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Navigating ICT Challenges and Effects at Rekopantswe Senior Phase Schools: Exploring Teaching and Learning Results

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Abstract

The effective and sustained use of Information and Communication Technologies (ICTs) is critical to meeting 21st century educational demands. ICT integration is no longer merely an enhancement but a fundamental shift that requires active participation from teachers and school management. Despite its potential, ICT adoption in South African schools remains inconsistent, with full-scale integration occurring only after 1994. The integration process is largely affected by challenges such as inadequate teacher training, limited infrastructure, negative attitudes, and insufficient technical support, which hinder sustainable implementation. These challenges affect schools in under-resourced areas, such as those in the Rekopantswe sub-district, where ICT implementation remains inadequate. This study focuses on a critical research gap, exploring the unique challenges impeding integration in senior phase classrooms within the sub-district. A qualitative research approach is employed, using semi-structured interviews, classroom observations, and group discussions with senior-phase teachers and learners in Rekopantswe sub-district schools. Findings reveal that while teachers recognize ICT's pedagogical benefits, its effective integration is constrained by a lack of formal training, technical resources, and inconsistent institutional support. The study underscores the need for structured professional development programs designed to the contextual needs of teachers and improved infrastructural support to enhance ICT's impact on teaching and learning. Through reflections on the barriers, the study adds to the body of knowledge by highlighting strategies to be adopted in fostering ICT integration in less resourced schools, informing policy direction and future research in the field.

Keywords: ICT Implementation; Teaching and Learning; Formal Training; South African Schools; Technical Resources

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INTRODUCTION

The integration of ICT in education has been shown to significantly aid learners in grasping complex concepts. Digital tools provide interactive and visual representations that make abstract ideas more tangible and accessible to learners (Medina Herrera et al., 2024). Beyond comprehension, ICT acts as an intrinsic motivator, enhancing learners' morale and fostering a more engaging learning environment (Sattar et al., 2019). Educational experts advocate for a transition from traditional teaching methods to more interactive and engaging pedagogical approaches that leverage the benefits of technology (Pantuwong et al., 2016; Roslin et al., 2022).

The effective use of ICT fosters active learning by encouraging learners to participate in problem-solving, collaboration, and research-based activities. Digital learning environments provide opportunities for learners to explore content at their own pace, engage with multimedia resources, and collaborate with peers in meaningful ways. This shift in teaching methodology supports the development of critical thinking and problem-solving skills essential for 21st century learners (Dhawan, 2020; Favale et al., 2020). By moving away from rote learning and passive instruction, ICT enables a more dynamic and learner-centred learning experience.

During the COVID-19 pandemic, ICT emerged as a crucial tool in bridging educational gaps globally, including in South Africa (Kusmaryono et al., 2021). Digital platforms allowed for continued learning despite physical school closures, highlighting the role of technology in providing equitable access to education. Additionally, ICT facilitates differentiated instruction, catering to diverse learning needs and styles. Tools such as assistive technologies support learners with disabilities, ensuring a more inclusive and equitable learning environment.

Despite its advantages, the integration of ICT in education is hindered by significant infrastructural and technical challenges, particularly in under-resourced areas. The lack of adequate infrastructure, including limited internet access, insufficient multimedia tools, and unreliable electricity supply, impedes the effective use of digital learning tools (Kassutto et al., 2021). Additionally, inadequate technical support and the lack of teacher training further exacerbate these challenges, preventing schools from fully leveraging ICT's potential (Cabero-Almenara et al., 2010; Murungi et al., 2018). To summarise these challenges, Table 1 outlines the key obstacles to ICT implementation in under-resourced schools.

Table 1. Key obstacles to ICT implementation in under-resourced schools

Challenge	Description
Lack of infrastructure	Limited internet access, inadequate multimedia tools, and unreliable electricity hinder effective ICT use.
Inadequate technical support	Schools lack sustained technical assistance, making it difficult to integrate ICT effectively.
Teacher training deficiencies	Insufficient professional development leaves teachers unprepared to use ICT in pedagogy.
Teacher confidence issues	Teachers may hesitate to use technology due to lack of experience or misconceptions.
Socio-economic constraints	Economic disparities limit learners' and schools' access to necessary ICT tools.

Teachers' perceptions and confidence levels play a crucial role in the successful implementation of ICT in classrooms. While technology has the potential to enhance teaching and learning, many teachers remain hesitant due to limited training, lack of institutional support, and persistent misconceptions regarding the effectiveness of ICT (Nkula & Krauss, 2014). Studies emphasise that merely providing technology is

insufficient; instead, targeted professional development and pedagogical support are necessary to ensure meaningful integration into teaching practices (Tamim et al., 2015; Vakaliuk et al., 2021).

Contextual challenges in the Rekopantswe sub-district

The Rekopantswe sub-district in the North-West Province of South Africa presents unique challenges to ICT integration. Unlike national studies that broadly explore ICT barriers, this study delves into the specific infrastructural limitations, teacher perceptions, and socio-economic constraints affecting schools in this region (Arkorful et al., 2021; Dei, 2018; Gillwald et al., 2018; Mwapwele et al., 2019; Ojo & Adu, 2018; Salam et al., 2018; Suleiman et al., 2020). Limited access to internet connectivity, inadequate multimedia resources, and economic disparities further hinder sustainable ICT adoption in senior phase schools (Adu, 2016; Doringin & Oktriono, 2019). Addressing these challenges requires localised solutions that consider the specific needs of schools in this sub-district.

Study objectives and contribution

This study aims to provide an in-depth analysis of the barriers to ICT implementation in the Rekopantswe sub-district. The key objectives include:

1. Identifying infrastructural and technical challenges that hinder the effective use of ICT in senior phase schools.
2. Examining teachers' perceptions and attitudes towards ICT and how these impact integration in teaching and learning.
3. Investigating socio-economic factors that influence ICT adoption and sustainability in the sub-district.
4. Providing recommendations for improving ICT implementation, with a focus on enhancing teacher training, technical support, and infrastructure development.

By addressing these objectives, the study contributes actionable insights to overcoming ICT-related challenges specific to the Rekopantswe sub-district.

Scope and limitations

The study focuses specifically on senior phase schools in the Rekopantswe sub-district, a resource-constrained region in the North-West Province of South Africa. It explores ICT-related challenges from multiple perspectives, including infrastructure, teacher readiness, and socio-economic influences. The study is primarily qualitative, drawing insights from teachers, and relevant stakeholders to provide a comprehensive understanding of ICT integration barriers in this context.

While the study offers valuable insights into ICT challenges in under-resourced schools, its findings are geographically limited to the Rekopantswe sub-district and may not be fully generalised to other regions. Additionally, the study focuses on qualitative analysis, meaning that while it captures in-depth perspectives, it does not provide extensive statistical generalisation. Future research could expand on this by incorporating quantitative data or comparative analysis across multiple sub-districts.

