

Barriers to Electronic Access and Delivery of Educational Information in Resource Constrained Public Schools: A Case of Greater Tubatse Municipality

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Abstract: Information and Communication Technologies (ICTs) are capable of expanding access to quality education, educational resources and provide teachers with new skills. Nevertheless, a majority of rural public schools have limited ICTs, mainly due to geographical landscape, lack of service delivery and poverty. As a result, they currently seem not to be adequately benefiting from current advancements in ICTs. The main objective of the research presented in this paper was to understand the challenges faced by resource constrained schools under the Greater Tubatse Municipality (GTM) in the Limpopo Province of South Africa regarding lack of access to electronic educational information. An exploratory case study approach was adopted to identify and understand the challenges faced by rural schools, including educational services and content considered by schools as relevant and useful. The results indicate that resource-constrained schools in the GTM are facing challenges of lack of access to electronic educational information and services, as the result teaching and learning becomes difficult.

Keywords: e-Education, ICTs, Resource-constrained, Rural Schools, Greater Tubatse Municipality, Public Schools, Electronic Access, Case Study, Educational Information.

1. Introduction

Introduction of Information Communication Technologies (ICTs) in the schools is seen as a tool to facilitate teaching and learning [1]. According to South African National Department of Education's e-Education White paper [2], ICTs are combinations of networks, software and hardware that enable the processing, management and exchange of data, information and knowledge. The use of ICTs eases access to information and learning resources for both learners and teachers in the schools; furthermore they improve general schools' administration [3]. As stated in the South African Department of Basic Education's (DBE) Guidelines for Teacher Training and Professional Development in ICT [4]:

“...the ICT is fundamental to the implementation of e-education and offers greater opportunities to access learning, redress inequalities, improve the quality of teaching and learning and provide personalised learning experiences”.

ICTs do not only facilitate teaching and learning, as [5] argues that use of ICTs to enhance learning could also help overcome some challenges of improving low efficiency

and productivity of both the teaching and learning in South African schools. ICTs also expand access to quality education and access to educational resources that might not otherwise be available in disadvantaged schools (e.g. online courses, lessons, and broadcast media). The South African National Department of Education's e-Education White paper [2] also states that ICTs have the potential to enhance the administrative capacity and management of the schools. In addition, ICTs provide universal primary education in developing countries, boost the literacy and help in preparing learners by developing skills such as self-directing learning, critical evaluation of information and collaboration skills [6]. Therefore, it is evident that acquiring and/or accessing information through the use of ICTs in education is of crucial importance.

Learning and teaching using ICTs has been adopted by many educational institutions [7] across the globe. In South Africa, various government departments in partnership with Non-Government Organisations (NGOs) such as SchoolNet and other stakeholders introduced a number of programs and projects to support traditional teaching and learning with ICTs.

Some of the recent developments to support teaching and learning via technology-led innovations in South African schools include:

- **SchoolNet Projects:** promotes learning and teaching through the use of ICTs in schools. Some SchoolNet projects include supporting teachers through hosting discussions across its social network platforms such as Twitter, Facebook, YouTube and the SchoolNet Blog [8].
- **ICT4RED Project:** ICT for Rural Education Development (ICT4RED) is a sub-project to TECH4RED (Technology for Rural Education Development) project. The project was initiated by DBE, Department of Science and Technology (DST) and Council of Scientific and Industrial Research (CSIR) to improve rural education via technology-led innovation in the Cofimvaba region in Eastern Cape [9].
- **Intel Teach Program:** Intel Teach program sponsors SchoolNet conferences and provides funding for professional development of teachers at selected schools nationally [8].
- **Google in Education:** The mission of Google in Education and SchoolNet partnership is to develop educators who are using technology for teaching to become Google Certified Teachers (GCT). The ultimate goal of the program is to improve learning through web-based literacy technology.
- **Microsoft Partners in Learning:** Microsoft Partners in learning program enables school leaders to embrace innovation and implement technology to support teaching and learning.
- **Operation Phakisa ICT in Education Lab:** The programme fast tracks the objectives outlined in the National Development Plan (NDP) [10]. The aim of the initiative is to develop a systematic and detailed roll-out plan for delivery of curriculum through ICT to schools in South Africa [11].

