Digital Divide or Digital Bridge? Evaluating the Impact of ICT Integration in South Africa's Rural Schools

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Abstract

The advent of the knowledge economy necessitates the development of specific skills pertinent to 21st-century citizens, such as global competitiveness and the proficient use of information and communication technologies (ICTs) for personal and economic advancement. In response, nations worldwide, both developed and developing, are reforming educational curricula and promoting the integration of ICTs in teaching and learning. South Africa is no exception and through policy initiatives aimed to enhance educational opportunities by equipping all schools with laptops and tablets by 2013. Rural schools were to be given particular attention through the development of eLearning. This study explores the alignment between eLearning policy directives and their implementation in rural schools. The research engaged five school principals and one district official, employing semi-structured interviews and document analysis as data collection methods. The findings reveal that teachers lack training to effectively integrate ICTs into educational practices. Despite a revised implementation strategy from 2013 to 2025, progress remains minimal and disproportionately favours smart schools within the province rather than a universal application. The study advocates for the KwaZulu-Natal education department to prioritise comprehensive ICT integration training for teachers across all educational phases. Furthermore, it recommends an expansive distribution of devices in form of tablets and laptops to include primary schools and calls for a national curriculum overhaul to meet the needs of the 21st-century learner. Teachers are also encouraged to proactively seek professional development opportunities independently of departmental offerings.

Keywords: *Rural; Elearning; Rural Schools; ICT in Schools*

1. Introduction

South Africa has enshrined education as a fundamental right in its constitution (Act 108 of 1996), declaring, "Every citizen has the right to basic education, including adult basic education, and to further education, which the state must make progressively accessible." This constitutional mandate demands equitable education delivery, focusing on practical approaches to rectify historical imbalances created by apartheid policies. During apartheid, starting in 1948, the National Party implemented policies that enforced racial segregation and controlled educational resources and cultural practices to maintain dominance (Labuschagne, 2017:71). Even 25 years post-apartheid, the legacy of these policies continues to affect South Africa, particularly in rural areas where challenges persist.

Rural communities in South Africa struggle with digital connectivity, exacerbated by poverty and inadequate infrastructure, which hinders their participation in modern digital advancements (Salemink, Strijker, & Bosworth, 2015:360). Globally, over 1.3 billion people live in severe poverty, predominantly in rural locales (Apata, Alani, & Bioku, 2015:151). Efforts like the Millennium Development Goals (MDGs) and the International Fund for Agricultural Development (IFAD) have aimed at reducing inequality by promoting universal education. However, education in rural South African schools remains problematic, affecting student outcomes. Teachers are reluctant to work in rural areas and lack training in adapting to these environments (Dlamini, 2018:86). Furthermore, approximately 1.4 billion people worldwide lack electricity access, 85% of whom are in rural regions of Sub-Saharan Africa, including 55% of rural South Africans. This deficit impacts educational quality as electricity is essential for effective teaching and learning (Longe, Ouahada, & Chinnamen, 2014:1).

In South Africa, a significant portion of the population, including those in rural areas, remains unaware of their human rights, limiting their capacity to advocate for governmental accountability and the protection of these rights (Mubangizi, 2015:497). UMzinyathi, a rural district in KwaZulu-Natal, exemplifies these challenges with its deep rural areas plagued by poor infrastructure development.

1.1 Types and Context of South Africa's Public Schools

Athiemoolam and Vermaak (2021) expound on the historical progression of public schools in South Africa, tracing the shift from the apartheid era to the post-apartheid period characterised by desegregation and educational transformation. In the past, schools were segregated based on race, leading to the isolation of learners from diverse ethnic backgrounds. The process of desegregation commenced in 1991 with the establishment of Model C schools, which initially catered to White students but later opened their doors to learners from other ethnicities due to declining White student enrollment. This shift signified a pivotal moment in South Africa's education system following the dismantling of apartheid laws, transitioning schools from homogenous to heterogeneous environments that embraced a non-racial educational approach. This transition aimed to eliminate educational disparities, as highlighted by Jordaan in Le Roux (1997) and elaborated on by Lemmer, Meier, and Van Wyk (2012).

The categorisation of schools into quintiles by the Department of Basic Education in South Africa is a strategic measure to address educational inequality by allocating government funding based on the socio-economic status of the communities they serve. Despite this framework, the allocated funding often proves insufficient to meet all educational requirements. Consequently, schools in more affluent areas, where parents can afford higher fees, tend to offer superior resources, smaller class sizes, and better academic outcomes. While attending a state school in quintiles 4 or 5 may be more cost-effective compared to private schooling, it remains financially burdensome for many families.