Research Questions

This study seeks to explore how ICT implementation influences teaching and learning in senior phase schools by analysing key infrastructural, pedagogical, and socio-economic barriers. To achieve the aim and have patent analysis of the results, the study structured its epistemic research question as follows:

1. To what extent do ICT implementation challenges impede teaching and learning in senior phase schools in the Rekopantswe sub-district?
2. To contextualise these challenges, the following section provides an overview of existing literature on ICT integration in education, highlighting both successes and persistent obstacles.

Literature review

The role of technology in the curriculum is crucial, requiring educational leaders and technology coordinators to expedite implementation and synchronise learning with modern pedagogies and the curriculum (Bosch et al., 2024; Ndlovu, 2016; Whitehead et al., 2013). Recognising ICT's potential, researchers and teachers acknowledge its opportunities for teaching and learning (Hasbullah et al., 2022; Mohamad et al., 2022). ICT is a valuable tool that can be integrated into the classroom across all subjects (Leask & Pachler, 2013). The presence of ICT in the learners' life is efficient to support communication with other learners and teachers (Bozanta & Mardikyan, 2017; Waghid & Davids, 2018). Li and Jing (2023) support this perspective, asserting that emerging ICTs, including computers and the internet, have become indispensable tools in education due to their profound ability to transform teaching and learning. Studies show that in South African schools where ICT integration has been successfully implemented, it has significantly enhanced classroom instruction and learning outcomes (Buzuzi, 2020; Garlinska et al., 2023; Li & Jing, 2023; Mwapwele et al., 2019).

In a study by Mugani (2020), cited by Mahlo and Waghid (2022), which explored the pedagogical effect of smart classrooms; focusing on Grade 11 teachers in Gauteng, South Africa, the findings reveal that teachers use ICT in smart classrooms to achieve a variety of benefits, including:

1. To foster an engaging learning environment that captures learners' attention.
2. To derive effectiveness and joy in learning through the use of visual and audio aids.
3. To improve and add to learner participation in classroom engagements.
4. To use time optimally in teaching and learning—e-textbooks and other tools can be easily accessed on smart boards, streamlining lesson preparation and minimise planning time.
5. To ensure effective curriculum content coverage within a shorter period.

Inadequate provision of ICT in classrooms can disadvantage learners, hindering their acquisition of essential skills for a technology-mediated globalised world (Bolaji & Jimoh, 2022; Demirci et al., 2013; Dlamini, 2022; Sudin et al., 2022). Effective ICT implementation necessitates supportive policies and professional development for teachers at all levels (Ndlovu, 2016; Shambare et al., 2022; Tondeur et al., 2008). As outlined by the Spanish government the emphasis is on the importance of developing teachers' computer skills to enhance their effectiveness in the classroom (Tarraga-Minguez et al., 2021). Teachers require targeted professional development opportunities to enhance their ability to use ICT effectively and to promote learner interaction and collaboration (Barbour et al., 2017; Brown et al., 2020; Miller & Kumar, 2022). Moreover, schools have a responsibility to use ICT to connect with stakeholders like learners, community members, including people in business (Dolezal et al., 2022; Shambare et al., 2022).

The school management team (SMT), in particular principals, play a vital role in supporting ICT initiatives, integrating technology into teaching and administration, and facilitating change in the school environment (Afshari et al., 2009; Murungi & Gitonga, 2015; Tigere & Netshitangani, 2022). Learner engagement tends to be higher when ICT is integrated and readily accessible throughout the classroom. In today's education landscape, ICT is no longer optional but essential for preparing learners to meet the demands of the twenty-first century (Saputra et al., 2024; Tondeur et al., 2008). Effective ICT implementation requires skills and resources for teachers, principals, learners, parents, and businesspeople.

Implementation of ICT in schools can lead to improved academic achievement, provided it aligns with academic and organisational goals (Ngodu et al., 2024; Saputra et al., 2024). The learning environment becomes conducive when learners are challenged, interested, and engaged in the learning process using technology (Saputra et al., 2024). Integrating ICT in classrooms can enhance learners' higher-order thinking skills while offering creative and personalised ways for them to demonstrate their understanding (Goodwin, 2012; Tigere & Netshitangani, 2022). Moreover, teachers often use personal resources like smartphones in teaching and learning to ensure that learners have a better grasp of the lesson (Msimanga, 2019). Teachers further considers using Interactive Whiteboards (IWBs) in their lessons, believing that they increase learner interest, engagement and motivation. IWBs contribute in making the lesson more engaging and action-oriented throughout (Mihai, 2020; Nhete et al., 2016). Findings from a study on teachers' use of ICT revealed that learners noticed a positive change in their learning and acquisition of new knowledge (Lawrence & Tar, 2018; Quyen, 2020). Utilising instructional platforms such as YouTube videos can be highly beneficial for second language learners, as these resources engage students by allowing them to watch and listen while acquiring new vocabulary, language structures, and skills (Kabooha & Elyas, 2018; Lim & Tan-Chia, 2022). This further translates to constructivist self-directed learning and moving away from traditional methods of learning (Ali et al., 2023; Mentz & De Beer, 2021).

METHOD

In this study, participants were six senior phase teachers from three schools: Maru, Tladi and Molapo (pseudonyms). The participants included four male and two female teachers. The male teachers were between 40-50 years old, with 10-15 years of teaching experience, while the female teachers were between 30-40 years old, with 5-10 years of experience (see Figure 1). The collective experience of the participants offered a diverse range of insights into the challenges ICT implementation in the classroom. Furthermore, thirty learners participated in this study, drawn from the same three schools. These learners were organised into three group discussions, with ten learners per school, including 17 girls and 13 boys. Classroom observations were conducted in six different classes to assess how teachers were integrating ICT into their teaching practices.

The sample size was limited due to the qualitative nature of the study, which prioritises depth over breadth. Previous research (Guest et al., 2006; Robinson, 2014) suggests that 5-10 participants in qualitative interviews can yield substantial insights. The small sample allowed for in-depth analysis while ensuring diversity in experiences across different schools.

