Moving beyond the challenges of learning through technologies: The current status of ICT integration in South African schools

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Abstract

The purpose of this study was to understand the current status of ICT integration in South African schools. Yet, this study focused on the Tshwane West District schools in Gauteng Province, South Africa. This study employed a descriptive research design to understand the aforesaid phenomenon. Data was collected through interviews and open-ended questionnaires with 10 teachers and one curriculum specialist. This study employed thematic analysis as a qualitative research method. Furthermore, Roger's Diffusion of Innovations is used as a framework. Despite the existence of policies, this study revealed that the integration of ICT remained a significant challenge for several instructors in South Africa. The most interesting part was that schools had improved on most ICT tools to enable access to learning with technologies, but to a greater extent, insufficient internet coverage in classrooms made it impossible for most teachers to appreciate the benefits that come with using tools such as laptops, whiteboards, and online videos. This research proposes the installation of pocket Wi-Fi devices in every classroom in schools to provide comprehensive internet access. This will facilitate interaction between instructors and students through up-to-date learning management systems subscribed to by schools, as well as films. This will promote a digitally viable learning environment that promotes creative opportunities for learners.

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Contribution of this paper to the literature
So many studies with a similar focus have been reporting on the challenges facing schools in integrating ICT. However, not much was done to find out how to move beyond those challenges. This study's contribution is that it provides workable strategies that can be used to achieve learning goals through ICT.

1. Introduction

Undoubtedly, learners today have unparalleled access to information, surpassing any other generation in history. Most learners are cognizant of the advantages of the World Wide Web in fulfilling their educational requirements. The growing use of ICT resources in classrooms, such as educational films, is empowering learners to take charge of their education by enhancing their comprehension and conceptualization of concepts. Recently, we have been introduced to digital applications that read texts from books, scholarly articles, etcetera, thereby allowing learners to multitask while learning. Moreso, social media platforms have also emerged strongly as a convenience strategy to improve learners' educational experiences. Of late, Meintjes (2021) studied how Facebook acts as a supportive digital pedagogical tool for Grade 12 Business studies. Meintjes (2021) discovered that there were benefits for Business studies learners in engaging on Facebook to learn business concepts. The greatest advantage was that learners were able to interact with others, which subsequently created everlasting learning communities. Also, Mtshali (2023) investigated the impact of TikTok videos on creative house plans in civil technology. This author found that learners acquired more creative ways on TikTok to design single-story house plans, and their spatial ability subsequently increased. Mhlanga, Denhere, and Moloi (2022) stress that since the abrupt change to online learning for most institutions in 2020, teaching with technology is fast becoming the classroom every teacher hopes to have. On account of this, this study sees it as imperative to understand if some South African schools are working towards achieving a technology-saturated classroom or not and what it will take to achieve that.

Indeed, there are unignorable and pressing challenges that come with having a classroom that integrates ICT. For instance, Aruleba and Jere (2022) claim that the unfavorable infrastructure in rural communities where general network access is a challenge makes it difficult for them to access and adopt ICT learning resources. Shava (2022) posits that there is still a great presence of learners and their teachers who are laggards when it comes to technological expertise to utilize modern technologies. Mtshali, Ramaligela, and Makgato (2020) add that limited funding for the procurement and maintenance of digital tools hampers the integration of ICT in schools. Amidst these challenges, there is a need to move beyond them, i.e., adapt to this fast-changing environment that compels digital inclusion. Hence, this study hinges on understanding the current landscape of ICT integration in South African schools. Thus, the following question serves as the study's guiding principle:

RQ: What is the current landscape of ICT integration in South African schools?

2. Literature Survey

The advent of ICT in education continues to gain strength each year. There are plentiful theoretical accounts that are testament to this fact. For instance, Dzansi and Amedzo (2014) state that there have been strides made to introduce ICT into rural South African schools, even though there is currently low uptake because of poor infrastructure. Dube, Nhamo, and Magonde (2018) also report that ICT integration is also feasible in physical education, even though there are still challenges due to a lack of physical education-specific ICT training for teachers and that there is no specific ICT software for physical education in such schools. Because of gradual improvements in the ICT field, challenges will forever be experienced in having software that deals with a specific discipline. However, Ngcapu, Simelane-Mnisi, and Mji (2022) report that while other disciplines may experience more ICT improvements than others, there are great benefits associated with ICT inclusion.