The quintile classification system mirrors a profound socio-economic disparity, with quintile 1 institutions primarily catering to underprivileged communities and quintile 5 schools serving wealthier

populations. Additionally, parents encounter formidable obstacles when selecting schools, including geographical constraints, limited school capacities, and financial constraints. Despite the existence of zoning regulations for public schools, parents can submit applications to schools outside their designated zones, albeit without a guarantee of acceptance. The prevalence of high demand and extensive waiting lists at urban schools of repute intensifies competition for enrollment, prompting individuals to consider rural and peri-urban schools, often positioned in lower quintiles and lacking adequate resources.

1.2 Problem Statement

Rural schools often battle infrastructural deficits, notably in their lack of internet connectivity, frequently attributed to the absence of necessary infrastructure such as ADSL lines. This deficiency hampers the implementation of educational innovations designed to enhance teaching and learning experiences. Salemink et al. (2015:360) highlight a growing disparity between well-equipped urban areas and underserved rural regions, a phenomenon they describe as a "rural penalty." This disparity manifests in a significant spatial digital divide, where individuals in remote areas experience pronounced inequality in access to educational resources. Consequently, this study aims to explore the dissemination and impact of innovative educational technologies in rural settings, focusing on their accessibility and benefits to learners irrespective of their geographic location.

1.3 Research Questions

This research investigates the alignment between policy objectives and the actual policy implimentation. The study explored the implementation of eLearning policies in rural, urban, and township schools within the uMzinyathi district since 2004. It also investigated the support provided to teachers as both policy implementers and agents of change. This involved examining the alignment between South African government policies intended to enhance education and the outcomes observed in these schools. First, however, it is helpful to understand the type and status of public schools in South Africa and the complexity this might pose to ICT integration.

2.Theoretical Grounding and Conceptual Framework

The theoretical framework and review of the relevant literature are discussed in this section, and thereafter, the study's methodology, findings and conclusion are discussed.

2.1 Theoretical Framework

For this study, we used a combined theoretical framework comprising Knowledge Diffusion Theory and Performance Management Theory to elucidate the inclusion of ICT in rural educational settings. Knowledge Diffusion Theory is pertinent as it explores how innovations, such as ICT tools, are communicated and adopted within a community. This theory will aid in understanding the spread of ICT innovations across rural schools and the factors influencing their adoption or rejection.

Performance Management Theory, on the other hand, offers insights into how the effectiveness of these ICT implementations can be evaluated within the educational sector. This theory emphasises the importance of setting performance standards, measuring outcomes against these standards, and adjusting strategies to improve educational outcomes. The integration of ICT in education will be assessed as an indicator of innovation acceptance and implementation success, examining whether these technologies have been effectively embraced and utilised to enhance educational practices in South Africa.

The Organization for Economic Cooperation and Development (OECD) underscores the importance of overcoming bureaucratic obstacles to allow for the spread of innovations within

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government entities (OECD, 2017:16). This involves ensuring that new ideas address the real needs and challenges faced by communities, thereby making innovations more relevant and likely to be adopted. Further, the OECD criticises research that focuses solely on the failures of government innovation projects without considering the complex political and economic environments in which these innovations are introduced (OECD, 2020:8). This perspective is critical as it highlights the need for a comprehensive evaluation of innovation projects that goes beyond mere success or failure.

The proposed theoretical framework guided the study in:

- Understanding and mapping the diffusion of ICT in rural schools, analysing the channels and barriers to this diffusion.
- Evaluating the performance and impact of ICT initiatives on educational outcomes in these settings.
- Assessing the effectiveness of governmental policies and support mechanisms in facilitating the adoption and implementation of ICT in education.

By employing this dual-theoretical approach, the study aimed to provide a nuanced analysis of the policy and practical realities concerning ICT in education, offering insights that could enhance policy formulation and the practical implementation of educational technologies in rural South Africa.