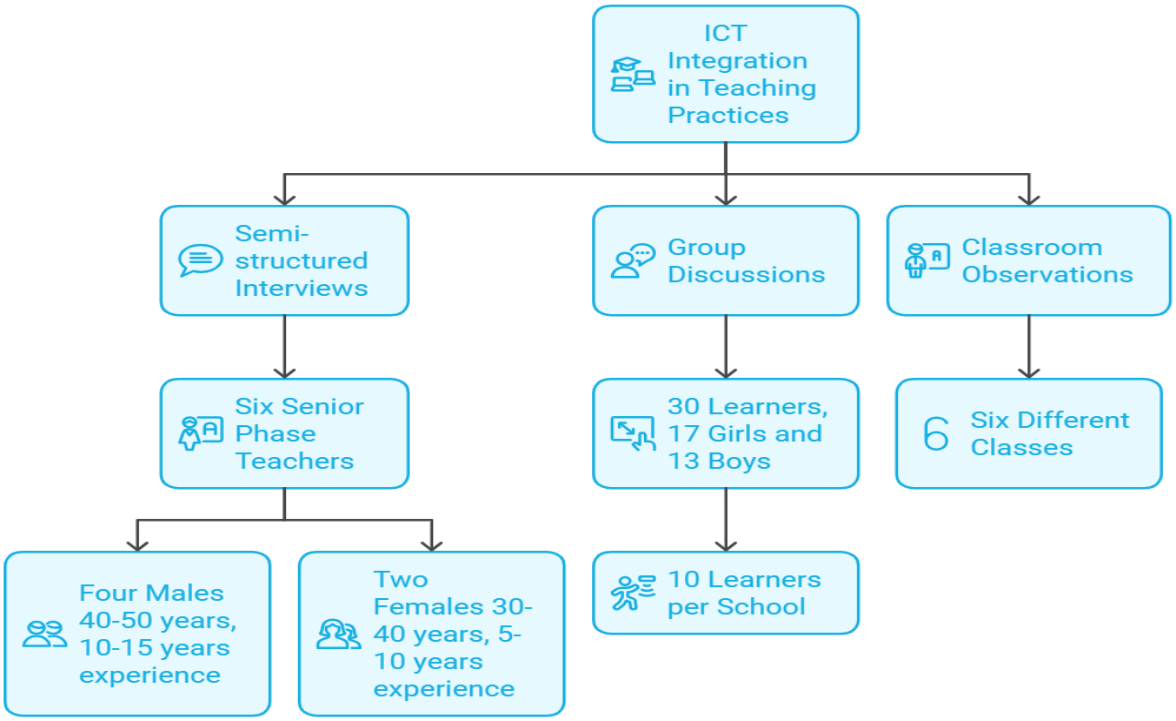

Figure 1. Visual representation outlining data gathering process

This study adopts a qualitative exploratory research design to investigate the relatively unknown challenges of ICT implementation in senior phase schools in the Rekopantswe sub-district, North-West Province, South Africa. The qualitative approach was chosen due to its focus on gathering in-depth knowledge from participants, while the exploratory nature of the research allowed for a deeper understanding of the nature of challenges and perspectives of the teachers, learners and other stakeholders. Semi-structured interviews, classroom observations and learner group discussions were the primary data collection methods, providing a comprehensive view of ICT integration. Each semi-structured interview lasted approximately 45-60 minutes and was conducted in a quiet setting at the participants' respective schools. All interviews were audio-recorded with participant consent and later transcribed verbatim for analysis. The literature review informed the development of the interview guide, ensuring alignment between the research questions and data gathering instruments. The following questions were presented to participants during individual interviews (Table 2) and group discussions (Table 3).

Table 2. Questions presented to participants during the interviews

Question Number	Interview Question
1	How do you understand the concept of "Information and Communication Technology" (ICT)?
2	Do you have access to a computer? In which subjects can ICT be utilized?
3	Provide examples of how you integrate ICT into your classes.
4	How do you use ICT in developing your teaching materials?
5	Can you specify the ICT tools you have used? Offer examples.

Question Number	Interview Question
6	What challenges do you face in using ICT for teaching?
7	How does ICT assist in the teaching process?
8	Have you received any training on ICT usage?
9	What additional support would you like?
10	Is the use of ICT beneficial to you? Please explain.
11	Do you utilize the computer laboratory? If so, what activities take place there?
12	Are there sufficient computers for learners? If not, how do the existing computers benefit them?

Table 3. Questions for group discussion with learners

Question Number	Question
1	How do you understand the concept of *Information and Communication Technology* (ICT)?
2	Is ICT used in your classes?
3	How does your teacher implement ICT in your class?
4	In what ways does ICT benefit you? Please explain.

Sampling Techniques and Data Collection

The study employed a purposive sampling method to select the teachers as participants. This approach was considered to ensure that the teachers possessed the relevant experience with ICT implementation, which was of importance in providing rich, meaningful data. Teachers were selected based on their active involvement in ICT initiatives at their schools. This ensured that participants had direct experience with ICT integration, allowing for rich, relevant insights. Additionally, teachers from different age groups and experience levels were selected to ensure diverse perspectives. Additionally, thirty learners were randomly chosen to provide a balanced representation of gender, academic performance, and engagement with ICT.

Instrument Validation and Data Analysis

Data was analysed using Braun and Clarke's (2021) six-step thematic analysis framework: 1) data familiarisation, (2) initial coding, (3) searching for themes, (4) reviewing themes, (5) defining themes, and (6) producing the report. An inter-coder reliability check was conducted to enhance validity.

The data collection instruments, which included the interview and observation guides, were validated through a process of expert review and a pilot study. The conducted pilot study, comprising a small group of teachers who were not part of the main study, assisted the researcher in refining the questions and procedures to guarantee clarity and relevance. The questions were refined to confirm that they directly address the core themes of ICT integration, such as infrastructural challenges, teacher perceptions, and socio-economic factors. The procedure on engaging was reviewed to put participants at ease by starting the interview process with general questions before moving to more specific topics like challenges in ICT implementation. These issues were addressed during the pilot study to ensure reliability of the instruments.

Analysis of data was followed by a structured thematic method, aligning with the study's qualitative objectives, for example *Understanding the functionality of ICT*. The interviews and group discussions were transcribed and analysed using Atlas.ti software to aid in the organisation and coding of the data, with thorough interpretation on classroom observations. The transcribed interviews included instances where participants like teacher Mmupudu said, *ICT is a way of communicating with other people technologically and improving the approach to teaching and learning*. The study applied thematic analysis to identify recurring patterns and challenges from the data that was gathered through semi-structured interviews, classroom observations, and group discussions. This process included coding the transcribed interviews and observation notes, categorising the data into themes such as "infrastructure limitations," "teacher confidence," and "support systems." These themes were then compared to the literature to ensure that the findings reflect both the empirical data and existing theoretical perspectives on ICT integration. This method ensured that the analysis captured the complexity of ICT implementation challenges in the context of Rekopantswe schools, providing insights into how these issues hinder teaching and learning.

Ethical Considerations

This study strictly adhered to ethical protocols to protect the rights and well-being of participants. Informed consent was obtained from all teachers and learners, who were told they could withdraw from the study at any time. Confidentiality and anonymity were ensured by using pseudonyms for schools and removing all personal identifiers from transcripts and recordings, which were stored securely.