From the aforementioned initiatives, it might be safe to conclude that the DBE and other stakeholders are doing enough to support teaching and learning through ICTs. However, researchers [9] noted that the large portion of resource constrained schools have limited or no access to ICTs infrastructure and teaching materials such as textbooks. A resource constrained environment is defined by [12] as an environment where there is low-income communities and low bandwidth. Resource constrained environment provides unique challenges, such as scarce and expensive power and network connectivity and cultures where people are unfamiliar with or afraid of technology [13]. This results in what is known as the digital divide [14].

In [15], it is maintained that due to geographical challenges such as mountainous terrain, valleys, swamps etc., it becomes difficult to deploy infrastructure in the rural areas.

In [16], it is also argued that deployment of ICTs infrastructure is hampered by lack of electricity, security, fixed line deployment cost and maintenance, poverty, lack of technical skills and geographical landscape.

Shortage of ICTs in the rural schools impact negatively on teaching practical subjects such as drama, music and science, which results in high failure rate in these subjects [17]. More often textbooks that are available are old and outdated, focus on theory only or have little relevance to students in wildly diverse contexts, therefore learners in the rural areas often miss out [18]. In addition, the research by [13] has also shown that problems and complexities within South African education system such as ongoing changes to curricula, teachers under-performance, lack of school leadership and management skills significantly influence the performance of learners, particularly in rural schools.

In the view of the general challenges highlighted above, this paper investigated direct challenges faced by resource-constrained public schools under the GTM in Limpopo, South Africa regarding lack of access to educational information in electronic platforms, such that appropriate solutions could be put forth on how ICTs could potentially increase electronic access to educational information and services. Secondly, the paper reports on the investigation of the digital content and services considered by educators in rural schools of the GTM as relevant and useful for teaching and learning.

2. Related Work

There are a number of wireless and wired networking pilot projects implemented in the rural communities in order to address the lack of access to connectivity in South Africa. The initiatives include the broadband for all (BB4All) wireless mesh networks project by CSIR Meraka institute aiming to provide affordable broadband connectivity to under-serviced rural communities [19]. Other similar initiatives include the Siyakhula Living Lab (SLL) project by the University of Fort Hare in Alice, Rhodes University situated in Grahamstown, the industry and government partners, and the rural communities of Dwesa and Nkwalini to provide telecommunication network [20].

There are also about 140 telecentres established in South Africa to cater for rural populations by providing access to basic ICTs and services to meet the basic necessities such as economical and communication needs of their communities [21].

A lot of ground work has been achieved through initiatives mentioned above and policy reforms, but there are still limitations with regards to existing initiatives. According to [22], there is still a large number of people in remote and rural areas in South Africa without connection to networked computers.

In [22], it is found that the current fixed line and wireless solutions in rural areas have largely been limited to the operation and maintenance of telecentres and phone shops due to connectivity affordability and limitations of the bandwidth. A study presented by [21] also argues that telecentres find it difficult to sustain themselves, as the results of problems like; financial constraints, poor pricing structures, theft and vandalism and lack of well-trained managers. In [15], the challenges such as lack of skills and experience amongst the locals in the rural areas, are highlighted as the major problems that result in delays on fault repairs and high maintenance cost because the experienced teams that support the network reside away from the site.

3. Research Problem

Throughout the world many educational sectors understand the importance of ICTs in supporting education improvements [23]. However, majority of resource constrained public schools in South Africa still have limited or no access to ICTs; therefore not all schools

benefits equally from the use of ICTs. This lack of ICTs brings challenges of accessing learning and teaching educational information in electronic formats.