2.2 Varieties of ICT Learning

Information and Communication Technologies (ICT) encompass various components such as hardware, software, networks, mobile technology, satellite communications, video conferencing, RFID technology, and internet-based services, including social media and websites (Ojo & Adu, 2018:2; Kaur, 2015:8; Roy, 2015:73). ELearning, a prevalent method in both the corporate world and higher education, facilitates learning through both formal and informal levels via the intranet (LAN) or extranet (WAN), integrating synchronous technologies like real-time webinars and asynchronous technologies such as emails and online forums (Kaur, 2015: 8; Gnanam, Vetrivel, & Rama-Raju, 2016: 153).

The OECD (2016:101) traces the origins of eLearning back to the 19th century, which has evolved significantly by the mid-20th century, primarily in the UK and Spain. ELearning can occur synchronously in a single location or asynchronously across different locations. Modern eLearning utilises the internet extensively and can be categorised into four main approaches. *Web-supplemented courses* leverage web resources for passive course elements such as posting materials and assignments, eliminating the need for face-to-face interactions. *Web-dependent courses*, on the other hand, integrate substantial online components that are crucial for discussions, assessments, and projects. *Mixed-mode courses* blend traditional classroom learning with mandatory online activities, providing a hybrid learning environment. Lastly, *fully online courses* are conducted entirely over the internet, making them globally accessible and including options like Massive Open Online Courses (MOOCs), which cater to a wide range of educational needs at all stages of life.

Nevertheless, Srivastava (2016:40) cautions that ICT is not about computers only. Still, other devices like projectors, calculators, data sorting, digital recording equipment, multimedia resources and other information sources are available for teaching and learning. In addition, Mabusela and Adams (2017: 10221), Butcher (2003:30-31) augment the assertion that other resources support technologies used in teaching and learning. These include but are not limited to text, print, audio, radio, audiocassettes, video, television, and integrated multimedia.

2.3 South Africa Context CT Policy Development Guidelines

Literature underscores that effective ICT integration requires meticulous planning, dedicated government investment, and not merely reliance on donor funding. USAID outlines ten critical principles for

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policymakers to ensure successful ICT implementation in education, emphasising the alignment of ICT with educational objectives, enhancing learner information and skills, fostering data-driven decision making, and including all associated costs in budgetary considerations. These guidelines also advocate for exploring appropriate technological solutions, focusing on teacher development, engaging diverse stakeholders, establishing supportive policy environments, integrating monitoring and evaluation into project planning, and prioritising system strengthening over transformation.

Despite these guidelines, many countries, including South Africa, often overlook these comprehensive principles, leading to inadequate groundwork for policy implementation. This oversight can be addressed through substantial investment, advocacy, and capacity-building at various policy implementation levels. Jhurree (2005) suggests that well-crafted policies position citizens advantageously in the global market, enhancing their competitiveness. However, South Africa faces dual challenges: competing internationally with advanced economies and responding to a domestic market driven by information and knowledge rather than traditional industries. This mismatch between the educational outputs and market needs highlights the urgent necessity for curricular reforms to better prepare South Africans as globally competitive citizens in the knowledge economy. First however we need to understand policy and practical realities concerning ICT in education, offering insights that could enhance policy formulation and the practical implementation of educational technologies in rural South Africa.

2.4 South Africa's Policy on eLearning

South Africa developed its ICT policy on eLearning in 2004, with the objective that by 2013, all schools would be prepared to implement this policy, equipping teachers with laptops and learners with tablets to facilitate eLearning (RSA 2004). Despite the positive intentions of the policy, Hart and Laher (2015: 1) argue that its goals remain largely unmet. Additionally, as cited in Hennessy et al. (2010: 48), Naseem highlights the irony in South Africa's situation: despite being the wealthiest nation in Africa and possessing superior connectivity infrastructure, the country still reflects the general African challenge of limited computer and internet access.

In response, the Parliament of the Republic of South Africa initiated Operation Phakisa to analyse the ICT rollout, assessing the opportunities and hurdles of implementation. Findings from this initiative indicated that about twenty-six percent of teachers possess basic ICT skills. Only seven percent demonstrate intermediate skills in using ICT for educational purposes (Parliament, 2018: 6). Complementing this, Saal (2017: 95) notes that while a majority of South African teachers, specifically 80% who specialise in mathematics, do use computers, their usage is predominantly for administrative purposes and class preparation, rather than for direct educational engagement with students.

Furthermore, Padayachee (2017: 57) aligns with the Parliament's findings by pointing out the lack of a clear vision among South African teachers for integrating ICT into pedagogical practices. The report also mentioned that despite some schools' connectivity, the available speeds are insufficient for educational use. The major impediments to effective implementation include limited broadband access, especially in rural schools, budget constraints, inadequate funding, and limited corporate social investment support (Parliament, 2018: 9).