To minimize harm, interviews and group discussions were conducted unobtrusively, and questions were limited to ICT use rather than sensitive personal information. Voluntary participation was emphasized, and participants could skip any questions they found uncomfortable. Standard ethical approval procedures were followed, ensuring that the study's objectives, methods, and data collection practices respected participants' rights and dignity at all times.

RESULTS AND DISCUSSION

The analysis of this study's results offers a clearer understanding of the challenges to ICT implementation in Rekopantswe sub-district schools, directly addressing the research objective: *To what extent do ICT implementation challenges impede teaching and learning in senior phase schools in the Rekopantswe sub-district?* The findings align with previous studies but also introduce unique contextual insights specific to this sub-district, tying both empirical evidence and theoretical perspectives to a more nuanced explanation of the challenges. The participants, that is 50% had a strong view on the use of ICT for communication purpose and the need to train teachers to effectively integrate technological tools in their teaching. Furthermore, more than 60% of the teachers mentioned that ICT does help with accessing information to improve their teaching material.

Examination of individual interviews

The information gathered during the interviews was associated with the following groupings (Table 4): (1) Comprehension of ICT operations; (2) Supply of

ICT tools in educational institutions; (3) Assimilation of ICT into the educational process; and (4) Enhancement of ICT proficiency.

Table 4. Groupings and sub-divisions

Categories	Sub-Categories
1. Understanding the functionality of ICT	• Communication Accessing information
2. The provisioning of ICT equipment in schools	• Efficiency of computer equipment • Applicability of computer labs
3. The integration of ICT in learning	• Developing teaching material • Lesson presentation
4. Capacity development for ICT	• Formal training • In-school development

Understanding the functionality of ICT

Participants express a belief that the increased utilisation of computers in schools can enhance speed and efficiency. Two closely intertwined issues crucial to the functionality of ICT in schools are identified as communication and information.

Communication

Participants acknowledged the importance of general communication but emphasised technical communication skills, particularly in instructional and administrative contexts. This includes methods, processes, techniques, and procedures related to effective teaching and learning. The scope extends beyond instructional leadership to encompass administrative school matters, involving ICT in academic and financial school administration. Discussion on ICT's role in schools highlighted its intimate connection with communication. Participants emphasised that ICT *serves as a technological means of communication, facilitating contact between various parties and for teaching and learning*. It is viewed not merely as a tool for enhancing school communication and teaching and learning but as a comprehensive mechanism for overall school improvement.

Teacher Mmupudu in this regard said, *ICT is a way of communicating with other people technologically and improving the approach to teaching and learning*. The same view was shared by teacher Mmilo by saying, *ICT allow us to communicate and share ideas, adding to learners' interest in classroom activities*. Teacher Kwena said, *to a large extent, in a sense ICT is a means of establishing communication between various parties using technology allowing learner engagement and effective classroom management*.

These viewpoints align with findings in the literature, indicating that the increased use of ICT in schools corresponds to technological advancements, particularly in internet usage, affecting communication across various sectors, including education (Barbour et al., 2017; Brown et al., 2020; Li & Jing, 2023).

Accessing information

In the realm of information, data and information emerge as pivotal aspects in Rekopantswe sub-district schools, North-West Province, South Africa. Despite a collective understanding that new technology improves efficiency, some participants nostalgically recall the days when manual processes were the norm. Schools

acknowledge that electronic media have replaced manual organisation and calculation of data. Secondary schools in the sub-district utilise electronic documents containing crucial information such as timetables, mark lists, and budgets. However, challenges and constraints related to information access will be further elucidated in subsequent sections.

Participants also noted that *regardless of their responsibilities in schools, the volume of information and data they need to handle continues to increase over time.* Apart from routine requests for data from the Department of Basic Education, information disseminated to parents, and internal school correspondence, there is a growing number of requests from various stakeholders and non-stakeholders. These entities include research organisations, School Governing Body (SGB) members, and private organisations. Thus, it is not merely a matter of complying with requests; exercising sound judgment on whether to provide information is an integral part of the process.

Specifically, Teacher Kwena emphasised that ICT serves as *a means to exchange information between individuals, or between an individual and a group, and vice versa.* Teacher Mmilo added by saying, *ICT empowers both learners and teachers to access information as this translates to success in various grades of learning,* while Teacher Mmupudu highlighted that *through ICT, valuable information for the school and community can be obtained to advance an effective engagement.* Additionally, Teacher Seolo asserted that *ICT enables a better acquisition of crucial information where learners' participation is achieved even beyond school hours.* Schools universally recognise the critical role of information and its distribution in effective and efficient school management.

The literature points significantly to the role played by ICT as a means of engagement to the benefit of stakeholders as applied by managers (Afshari et al., 2009; Murungi & Gitonga, 2015; Tigere & Netshitangani, 2022). School managers and staff members increasingly use tools like Facebook, YouTube, and X formally Twitter to connect with learners, staff, parents, and community members. Schools have a responsibility to use ICT to connect with stakeholders like community members, including businesspeople.

Provisioning of ICT equipment in schools

The provision of ICT equipment in schools is crucial for comprehensive implementation. Participants in Rekopantswe sub-district schools emphasised that *the provisioning of ICT has been progressing slowly.* In a world where information and communication technology enable broader access, generation, and sharing of ideas, it is imperative for the basic education system to capitalise on these new possibilities.

Efficiency of computer equipment

Participants acknowledged that the presence of ICT in schools brings about improvements in both teaching and learning. Through interviews, it became evident that teachers are highly inspired and motivated when ICT tools like laptops are utilised in schools. Participants highlighted that *ICT reduces workload by simplifying organisation and preparation.* They expressed that *technological tools enable the creation of a single classroom test that can be administered to many learners without rewriting on the chalkboard.* Learners also find enjoyment and interest in learning as they are motivated by visual aids. However, participants expressed dissatisfaction with the supply of ICT materials, particularly citing a shortage of equipment. Teacher Kwena said, there is an

inadequacy of computers and suggested that the Department of Basic Education should provide schools with modern gadgets. Teacher Seolo concurred by saying, *the department need to provide computers to equip all children with essential computer skills.*

In addition, Teacher Mmupudu said, *frankly, the available computers are insufficient for learners,* with Teacher Leotwana adding by saying, *the computers we have are not nearly enough. When we take learners to a computer lab, approximately seven learners must share.*

Applicability of computer laboratories

Learning to use a computer imparts essential job skills, even to the youngest learners, covering aspects like typing and basic research. Participants regarded *a computer laboratory as a space where computer skills can be nurtured, exposing children to new ways of thinking using both creative and logical thought processes*. The interviews also revealed that the computer laboratory is not only beneficial for learners but also resourceful for teachers, offering them more time to practice and enhance their ICT use in the classroom. Teacher Mmupudu supported this by stating, *I make use of the computer laboratory... we have started with the learners, they need to know the basic procedure of operating the computer... switching it on and off.* Additionally, Teacher Kwena mentioned, *most of the time, I use the computer laboratory to search for information... scholarly information.*

These perspectives align with the literature, highlighting the importance of ICT in schools to effect changes in academic performance (Ngodu et al., 2024). Despite the positive aspects of ICT implementation in schools, the provision of necessary infrastructure is crucial, encompassing physical space, furniture, electricity, and internet connectivity (Bolaji & Jimoh, 2022; Sudin et al., 2022).