The main thrust of this research was: (1) To understand the challenges faced by resource-constrained high schools in the GTM regarding lack of access to teaching and learning material in electronics platform, (2) To determine educational services and content considered by schools in the GTM as relevant and useful, (3) To investigate state of ICTs access in the GTM.

4. Significance of the Study

The findings of this case study provide a greater understanding of the challenges faced by resource-constrained public schools and demonstrates the impact of ICTs adoption in the rural high schools. These findings contribute significantly to the DBE's programs such as *Operation Phakisa ICT in Education Lab* and turnaround plan called *Action Plan 2014 towards the realisation of Schooling 2025*, which aims to fast-track the provision of basic infrastructure to schools in the remote areas. Furthermore, the findings from this case study will inform other academic community, policy makers and content providers about the nature of value adding services and content considered by high schools as relevant and useful.

5. Research Setting and Approach

The study focused on resource-constrained high schools situated in the Greater Tubatse Municipality (GTM) of the Sekhukhune District in the Limpopo province, South Africa. The area of jurisdiction is approximately 4 550 square kilometres in size and is known as the Middelveld [24]. Large portion of municipality is rural with approximately 166 villages and six townships. Due to its rural and mountainous nature, it makes the provision and maintenance of services very costly, and is confronted with high service delivery backlogs [24].

In terms of education, the municipality has 161 primary and 88 secondary schools with 114 723 learners and 3689 educators, and two of the schools are private schools. The schools have inadequate education facilities [24]. Some of the challenges are shortage of classrooms, lack of basic services such as electricity, water and sanitation.

For the research presented in this paper, an exploratory case study was conducted to explore and acquire relevant information from the participants, using semi-structured interviews and direct observations in the rural and public high schools located within the GTM. The identified schools are experiencing various challenges in terms of basic services and resources [24].

According to [25], the case research is an in-depth investigation of a problem in one or more real-life settings (case sites) over an extended period of time. The data of those case studies may be collected using combinations of internal or external documents, structured or unstructured interviews, personal direct observation, participant observation and group discussions [26]. Case studies research needs not to depend on single source of evidence, but variety of sources [27]. The method is able to discover a wide variety of social, cultural, and political factors potentially related to the phenomenon of interest that may not be known in advance [25]. The sampling technique is discussed in the following section.

5.1 Sampling Technique

For the purpose of this study, purposive sampling was adopted. Purposive sampling is based on assumption that the researcher need to purposefully select individuals, groups, and settings because they are likely to be knowledgeable and informative about phenomena the researcher is studying [28]. Due to time and resource limitations, the researcher focused on

the ten (10) resourced-constrained high schools in the GTM. The researcher focused on secondary schools because of a high demand of ICTs in high schools as compared to primary schools. The identified high schools were selected because they are located in the deep rural areas of GTM. Furthermore, these high schools are experiencing various challenges in terms of basic services and resources facilities [24]. The targeted participants for this study were educators and principals responsible for the computer related curriculum.

5.2 Ethical Considerations

The researcher applied for ethical clearance from the university (i.e. UNISA) to cover confidentiality and anonymity of participants. After the clearance was received, the DBE (Sekhukhune District Municipality) was approached through a letter addressed to district Senior Manager, after the aim of research was discussed telephonically. The letter of approval was obtained, and school principals were asked for permission for their teachers to participate. Once they agreed to participate, the date and times were settled for when the field observations and interviews could be performed. The participants were asked to fill and sign the consent form. The consent form outlined the research purpose. The participants were volunteers and could terminate their participation at any point in the process. The participants were informed about the recording of interviews. The interviews took between 18 to 33 minutes. The participants and schools will remain anonymous to protect their confidentiality as per ethical clearance conditions.

5.3 Data Collection

Due to the nature of this study, a qualitative approach for data collection was chosen. In [25], it is highlighted that qualitative research relies mostly on no-numeric data, such as interviews, observations, and content analysis techniques for data collection. The qualitative data collection process for this study relied on three (3) research methods: semi-structured interviews, direct observation and literature review. The primary data collection process was achieved by conducting an exploratory case study focusing on the under-serviced high schools situated in the GTM.