These challenges have necessitated a revision of the ICT rollout plan, now extended from 2013 to 2025. The revised strategic plan by the Department of Basic Education emphasises four key outputs: a coordinated implementation plan with ongoing support for e-education from 2013 to 2015, development and distribution of electronic multimedia resources, execution of a National Teacher Laptop Initiative (TLI), and completion of the Proof of Concept (PoC) scheme. This strategic plan lays out a phased approach—immediate, short, medium, and long-term—for achieving widespread e-education in South Africa.

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3. Methodology

A qualitative research approach was adopted to understand participants' perspectives from the UMzinyath district municipality on the realities of ICT's integration in rural schools. The adopted research approach is underpinned by the interpretivist worldview of the researcher, which focuses on uncovering the subjective meanings behind participants' experiences and perspectives. Data collection involved semi-structured interviews and document analysis to ensure an in-depth exploration that draws on a richer and more comprehensive data set. These data collection methods were employed to enhance the credibility and reliability of the research findings. Telephone interviews were used due to COVID-19 restriction protocols. This offered greater convenience for participants who are geographically isolated. The qualitative data analysis involved content and narrative analysis to identify and interpret patterns within the collected data. This involved carefully reading, transcribing and coding data sources to organise and identify key themes. This study observed required research protocols and sought ethical approval and the consent of participants before the interview.

4. Study Area

The study focuses on the UMzinyathi District in KwaZulu-Natal, one of the largest rural districts in the province, which faces multiple challenges, including poor education, inadequate infrastructure, and high unemployment rates. The district comprises four local municipalities: Endumeni, Msinga, Nquthu, and Umvoti. Endumeni, located in Dundee, features urban and rural communities and economically benefits from mining businesses. Msinga is predominantly rural, with communities relying on national government grants and lacking a rate payment system. Umvoti, similar to Endumeni, includes both rural and urban areas and benefits from businesses like timber. Nquthu, primarily rural, depends on national funding but was not included in the study. The research encompassed schools from Umvoti, Msinga, and Endumeni, aiming to assess resource allocation to facilitate the implementation of innovative policies. It included three schools in Endumeni (one urban, two townships), four rural schools in Msinga (two primary, two secondary), and three schools in Umvoti (two rural, one urban), though access issues prevented study in Msinga.

5. Presentation of Results

All text should adhere to the following format: 1.0-line spacing, justified alignment, size-10 font in Book Antiqua. The results derived from the data analyses should be articulated in alignment with the study's objectives. Utilize tables and figures as necessary to visually represent the analysis outcomes. The section should primarily focus on presenting the results, though it may incorporate discussions on the findings if the author opts not to allocate a separate section for such discussions. Employ sub-headings corresponding to the study's sub-objectives for clarity. Ensure that sub-headings are aligned to the left, italicized, and with the initial letter of each word capitalized.

6. Discussion of Findings

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This research investigates the alignment between policy objectives and the actual policy implementation. The study explored the implementation of eLearning policies in rural, urban, and township schools within the uMzinyathi district since 2004. It also investigated the support provided to teachers as both policy implementers and agents of change. The findings from the study have been presented using pseudonyms [Principal #0…]. Thematic analysis was employed to present the findings

from the research questions. From the data, six themes relating to the challenges experienced by the participants were identified, namely (2) Variations in eLearning policy implementation (2) Disparities in training teachers for eLearning (3) Disparities in access to funding (4) Connectivity Challenges (5) Teacher Attitudes Toward ICT (6) The province's stance on policy implementation.

Variations in eLearning Policy Implementation

The study reveals considerable variation in implementing eLearning policies across different types of schools in South Africa. Principals from various high schools in the district provided insights into their schools' adoption of eLearning, influenced significantly by their resources. A rural high school principal noted the inability to fully afford eLearning infrastructure, though they try to incorporate some elements like using the school library for internet access. In contrast, a township school has implemented eLearning partially, supported by NGO donations of computers, yet still faces limitations due to the government's incomplete provision of necessary equipment.

Former Model-C schools, which generally have better funding, displayed a more advanced integration of eLearning. These schools have moved beyond basic computer literacy to incorporate comprehensive programs like the International Computers Driver's License (ICDL), benefiting from previously established resources that allow for a broader range of digital learning tools, such as data projectors and specialised educational software.