Integration of ICT in Learning

The integration of ICT in learning involves enriching the learning process by incorporating technological means into the educational practice in the classroom.

Developing teaching material

Learners can be highly motivated to learn and attend school regularly when technology is part of their classroom experience. Teachers can leverage this positive attitude to explore new learning strategies, engaging learners actively rather than having them passively receive information. Interview findings reveal that teachers frequently use ICT to develop teaching materials, viewing it as a means for information sharing and knowledge improvement in their subjects. Teacher Mmupudu emphasised that it is *important to conduct research before presenting a lesson as this makes the lesson productive and beneficial to the learners*, and Teacher Kwena said, *I use the computer to search for information and materials to aid in teaching and learning.* Teacher Mmupudu stated that *I use ICT to access work from the internet and integrate such information into lesson plans, making the content more comprehensible to learners*. Teacher Leotwana also mentioned that *I use the computer to search for additional information for lesson preparation and personal development.*

The teachers need to go beyond traditional approaches and familiarise themselves with new methods to understand the educational functionality of technological tools in their practices. Lim and Tan-Chia (2022) notes that learners develop interest in learning when instructional platforms like YouTube videos are integrated into the lesson. ICT develops autonomy in teachers, enabling them to create

their own materials and exert more control over subject content than it is possible in a traditional classroom setting (Mahlo & Waghid, 2022).

Lesson presentation

The interviews revealed that most teachers exhibit confidence in presenting lessons, demonstrating proficiency in utilising overhead projectors and creating PowerPoint presentations (PPPs). Particularly, the use of PowerPoint is deemed a crucial technological tool as it aids learners in visualising educational materials. In subjects involving diagrams, learners appear to grasp concepts more effectively when these visual aids are employed. Teacher Mmilo emphasised that *visual aids, such as overhead projectors and data projectors, add value to classroom teaching and learning. I encourage that my colleagues use technology regularly in their teaching*. Teacher Mmupudu stated that *I prepare slides and use a projector to display content, including models or simulation videos, while also utilising speakers for enhanced learner engagement*. Teacher Kwena said, *it is convenient for me to prepare and type notes on a computer and present lessons through PowerPoints.* Teacher Setlhare stated that *I use computers to develop assignments for learners and display questions and marking guidelines to facilitate comprehension in the classroom.*

A more in-depth analysis of the findings indicates that the use of ICT tools is paramount across all subjects offered at the senior phase of schooling. Teachers employ these tools universally. Teacher Kwena said, *ICT can be applied in almost all subjects, and this has an effect in learners' progression in their studies.* Teacher Leotwana concurred, stating that *ICT is applicable in all subjects, not limited to a specific one and thus impact on the learning and teaching activities.* Teacher Mmupudu said, *ICT is flexible as it applies to any subject, and it is particularly important in content subjects with numerous diagrams and models that would otherwise take considerable class time to draw or demonstrate*. However, a significant challenge faced by many teachers is efficiently using laptops in teaching. Connectivity issues aside, some teachers, as stated by Teacher Setlhare that, *teachers in schools still struggle with computer literacy and tend to revert to traditional teaching methods as this provide confidence and enjoyment in their delivery of content.*

These findings are in alignment with the observations, where positive feedback from teachers and learners was noted regarding the use of technological tools like interactive whiteboards (IWBs) in the classroom (Leask & Pachler, 2013). The introduction of IWBs was associated with a significant impact on classroom interactions. Additionally, laptops were found to be motivating and engaging for learners, especially when used in conjunction with whiteboard technology. Digital image techniques were also noted to positively affect learners with poor speaking and listening skills and low levels of literacy.

Specifically focusing on the importance of ICT in South African schools, it highlights the Department of Basic Education's intensified efforts in introducing ICT into the school curriculum and administration since the advent of democracy in 1994 (Mwapwele et al., 2019). The Department of Basic Education emphasised the significance of ICT use in education, advocating for computer literacy for all learners by 2030 (UNESCO, 2017). The role of computers in the foundation phase was noted to focus on learning concepts and basic skills, while the intermediate phase provided opportunities to expand learning into various areas and enhance research skills.

Capacity development for ICT

This investigation focuses on the development of teachers' knowledge and skills in ICT-related matters, addressing both formal training and in-school development.

Formal Training

Teachers play a pivotal role in any educational innovation effort, requiring appropriate training to transition from traditional to new delivery modes. Based on the interviews, teachers currently lack proper training that can bring meaningful change in ICT application. Participants *strongly advocate for formal training to acquire ICT usage skills.* Teacher Setlhare explicitly stated that *there is a need for teachers to be formally trained*. The participants in the sub-district emphasise the necessity for continuous training by facilitators. Both teacher Leotwana and Mmupudu similarly said, *the department should source facilitators to continuously empower teachers in the effective use and implementation of ICT teaching and learning*. Emphasising the ever-changing nature of technology, teacher Leotwana said, *the importance of continuous formal training to keep abreast of technological advancements and evolving functions can no longer be ignored*.

The aforementioned findings underscore the crucial role of teachers in the effective utilisation of ICT in schools, particularly at the senior phase. These findings align with an earlier reference emphasising the need to empower teachers as individuals responsible for ICT usage and integration in schools (Buzuzi, 2020). Additionally, Miller and Kumar (2022) assert that teacher development should precede ICT use, considering teachers as pivotal figures in the learning and teaching process. Spain, as a developed nation, has emphasised the importance of teachers' professional training, suggesting that training users can enhance their attitude toward computer use, boost self-efficacy, motivation, and computing habits (Tarraga-Minguez et al., 2021). The rationale for formal training is also linked to constructivism as discussed in this study, emphasising that teachers' knowledge, beliefs, and actions significantly impact learners' academic success (Tigere & Netshitangani, 2022).

