or limited access to ICT resources in schools can impede the smooth integration of technology into the curriculum (Gupta & Yadav, 2022). According to Motala and Menon (2020), the ingrained preference for traditional teaching methods among some teachers and educational institutions can contribute to resistance. Embracing ICT necessitates a shift in pedagogical approaches, and reluctance to depart from familiar methods may result in resistance. Moreover, the financial aspect plays a role, as implementing ICT requires hardware, software, and ongoing maintenance investments. Budget constraints further complicate the adoption and sustainability of ICT integration in schools.

Aligning ICT with existing curriculum goals and learning objectives poses a challenge, with teachers perceiving a potential disconnect between traditional subjects and incorporating technology, fostering resistance (Motala & Menon, 2020; Oke & Fernandes, 2020). Students' varying levels of familiarity and comfort with technology can create challenges if there is a mismatch between their technological skills and the integrated ICT tools, impacting the learning process. The broader education system's general resistance to change adds another layer of

complexity, with stakeholders resisting the introduction of ICT due to concerns about disruptions or uncertainties associated with adopting new technologies. Addressing these challenges necessitates comprehensive training for educators, ensuring adequate technological infrastructure, and effectively communicating the benefits of ICT integration in enhancing learning outcomes. Successful resistance mitigation requires collaboration between educators, administrators, and policymakers to create an environment conducive to using ICT effectively in education.

Content Localization

Developing and promoting locally relevant digital content is crucial for enhancing engagement and effectiveness in education. By tailoring content to the local context, educators can make learning more relatable and meaningful for students. Collaboration with local content creators further enriches the educational experience, as these creators bring cultural insights, perspectives, and authenticity to the material (Moremoholo, 2023; Jansen et al., 2020; Lembani et al., 2020). Leveraging indigenous languages is a key aspect of creating a more inclusive educational environment. Language is a powerful tool for communication and understanding, and incorporating indigenous languages into educational content helps preserve cultural heritage while making learning accessible to a wider audience (Moremoholo, 2023).

This approach not only promotes linguistic diversity but also ensures that education is more inclusive and resonates with students' cultural identities. Overall, the combination of locally relevant digital content, collaboration with local content creators, and indigenous language use contribute to a more holistic and effective educational experience. It fosters a sense of connection, inclusivity, and cultural appreciation, ultimately benefiting the educational system and its communities (Jansen et al., 2020; Lembani et al., 2020).

However, **e**xisting educational content may not be tailored to the local context and languages, creating a potential barrier to effective learning. Educational materials developed without considering the local context may lack relevance to students' lives, making it challenging for them to engage and comprehend the content (Ahmad et al., 2023; Ajani, 2023). Language plays a crucial role in understanding and retention, and content not presented in the local language may hinder effective communication and learning (Heleta, 2023).

To address this issue, there is a need for the development and adaptation of educational content that aligns with the cultural and linguistic nuances of the specific community. Tailoring content to the local context ensures that it resonates with the experiences and backgrounds of the learners, making education more meaningful and accessible (Heleta, 2023; Fitria, 2022). This recognition of the importance of localization helps bridge gaps in understanding, enhances engagement, and contributes to a more effective learning experience.

Remote Learning Opportunities

Information and Communication Technology (ICT) is crucial in bridging educational gaps through various means. Virtual classrooms, online resources, and collaborative tools provided by ICT create opportunities for students to engage in interactive and dynamic learning experiences

(Gupta et al., 2020; Hsu & Lin, 2020). These digital tools can enhance the educational environment by offering multimedia content, interactive lessons, and real-time communication. One significant advantage of ICT in education is its ability to facilitate distance learning. Through online platforms and resources, students in remote or underserved areas can access quality education that might otherwise be unavailable. Distance learning eliminates geographical barriers, allowing students to connect with educational content, instructors, and peers regardless of their location (Qaddumi et al., 2021; Liesa-Orús et al., 2020).

ICT is a powerful enabler, making education more accessible and inclusive. Virtual classrooms and online resources provide a flexible and interactive learning environment, while collaborative tools foster communication and engagement (Makrakis & Kostoulas-Makrakis, 2023; Mpungose, 2023). This technological approach helps democratize education and contributes to a more equitable distribution of learning opportunities, particularly benefiting students in remote areas.

In rural areas, physical distances challenge face-to-face interactions in education. The geographical spread of communities in remote locations often results in limited access to educational resources and facilities. Schools, teachers, and students may be dispersed over large areas, making regular in-person interactions difficult (Liesa-Orús et al., 2020). This challenge can hinder the traditional model of education that relies heavily on face-to-face teaching. Students may face difficulties in attending schools regularly, teachers may find it challenging to reach every student, and educational infrastructure may be limited. As a result, there is a need for alternative approaches, such as leveraging technology for remote learning or adopting flexible education models that accommodate the geographical constraints of rural areas (Ndebele, 2022; Sayaf et al., 2022).

Addressing the issue of physical distances in rural education requires innovative solutions that take advantage of digital communication, virtual classrooms, and other technology-driven methods to ensure that quality education reaches all students, regardless of their location. Thus, while challenges exist, the prospects for ICT adoption in teaching and learning at rural South African universities are promising with targeted interventions, collaborations, and a strategic, phased approach. Addressing rural communities' unique needs and context will be essential for successful implementation.

Managerial Implications and Recommendations

The systematic review of prospects and challenges to ICT adoption in teaching and learning at rural South African universities reveals a complex landscape. While there are evident opportunities for leveraging ICT to enhance education, challenges, particularly related to infrastructure, connectivity, and digital literacy, persist in rural universities. The importance of addressing these challenges is paramount to unlock the full potential of ICT in education. Recommendations include investing in robust ICT infrastructure in rural universities, including reliable internet connectivity and access to necessary hardware. This is crucial for enabling the seamless integration of technology in teaching and learning. Implement comprehensive training

programs for educators and students to enhance digital literacy skills. This includes technical skills and the ability to effectively integrate ICT tools into the curriculum. Foster collaborations between universities, government agencies, and private entities to pool resources and expertise. This can help overcome financial constraints and promote sustainable ICT initiatives in rural education.

Develop and promote locally relevant digital content that aligns with rural communities' cultural context and languages. This ensures that educational materials resonate with the students, enhancing engagement and effectiveness. Explore flexible learning models, including blended learning and distance education, to accommodate the challenges posed by physical distances in rural areas. This requires adapting teaching methodologies to suit the unique circumstances of rural learners. Encourage ongoing research to monitor the impact of ICT adoption in rural education. Regular evaluations will provide insights into the effectiveness of interventions and inform future strategies for improvement. By addressing these recommendations, South African universities can work towards creating an inclusive and technologically empowered educational environment in rural areas, ultimately contributing to the overall advancement of education in the country.

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