The findings align with broader research, indicating that the potential for ICT integration in education offers significant opportunities for enhancing teaching and learning Durodolu and Mojapelo (2020), Castelyn, Viljoen, Dhai, and Pepper (2020) Graham, Stols and Kapp (2020). However, the disparity in resource allocation among schools continues to perpetuate educational inequalities. Effective policy implementation, therefore, remains uneven, with well-resourced schools advancing further while under-resourced schools struggle to catch up. This underscores the need for a more equitable distribution of resources and infrastructure development to ensure all schools can effectively implement eLearning strategies and improve educational outcomes across the board.

Disparities in Training Teachers for eLearning

Teacher training in eLearning is crucial for effectively integrating ICT in education. Initially, a phased strategy was aimed at training all educators by 2013, with progressive steps introduced in three phases to enhance ICT proficiency and usage in schools. Despite these well-laid plans, implementation was patchy, with only a few provinces engaging significantly. Post-2013, a new strategy was introduced, extending to 2025, focusing on nationwide support for e-education and the development of multimedia resources.

However, actual progress has been limited. Regional disparities persist, and the COVID-19 pandemic further disrupted planned training initiatives, leading to significant budget cuts and unfulfilled training commitments. Eight years into the new strategy, there remains a lack of widespread, competent ICT integration among teachers. One responded commented that *"I would say teachers were not ready to implement the e-schooling because they haven't been trained" [Principal# 0]*. This shortfall hampers the readiness of educators to meet the demands of contemporary educational goals and leaves students at a disadvantage in a technologically advancing world. This situation underscores the need for more effective and committed implementation of ICT training programs aligned with national educational and economic development goals.

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Disparities in Access to Funding

The White Paper on e-Education (2004) outlines the Department of Education's duty to develop and ensure access to electronic educational resources across various platforms, such as educational portals and the internet, ideally with zero-rated access to facilitate widespread use. It also emphasises forming partnerships with the business community to support these initiatives financially. However, the findings of this research suggest that schools in affluent places are predominantly self-funding their internet connectivity and usage. One principal reported that.

> *The school has successfully integrated eLearning through the establishment of a computer room and the utilisation of smart boards. This enhancement of educational technology was facilitated by the school's designation as an X-Model – C -school, which provided the necessary funds to acquire these facilities [Principal #1].*

Principals from less privileged schools also indicated they manage their connectivity expenses through school fees and additional sources like tuck shop revenues. Despite expectations that the government would prioritise funding for disadvantaged schools to rectify past inequities, the responses suggest that most schools have yet to receive the promised support and are primarily left to fund their internet resources independently. As previously noted, it is evident that despite legal assurances of equality, disparities persist within our education system.

Connectivity Challenges

The vision for SchoolNet was to provide connectivity to every school in South Africa, emphasising universal access without exceptions. However, the reality, particularly in the UMzinyathi District, shows significant discrepancies in achieving stable and sustainable internet connections. Many schools rely on independent providers, facing limitations in speed and coverage. In exploring the type of connections schools received, the responses varied:

- *Our school has partial Wi-Fi coverage only on some school blocks [Principal#2].*

- *Our school relies on a private company for Wi-Fi, previously disrupted by infrastructure issues like cable theft [Principal#3]*

- *There is a complete lack of connectivity, and we resort to temporary data purchases for specific tasks. [Principal#4]*

A district official noted that while many schools are nominally connected, actual access varies widely, with technologies ranging from ADSL in urban settings to 3G and satellite connections in rural areas. This patchwork approach has left significant gaps, particularly in rural schools. It raises questions about South Africa's readiness to advance technologically, such as moving to 5G when some areas lack even basic 2G coverage.

This scenario contradicts optimistic reports like those by Venter et al. (2020), which rank South Africa highly in infrastructure improvements. Yet, such advancements appear concentrated in urban areas, bypassing rural and township schools. Furthermore, despite zero-rated options for some schools, many still struggle with high costs and inadequate support, reflecting a broader digital divide that impacts educational equity and access.

This connectivity shortfall hampers current educational outcomes and poses long-term challenges for integrating technology in teaching and learning, essential for keeping pace with global digital advancements.