In-school development

Participants underscored the need for in-school development, recognising its potential to enhance the school culture. ICT in schools provides an avenue for teachers to transform their teaching practices, offering improved educational content and more effective teaching and learning methods. Each school in Rekopantswe sub-district varies in its acceptance and implementation of innovations, such as integrating ICT into the curriculum. The perspective on in-school development is deemed critical, as it leaves a lasting impact in the sub-district, with participants emphasising its long-term benefits.

Moreover, participants in the sub-district noted that if schools take the initiative to develop their staff, it could have a significant impact on the broader community. Teacher Seolo said, *if the department of basic education can provide professional development to the school staff, in particular teachers, that will contribute to well-rounded development and the effective introduction of ICT in teaching and learning.* This sentiment was echoed by Teacher Mmilo, when she said, *in-school development would motivate teachers to bring positive changes to the preparation of effective lessons.* A notable aspect of in-school development is its apparent contribution to building leadership capacity at the school

level. Teacher Kwena to this regard said, *it is important to train staff internally to effectively implement the use of ICT equipment.*

The results of this study present a comprehensive understanding of ICT implementation in Rekopantswe sub-district schools. The study further presents an in-depth analysis on certain gaps and challenges that align with the research objectives. Additionally, the findings are consistent with existing literature, emphasising the importance of integrating ICT tools into both Initial Professional Education of Teachers (IPET) and Continuing Professional Teacher Development (CPTD). Moreover, ongoing professional development for teachers is a key performance indicator for a school's progress (Shambare et al., 2022). Additional research highlights that in-school development and leadership behaviour are critical factors influencing the success or failure of schools in implementing ICT in their activities (Brown et al., 2020; Bush, 2021; Miller & Kumar, 2022; Murungi & Gitonga, 2015; Tigere & Netshitangani, 2022; Vandeyar, 2015).

Findings from the group discussions

In this investigation, a total of eighteen learners participated in three group discussions, with six learners per school. These discussions were scheduled after regular school hours to minimise disruption to ongoing teaching and learning activities. Learners were required to respond to the questions in the best possible way they understand with other group members adding to the views presented. Subsequently, the researchers conducted individual meetings with participants to clarify any unclear responses. The findings from the group discussions, organised by question, are summarised as follows.

Understanding of the concept "Information and Communication Technology" (ICT)

Learners demonstrated a broad understanding of ICT, particularly its potential to enhance learning. Lerato, for example, from Maru School stated, *ICT presents a clear way of understanding in our learning, while* Mpho added, *some of our school mates have internet access at home, while others like me rely on our parents' personal phones and shops with Wi-Fi.* In Tladi School, Olebogeng said, *I belief that by using ICT in our subjects and utilising computers in school laboratories and classrooms that would enhance computer literacy in our school, allowing for more efficient use in teaching and learning.* Moreover, the learners recognised the importance of technology, particularly cell phones, for communication purposes and learning. Lerumo in Molapo School said, *ICT teaches us about communication and collaboration, making tasks easier and helping in completing homework*, while Ofentse from Tladi School said, *ICT adds value to our learning, improving our ability in understanding what is said by our teachers in the classroom*. These comments show an awareness of ICT's benefits; however, they also present disparities in access, which could hinder equal opportunities for all learners.

The observation aligns with constructivist theory, which suggest that access to vast learning materials through ICT can empower learners to shape their own educational experiences (Lim & Tan-Chia, 2022; Mentz & De Beer, 2021). However, limited access to devices and connectivity also reinforces digital divide literature, which underscores the challenge of unequal access to technology, particularly in poor and under resourced schools (Ali et al., 2023).

Use of ICT in class

Learners reported various uses of ICT in the classroom, including listening to educational programs on the radio, watching educational television slots and completing assignments using digital tools. Figure 2 illustrates the reliance on traditional radio-based instruction at Tladi Secondary School. This suggests that in the absence of advanced ICT infrastructure, teachers are adapting by using available resources, highlighting the digital divide in the sub-district. Serame, for example from Molapo School noted, *our teacher instructs us to listen to the radio, and if we do not understand, she encourages us to watch educational channels on television*. In Maru School, Omogolo said, we listen *to educational programs on the radio and watch plays or dramas on television*. In Tladi School, Zanele mentioned, *we watch English drama on television to improve our understanding of the prescribed texts*.

Figure 2. Radios used for teaching and learning in Tladi Secondary School

Additionally, learners maintained that they use ICT in class to prepare and complete assignments. Actively participating in these assignments is seen as essential for assessing their understanding of the taught material in class. Kgalalelo from Molapo School said, *we work together in class using ICT material, playing compact discs (CDs) for in-class assignments*, while Omphile from Tladi School said, *we use our phones for research and during class discussions, particularly when dealing with challenging questions*.

These practices suggest that ICT is being used creatively, even in environments where high-end technology, such as laptops or interactive whiteboards (IWBs) may not be readily available. The reliance on traditional media, however, like radio and television signals a gap in implementing more advanced technologies into daily classroom practices. This shows a disconnect between policy intentions and the realities of ICT implementation in some schools, echoing literature that notes the need for more comprehensive infrastructure (Msimanga, 2019; Mwapwele et al., 2019).

Teacher implementation of ICT in class

Learners mentioned the crucial role played by teachers in implementing ICT in classrooms. Teachers used digital devices such as laptops, projectors, and digital videos in class. Motlalepule, from Maru School said, our *teacher in Life Sciences' class use a laptop and a projector to display notes. Making our notes taking process easy*. These tools were also used in Physical Science classes, as highlighted by Motheo from

Molapo School when he said, *in our class the teacher uses a projector during Physical Science lessons to present content on the whiteboard*. Meanwhile, from Tladi School, Mosa said, *our teacher in English uses ICT to aid us during class discussions. We watch English materials through digital video in the classroom.*

Figure 3. A laptop trolley with laptops used for learners in Maru Secondary School

While learners acknowledged the value of ICT in supporting learning, the findings point to the need for ongoing teacher professional development. Teachers' ability to effectively use these tools directly impacts learners' educational experiences, yet some teachers may lack confidence or required skills to fully implement ICT into their lessons. This observation resonates with studies emphasising the importance of continuous training for teachers to enhance their digital literacy and pedagogical skills (Kabooha & Elyas, 2018; Lim & Tan-Chia, 2022; Mereku & Mereku, 2015).

Analysis of Findings

The findings, descriptive as they are presented, do expose several key challenges related to ICT implementation. Disparities in learners' access to ICT at home, for example, reliance on parents' phones or public Wi-Fi highlight the digital divide within the Rekopantswe sub-district schools, in particular at the senior phase. These gaps reflect broader societal issues around equity in education and educational technology access, particularly in under resourced schools (Ali et al., 2023).

While teachers' efforts to incorporate ICT are commendable, the findings suggest a need for more structured and continuous professional development. Teachers play a crucial role in transforming educational practices through ICT integration, but limited training may impact this potential (Miller & Kumar, 2022; Tarraga-Minguez et al., 2021).