5.4 Data Analysis Techniques

The method of analysis chosen for this study was a thematic data analysis technique to analyse the qualitative data. The thematic technique is defined by [29], as a search for themes that emerge as being important to the description of the phenomenon. The thematic analysis started by finding the recurring patterns emerging from field notes and interview data, for similarity and differences. In [30], it is reported that the similarities and differences techniques involve taking pairs of expressions from the same informant and looking for their similarities and differences. The themes are identified through careful reading and re-reading of the data [29].

Then the data was inspected to identify the occurrences of the themes related to three research questions. Data from the direct observation and semi-structured interviews were transcribed into a Word processor, and interviews were recorded on the recording device to ensure that participants' responses are correctly captured. The researcher transcribed semi-structured interviews by listening to the audio recordings and simultaneously typing everything that is said on the tape. Transcription of audio recordings and typing of field notes was done as soon as the data was collected. The answers were grouped into categories; themes were determined and the pertinent quotes from the participants' interviews were also extracted.

6. Results

As stated in Section 4.2, the researcher visited ten (10) high schools, but only collected data from seven (7) high schools in different villages within the GTM between the 04th and 05th of September 2014. Other two (2) high schools opted not to participate citing that the educators were unavailable. One of the high school requested permission letter from their local circuit offices instead of the one (Sekhukhune district municipality) presented. Due to time constrains and distance, it was impossible to seek the letter from the local circuit at short space of time. Nine participants were interviewed (2 principals, 2 vice principals and 5 teachers). Some of the principals preferred to be participate with a teacher who understands ICTs better. All participants were senior educators.

The identified themes were clustered under the headings that directly relate to research questions.

In *Table 1*, the main themes, research questions and the results are summarised.

Table 1: Mapping of Main Themes, Research Questions and Results

| Main Themes | Research Questions | Results |
|---|--|--|
| Theme 1: Access to ICTs for teaching and learning | What ICTs do the high schools in the have access to? | Mobile modems; PCs; Tablets; Projectors; Printers; Scanners; Computer labs; Mobile (GSM/EDGE technologies) and VSAT internet and DSTV. |
| Theme 2: General ICTs requirements for teaching and learning | What are the value adding services and content considered by high schools as relevant and useful? | Reliable internet connection; Video content; Digital library; E-books; E-mails and The Web. |
| Theme 3: Important of using ICTs at public high schools | | ICTs are seen as vital tool for both teaching and learning. |
| Theme 4: Challenges faced by high schools regarding lack of access to ICTs | What are the challenges faced by resource-constrained high schools in the GTM regarding the lack access to learning information? | Poor performance of learners; Limited resources for teaching (relies on text books); Learners and teachers are excluded from digital world; Traveling costs and Information sharing within learners and other schools. |

Table 1 outlines data categorised into four (4) main themes to address three research objectives mentioned in Section 3. Furthermore, Table 1 indicates the findings of current ICTs resources, the requirements for teaching and learning, the value of using ICTs for education and challenges faced by schools regarding lack of access to ICTs. The results are discussed further in Section 6.

From the observations, the researcher noted that the municipality is mountainous, and quality of cellular networks (voice and data) and television coverage is very poor in some areas. There is high shortage of computer resources in the schools visited. Schools with access to computers were donated by local mines, and some of them never worked and maintained. The computers are mainly used by teachers for school administrations such as typing tests, capturing learners' marks and administration of South African School Management System (SASAMS).

In terms of telecommunication infrastructure, majority of local business and schools depend on Very Small Aperture Terminal (VSAT) satellite and cellular networks (GSM/EDGE (Global System for Mobile Communications/ Enhanced Data rates for GSM Evolution) technologies for voice and data services. The GTM has no fixed line copper telecommunication infrastructure due to vandalism (see Figure 1 and Figure 2).