Teacher Attitudes Toward ICT

Despite the availability of computers in some schools, their usage among teachers varies significantly. Research indicates that age is a significant factor in teachers' adoption of ICT, with younger teachers (Generation Y, born between 1982-1991) more adept at integrating technology into their teaching practices (Padayachee 2017:54-55). Principals have shared mixed experiences regarding ICT implementation. For example, the principal of GJ highlighted numerous challenges, such as load-shedding and social unrest disrupting planned lessons, forcing a return to traditional teaching methods. Moreover, resistance from older teachers remains a notable barrier. One elderly teacher exhibited a strong reluctance even to attempt to use a computer, a sentiment rooted in technophobia rather than incapacity.

Another principal from DH noted a distinct divide in attitudes based on age, with some older teachers disinterested in learning new technologies due to impending retirement, while others are open to new skills. This generational gap underscores the broader issue of a lack of comprehensive training and support from the education sector. Although initiatives in the 90s demanded computer literacy, these were not uniformly enforced or supported by the Department of Education.

According to the Department of Basic Education's Multi-Year Programme of Action, we are in the third phase (2018-2021) of ICT integration, which anticipates significant advancements in teacher training. However, the actual rollout has lagged, leaving many teachers unprepared for digital teaching environments. This is compounded by observations from district officials that training frameworks are not effectively implemented, delaying the readiness for eLearning projects.

The Parliament of South Africa (R.S.A.2018) has expressed concerns about widespread computer illiteracy among teachers, necessitating increased investment in training. Despite these challenges, there is a glimmer of hope with the establishment of 'smart schools' like the one in the Ngubevu circuit, which, despite some geographical confusions, promises better resources and potentially easier training due to its younger staff.

Overall, while younger teachers and students might be more receptive to ICT, the full integration of technology into education is hindered by a mix of infrastructural inadequacies, insufficient training, and varying attitudes among educators.

The Province's Stance on Policy Implementation

Although the KZN province was not an early adopter of the eLearning policy, it is actively working to accelerate its implementation. Interactions with provincial officials revealed ongoing initiatives, such as establishing new "smart schools" equipped with advanced technology, including Anton Lembede Secondary School, which specialises in mathematics and science. Additionally, the provincial Education Minister has distributed tablets to school principals to enhance communication with the provincial department.

Despite the absence of direct interviews with provincial personnel, the materials provided to the schools suggest slow but progressive efforts towards policy enactment. However, the implementation is advancing at a modest pace. Only a few schools, primarily those offering Computer Application Technology (CAT), teach ICT to students. Most schools lack a standardised curriculum for basic computer literacy, even in higher quintile institutions.

Plans are underway to establish virtual centres using eighty-five selected schools as hubs. For example, a mathematics specialist at Sarel Cilliers in Glencoe will conduct live lessons for students across all eighty-five linked schools. While introducing learner portals and virtual centres marks progress, access is limited to students with mobile devices, inadvertently exacerbating the digital divide. Schools not yet

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linked to this network remain disadvantaged, highlighting the ongoing challenge of equitable technology distribution and infrastructure availability.

Conclusions

Based on the discussion of the findings from the research on ICT integration in education, particularly in the KZN region of South Africa, we draw the following conclusions within the frameworks of Knowledge Diffusion Theory and Performance Management Theory:

The legacy of the past three Industrial Revolutions has not favoured infrastructure development in rural areas, leading to persistent challenges in modernising these regions. This lack of development is particularly evident in places like the UMzinyathi district in KZN, where insufficient communication infrastructure significantly hinders participation in the knowledge economy. This infrastructure deficit deprives schools and communities of opportunities to develop contemporary skills, perpetuating the cycle of rural underdevelopment.

The global acceptance of ICT integration in education as a forward-moving strategy contrasts sharply with the on-ground realities in regions like UMzinyathi. Even as the shift to online learning is proposed as a solution to continue education during disruptions such as national lockdowns, the disparity in access to necessary technologies remains a significant barrier. This situation underscores issues of distributive justice in a country marked by profound inequalities, as Du Preez and Le Grange (2020) pointed out.

Moreover, the digital divide is not only a matter of access but also of epistemological access, which requires deliberate efforts by educators to facilitate structured and systematic learning. The lack of systematic teaching further exacerbates educational inequalities, as online methods tend to widen the digital divide, highlighted by Kayembe and Nel (2019) in their discussion on the impacts of the 4th Industrial Revolution.

Recommendations by The Commonwealth Education Hub (2025) stress the need for substantial changes to support ICT integration, including increasing broadband access, revising ICT in education policies, implementing clear action plans, and ensuring continuous professional development for educators. However, these recommendations have seen limited action, reflecting a disconnect between global trends and local policy implementation.