The use of ICT in class, particularly in the form of projectors and digital videos, aligns with the constructivist approach, as it encourages learners to engage actively with the material. However, reliance on traditional media, like radio and television, indicates a gap in more sophisticated ICT implementation, suggesting that schools

may not be fully equipped to integrate advanced technologies (Lim & Tan-Chia, 2022; Mwapwele et al., 2019).

Potential threats and limitations of ICT in senior phase schools

Based on the thorough analysis of the study, the findings present both the potential and the limitations of ICT in senior phase schools, addressing the research question. The key impediments include unequal access to ICT tools, inadequate infrastructure, and insufficient teacher training. Learners who are exposed to rich ICT tools can access interactive content, online research, and digital assessments, while those with limited access rely on the traditional textbook engagement, resulting in gaps in digital literacy. In poorly resourced schools, teachers may struggle to implement ICT-based teaching strategies due to inconsistent access to digital tools. As a result, teachers may develop high stress levels, frustration, and reliance on outdated or manual teaching methods.

These challenges align with digital divide theories and underscore the need for policies that address both resource provision and teacher development (Lim & Tan-Chia, 2022; Mentz & De Beer, 2021). The findings highlight how unequal ICT access and infrastructure gaps perpetuate educational inequalities, reinforcing digital stratification among teachers and learners. Irrespective of these challenges, learners and teachers alike recognise the value of ICT in enhancing educational experiences, in particular in terms of communication, collaboration, and information access. These benefits support constructivist principles, which argue that ICT can foster deeper learner engagement and autonomy when integrated effectively (Ali et al., 2023; Kabooha & Elyas, 2018). While ICT has the potential to enhance engagement and autonomy, its benefits are contingent on teacher competence and reliable infrastructure. Without these, ICT remains an untapped resource rather than an active learning tool.

Observation

Usage of ICT equipment by teachers

Both teachers integrated ICT into their teaching, utilising various tools to enhance the learning experience. In Maru School, the teacher began the lesson on Computer Applications Technology (CAT) by projecting an activity using a computer, a projector, and a drop screen. The teacher also assisted learners who experienced difficulties turning on their computers and resolved technical issues with non-functional devices before proceeding with the lesson. In contrast, at Tladi School, the teacher used a radio (see Figure 2) to broadcast an educational program relevant to the lesson, specifically for English First Additional Language (EFAL). Similarly, in Molapo School, the teacher employed a document camera, a projector (see Figure 4), and a whiteboard to present the lesson effectively.

Several studies have found that teachers' willingness to adopt ICT depends not only on its usability but also on its perceived usefulness (Lawrence & Tar, 2018; Quyen, 2020). Therefore, teachers' confidence and competence are vital for the successful implementation of technology in schools. To support this, it is essential to provide adequate ICT resources, including both software and hardware, alongside effective professional development, sufficient time for implementation, and ongoing technical support to teachers.

Figure 4. A projector and a document camera in Molapo Secondary School

Teacher management of the lesson

In Maru School, during the computer lesson, the teacher actively ensured that learners understood the lesson's requirements and encouraged them to ask questions to avoid anyone from falling behind. This was achieved by flipping through the projected notes and referencing specific slides to assist learners in their understanding. Furthermore, learners were given the opportunity to turn on their computers, with the teacher providing assistance to those who encountered difficulties.

Figure 5. A computer laboratory in Maru Secondary School

In Tladi School, the teacher emphasised the importance of attentiveness, particularly since part of the lesson involved listening to the educational radio broadcast. Similarly, in Molapo School, the teacher informed learners that the lesson would be projected and encouraged them to highlight any unclear points. Constructivist perspectives on learning often emphasise the importance of a seamless transition from informal knowledge environments to the formal realms of school knowledge through self-directed exploration (Ali et al., 2023).

The poor provision of ICT equipment is identified as one of the major impediments. In Rekopantswe sub-district many classes lacked basic technological tools such as multimedia projectors, functional computers, and stable internet access, thereby limiting teachers' proficiency to incorporate ICT into classroom practices. This finding is consistent with broader literature on ICT integration in under-resourced

schools (Kassutto et al., 2021; Ngodu et al., 2024), which frequently points to infrastructural limitations as a crucial challenge.

However, a more nuanced analysis in this study suggests that the gradual pace on the provisioning of ICT educational tools may also be linked to deeper socio-economic and administrative challenges. For instance, schools located in low-income environments such as Rekopantswe are often impacted by broader educational budgetary constraints, which prioritise other urgent needs over technology (Sudin et al., 2022). Thus, while insufficient provision of ICT equipment is an immediate barrier, it is linked to systemic issues in public funding and policy decisions in South Africa. This connection maintains the idea that ICT integration cannot be viewed in isolation but must be addressed through comprehensive reforms focusing on the socio-economic realities of the schooling system.

Furthermore, the findings identified that teachers' lack of formal training in ICT contributes to the challenges experienced in schools. Despite having access to certain ICT tools, teachers in Rekopantswe sub-district often struggled to use them optimally as they lacked both the technical understanding and the pedagogical frameworks to integrate these tools into learner-centred teaching practices. This challenge is in alignment with theoretical perspectives on constructivism, which emphasise the need for learner autonomy and active engagement (Tigere & Netshitangani, 2022).

The absence of structured professional development programs leads to teachers remaining rooted to traditional teacher-centred methods, resisting the important pedagogical change that would allow for more interactive, ICT-based experiences. This gap in the provision of relevant training for teachers suggests an institutional inertia that persist within the educational system, where resistance to pedagogical innovation slows the adoption of new educational technologies (Shambare et al., 2022). Drawing the comparison to these findings with international best practices, such as those discussed by Tarrage-Minguez et al. (2021), it becomes evident that continuous, context-specific training programs---focused on both the technical and pedagogical dimensions of ICT-----are essential to strengthen the teachers' knowledge in implementing ICT effectively (Haarala-Muhonen et al., 2023; Lin et al., 2012). Where there is inadequacy in the provision of educational ICT training, that will perpetuate a cycle where technology is present but not sufficiently used in classrooms. Consequently, failing to reach its potential in improving teaching and learning outcomes in schools.

The increased workload and the communication pressures that accompany ICT integration in the school environment adds to the additional barriers frequently less discussed. Teachers reported feeling overwhelmed by the additional tasks associated with using technology, such as preparing digital materials, managing online resources, and troubleshooting technical issues during class. This finding resonates with studies on teacher well-being, where ICT adoption, while beneficial for learners, can exacerbate stress and reduce job satisfaction if not accompanied by adequate support systems from the government (Timotheou et al., 2023).