Figure 1: Vandalised Telecommunication Infrastructures between Jane Furse and in Ga-Malekane Village



Figure 2: Vandalised Telecommunication Infrastructures in Ga-Malekane Village

7. Discussion of the Results

The findings from the case study as summarised in Table 1 confirm that rural schools in the GTM are experiencing challenges of lack of access to learning materials. From the interviews, it was noted that lack of access to the Internet and poor infrastructure makes teaching and learning difficult. The case study findings support the statement of [17] who states that the lack of ICTs infrastructure, shortage of text books and limited information in the textbooks and access to the computers, let alone access to the Internet, impact negatively on teaching of science subjects in the rural public schools. From theme 4, it was identified that lack of ICTs infrastructure does affect learners' performance negatively. Many educators rely on text-books for teaching life science and computer skills subjects. This becomes a problem as they have limitations and information is outdated.

From themes 1 and 2, it was noted that having access to learning material in electronic platforms could afford educators and learners the opportunity to interact with the outside world, and also will benefit the community as the whole. Theme 1 also indicates that some schools do utilise ICTs such as computers and Internet connectivity through GSM/cellular technologies to facilitate access digital content. Findings indicate that schools require reliable Internet connectivity to access services such as video, web, e-mail, digital library and e-books for teaching and learning practical and life science subjects. From [14] findings, the broadband access will enable the educators to obtain real-time material and use the programs such as video conferencing to interact with outside world.

From the observations, it was noted that schools are experiencing difficulties in accessing educational programs and learning materials due to poor quality of telecommunication networks and limited computers. The data connection via cellular networks is challenging in some parts of the area, which makes it difficult to access data

rich content. These research findings confirm the statement by [15], who argue that the geographical landscape in most of the rural areas brings the challenges to deploy the telecommunication networks, such as the valleys, swamps, and mountainous terrains. From the case study findings, the researcher noted that the geographical landscape in the GTM does affect access to television and radio services as well.

8. Recommendations and Further Research

This exploratory case study revealed that resource constrained public schools in the GTM are experiencing lot of challenges regarding lack of access to educational materials in electronic platforms. Furthermore, the study confirms that ICTs are very important to improve quality of education. The findings from this case study will also inform other researchers about the nature of value adding services and content considered by high schools as relevant and useful. In addition, the findings will then inform the state of network access technologies in the rural areas.

Despite the lack of adequate infrastructure in rural areas, the majority of communities in the GTM have access to mobile telecommunication infrastructure, in the form GSM, GPRS and EDGE technologies, which could be useful when it comes to accessing learning materials in real-time. Further studies can be undertaken to develop digital content service delivery model to address the identified challenges using access network technologies.

The case study was conducted to establish educators' ICTs needs. The themes developed in this case study were used as the requirement for proposed broadband service delivery model suitable for resource constrained environment in the other study. The proposed model seeks to address the challenges highlighted in this case study.

9. Conclusion

The challenges faced by GTM rural schools includes poor performance of learners, limited resources for teaching (relies only on text books), learners and teachers excluded from digital world, high travelling costs and information sharing within learners and other schools. Some of the challenges observed in GMT high schools include poor quality of cellular networks, lack of fixed line access network infrastructure due to vandalism, shortage of computers and lack of ICTs maintenance. Second objective of this study was to identify value adding services and content considered by schools as relevant and useful.

From the interviews, the respondents highlighted that reliable Internet connection, video content, digital library, e-books and e-mails services are very vital tools to improve the learning and teaching in the classrooms. Lastly, from the observations, the municipality has access to communication in the form of GSM/EDGE and VSAT technologies, which could be useful when it comes to deliver real-time digital content. Although high schools banned the use of cell phones in the classrooms citing inappropriate use during the lessons, some educators encourage the use cellular phones in the classrooms for educational purposes. However, DBE need to introduce directive policies governing the use digital technology in schools.

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