In Umzinyathi, despite some schools having computers, there is no standardised approach to ICT education, and many educators remain untrained in effective ICT integration, as per the ICT Implementation Strategy 2013-2025. The ongoing struggle to equip schools with modern technology, especially older schools, highlights a broader issue of resource distribution and priority setting that continues to disadvantage historically marginalised schools.

Persistent Infrastructure Gaps

According to Knowledge Diffusion Theory, disseminating new technologies depends on existing infrastructure. In rural KZN, the chronic underdevelopment of such infrastructure—particularly in communication technologies—creates a barrier to the widespread adoption of ICT. This gap prevents engagement with the global knowledge economy and limits the potential for local innovation and development, perpetuating a cycle of educational and economic stagnation.

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Digital Divide

This issue reflects failures in Knowledge Diffusion Theory, highlighting the importance of equitable access to new technologies for effective learning and societal advancement. The persistent digital divide in access to technology and online resources between urban and rural schools signifies a failure to ensure that all members of society benefit equally from technological advances, which is crucial for achieving inclusive growth and development.

Challenges in Policy Implementation

From the perspective of Performance Management Theory, the discrepancy between the goals of education policies (such as the ICT Implementation Strategy 2013-2025) and their actual implementation reflects inadequate performance measurement and management. Effective performance management involves setting clear goals, measuring progress accurately, and adjusting strategies based on feedback. The lack of a unified approach to implementing these policies leads to uneven progress and missed opportunities for leveraging ICT in education.

Inequity and Educational Justice

Issues of distributive justice are at the forefront of performance management, where resources and opportunities should be distributed fairly. The shift towards online learning methods could potentially democratise access to education, yet in practice, it has often exacerbated existing disparities. This reflects a significant oversight in performance management processes that fail to account for the baseline inequalities in resource distribution.

Teacher Training and Support

Effective integration of ICT in teaching is contingent upon comprehensive teacher training, which is fundamental to both Knowledge Diffusion and Performance Management theories. Teachers must have the hardware skills and knowledge to incorporate ICT into their teaching practices effectively. The current lack of training and support undermines the potential benefits of ICT in education, leading to suboptimal outcomes and a failure to build capacity among educators.

Impact of External Factors

External challenges like irregular electricity supply and societal disruptions highlight the need for education strategies that are resilient and adaptable. These factors affect the performance management of educational initiatives by introducing unpredictability into the system. A robust performance management system would include strategies to mitigate these risks and ensure continuity of education through flexible, resilient approaches.

The Need for Strategic Revisions

The findings emphasise the need for a critical reassessment of ICT policies. This involves a comprehensive review of policies' design, implementation, and monitoring, integrating knowledge diffusion and performance management insights. A coherent, universally applied strategy is essential for ensuring that the benefits of ICT are distributed equitably across all educational sectors.

Realisation of Sustainable Development Goals

As the deadline for the ambitious goals of the ICT Implementation Strategy approaches, it is evident that the current trajectories are insufficient. This situation calls for urgent, targeted actions informed by theoretical frameworks to bridge the gap between policy intentions and practical realities.

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Strategic, well-monitored initiatives are needed to accelerate progress and ensure that the educational benefits of the 4th Industrial Revolution are accessible to all students, irrespective of their geographic or socio-economic status.

These conclusions emphasise the complexities of integrating ICT in education within regions facing historical and ongoing challenges. Addressing these issues requires concerted efforts from multiple stakeholders, including policymakers, educators, and community leaders, to ensure equitable access to technology and its benefits in educational settings.

This study notes a stark mismatch between the aspirational promises of technology integration and the harsh realities of uneven policy implementation and support. The lack of universal strategy and adequate monitoring in KZN has left many schools, including newly declared innovative schools, without the necessary training and support to integrate ICTs in education effectively. As we approach the target year of 2025, the gap between the envisioned and actual progress in ICT integration widens, leaving the goal of equitably advancing through the 4th Industrial Revolution more elusive than ever.

Declarations

Author Contributions

This article is based on a Masters dissertation thesis by Bhekumuzi Sitwell Mkhonto - UKZN, supervised by Professor BC Mubangizi. Prof Mubangizi condensed the research dissertation into this manuscript.

All authors have read and approved the published on the final version of the article.

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