The broader implications of these pressures on teacher well-being need to be explored further. The study suggests that without adequate institutional support and workload management strategies, ICT implementation may inadvertently contribute to burnout and reduced motivation among teachers. This is a critical area where future research could delve deeper, examining how ICT integration not only impacts

educational practices but also influences the professional lives of teachers. A more robust comparison with empirical literature on teacher job satisfaction in the context of technology integration could offer deeper insights into this dynamic.

On the positive side, the study found that when ICT was effectively integrated in classrooms, it had the potential to significantly enhance learner engagement and participation. This aligns with existing research highlighting the motivational benefits of ICT in education (Sattar et al., 2019). Learners became more active participants in the learning process, and ICT facilitated better understanding of complex concepts (Maiti & Priyaadharshini, 2024). However, the study could benefit from a more detailed comparison with research that examines specific learning outcomes, such as improvements in literacy or problem-solving skills, following ICT adoption (Mahlo & Waghid, 2022).

Moreover, the finding that ICT improves engagement raises the importance of continuous teacher training. As Comi et al. (2017) and Lim and Tan-Chia (2022) point out, the effectiveness of ICT in improving learning outcomes is heavily dependent on teachers' ability to use the technology to its full potential. In the absence of continuous training, the benefit of ICT in the classroom will remain limited to sporadic, rather than consistent, improvement in learner performance. Thus, this study underscores the need for sustained investment in both infrastructure and teacher professional development.

CONCLUSION

The findings of this study provide a clear answer to the research question, to what extent do ICT implementation challenges impede teaching and learning in senior phase schools in the Rekopantswe sub-district? The study reveals that the primary obstacles lie in a combination of resource limitations and teacher preparedness, which together hinder the full integration of ICT into classroom practices in the Rekopantswe sub-district. The findings are hereby summarised, and their broader implications for practice, policy, and future research are presented.

The primary barriers identified include inadequate ICT equipment, such as computers, projectors, and reliable internet access, significantly impeding the ability of teachers and learners to fully benefit from educational technology. Empirical data from the study indicate that 67% of surveyed teachers reported inadequate provision of basic ICT tools such as computers, projectors, and reliable internet. The lack of infrastructure like computer laboratory has led to only 33% of teachers being able to integrate ICT tools into their teachings. This infrastructural limitation is one of the most prominent challenges, as many classrooms are not equipped to support the integration of ICT into daily lessons. Poor provision of ICT tools renders teachers being unable to consistently incorporate technology into lessons, leaving its potential to enhance learning unrealised.

While teachers expressed a positive attitude towards the use of ICT tools, their ability to effectively utilise these resources in the pedagogical practices was compromised by a lack of adequate educational training programs. While teachers expressed positive attitudes toward ICT use, only 50% emphasised the need for formal training in the use of technological equipment.

The study also highlighted that even when technology was available, it was not used consistently or effectively across classrooms. Observational data show that only

33% of classrooms incorporate ICT on a regular basis. This uneven implementation stems from varying levels of ICT proficiency among teachers, lack of technical support, and insufficient time to adapt lesson plans to integrate ICT tools. The result is fragmented approach to technology in education, where some learners benefit from ICT enhanced lessons, while others are left behind.

In order to overcome the identified challenges, schools need to invest in both infrastructure and teacher development. The critical part from this study is that merely introducing technology into classrooms is insufficient. Teachers must be provided with the necessary tools and training to integrate ICT effectively into their pedagogy. Schools, with the support of the department should ensure that classrooms are equipped with reliable and sufficient ICT tools, including computers, projectors, and internet access. Continuous training programs for teachers should be developed, focusing not only on the technical aspects of ICT but also on its pedagogical applications and benefits. This will enable teachers to confidently use technology in a way that enhances teaching and learning. Mentorship and peer-support initiatives need to be implemented to foster collaboration among teachers, allowing them to share best practices and innovative ways to use ICT in their teaching.

At the policy level, education authorities need to prioritise the allocation of funds towards ICT infrastructure in under-resourced areas, such as the Rekopantswe sub-district. Policymakers need to increase budgetary allocations for ICT infrastructure in schools, ensuring that all learners have access to modern technological tools. ICT training should be mandatory as part of continuous professional development for teachers, with a focus on both technical skills and the integration of ICT into curriculum planning and delivery. Partnerships should be established with the private sector to provide schools with up-to-date technology and ensure that teachers and learners have access to the latest educational tools.

The study opens a window of opportunity for future research where an investigation into the long-term impact of sustained ICT integration on both teaching practices and learner outcomes is explored, particularly in sub-districts that are under-resourced.

Finally, addressing ICT challenges is not only crucial for improving digital literacy but also for fostering an inclusive and equitable education system in South Africa. While this study provides valuable insights, its findings are limited to the Rekopantswe sub-district and may not be fully generalised. Future research should employ mixed-method approaches, incorporating quantitative data to assess the long-term impact of ICT on learning outcomes. Additionally, expanding the study to multiple regions would provide a broader perspective on ICT implementation across South African schools.

RECOMMENDATION

In the short term (immediately to one year), teachers should receive mandatory annual ICT training as part of their professional development to ensure they are equipped with the necessary digital skills. Experienced ICT users can serve as mentors to those who are less proficient, thereby promoting a culture of peer support and shared expertise. Policymakers must also increase funding allocations for ICT infrastructure, particularly in under-resourced regions such as the Rekopantswe sub-district, to address immediate technological gaps.

Over the medium term (one to three years), schools should establish and maintain computer laboratories to foster learners' hands-on ICT experience and enhance academic performance. Ensuring reliable and sustained internet connectivity—achieved through partnerships with local service providers—is critical to supporting both teaching and learning. By the 2026–2027 academic years, schools should aim for 100% reliable internet access, allowing learners and teachers to seamlessly integrate digital tools and content into everyday learning. In addition, schools are encouraged to develop broader community partnerships, enabling learners to use ICT tools beyond the classroom. Promoting the responsible use of personal digital devices for educational purposes is another step toward creating a digitally inclusive environment.

In the long term (beyond three years), systemic changes are necessary to ensure the widespread use of ICT in education. The Department of Basic Education should prioritize the modernization of ICT infrastructure by allocating ample funds to provide essential tools, such as computers, projectors, and stable internet access, for all learners and teachers. A key goal is to increase the availability of computers to achieve a learner-to-computer ratio of at least 1:5. Furthermore, ICT training must be incorporated into teacher education at the tertiary level to cultivate robust digital skills from the outset of each educator's career.

Overall, these recommendations—from short-term training and mentorship initiatives, to medium-term community-driven collaborations, to long-term government-backed infrastructure investments—are interconnected measures that, together, will create an environment where ICT is fully embraced and integrated into the senior phase educational landscape.

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