In a study by Shobande and Asongu (2022) on the critical role of education and ICT in promoting environmental sustainability, they discovered that through the use of ICT, there were possibilities for investing in complementary strategies for mitigating carbon emissions and environmental sustainability. These are clear signs that ICT is beneficial for differentiated learning needs. Schools are spaces of multi-disciplinary knowledge dissemination, and therefore ICT could serve as a preparation ground for all disciplines.

The use of ICT in the classroom is essential for meaningful interaction between learners and teachers to carry on in an information age (Adelabu, Alex, Ngwabe, Tatira, & Boateng, 2022). Also, because of the knowledge explosion, educational institutions, including schools, can no longer function as places that transfer knowledge from teacher to learner or use the textbook as the sole source of information; they need to be creative (Patricia, Isaac, & Manto, 2023). Of course, there are still lingering views that ICT is not beneficial to everyone, but this study argues that no matter the impact, it should be emphasized to learners in schools. We now see a lot of infrastructure improvements from the Department of Telecommunications and Postal Cable Service, where they install and wire multi-tenant buildings to ensure that every part that wishes to become inventive can use ICT resources to do so.

Most schools depend on funds from the national education department to secure resources for Information and Communication Technologies. Initially, it was costly to procure ICT resources, but of late, the costs have subsided owing to the plethora of ICT resources available in the country. Also, a lot of sponsors have come on board to assist schools in migrating to a more digital learning environment. There is an understanding that, without the necessary soft skills, learners may not be able to secure employment in the future. By default, this may mean most industries may run short of skilled people who can work smart with digital developments. Thusly, it is in the interests of industries and the education sector that schools afford to have digital tools and operate digitally.

According to Rana (2023), non-government organizations play a huge role in the affordance of integrating ICT in our schools, particularly where the government lacks training about ICT integration. Kilag et al. (2023) postulate that more than half of transformations we see today come as a result of ICT, and it is therefore important that schools afford resources that would better position them as foundations for inventions.

Hashemi, Si Na, Noori, and Orfan (2022) put forth one of the rarest perspectives on barriers to ICT integration: gender differences. According to Hashemi et al. (2022), there is a slight difference across genders in their preference to learn using ICT skills, where females are more likely to adopt ICT learning than males. Hunduma and Seyoum

(2023) postulate that barriers to ICT integration can be classified as extrinsic or intrinsic. By association, extrinsic barriers are those involving a lack of resources such as equipment and technical assistance. Intrinsic barriers are associated with having people and administrators to ensure the smooth running of ICTs.

Notwithstanding the abovementioned author contributions, Yalley (2022) claims that the following are key challenges affecting the use of ICT: They include Wi-Fi strength and coverage, maintenance of technological devices, regular software updates, infrastructure, time, and a lack of sufficient training support. In schools where the culture of learning through technology is intense, teachers and learners develop creative abilities to work with cellular phones to learn. This is why Ngcapu et al. (2022) state that integrating ICT into teaching and learning is a complex process, but with dedication, one could overcome those challenges.

A study by Rafiq, Batool, Ali, and Ullah (2021) reports that most schools lack libraries, books, and other essential amenities required to ensure high standards of instruction. It seems unlikely that South African schools will soon be able to purchase operating computers due to the severe absence of fundamental infrastructure in these institutions. In South Africa, communities currently experience inconsistent access to energy, and connectivity problems are still very present. As a result, the majority of ICT resources remain inoperable. As such, teachers are reluctant to depart from their established practices.

According to Makgato (2012), teachers do not use ICT resources because they are technophobic; it is because the conventional teacher-centered methods they use give them a sense of power in front of their learners (ibid.). However, Boice et al. (2021) suggest that teachers should not be hesitant to use educational technologies as they offer innovative twenty-first-century teaching and learning experiences. Thus, it is important to keep up with the momentum of using ICT resources even when teachers are comfortable with their conventional teaching methodologies.

3. Methodology

A qualitative research approach was deemed appropriate to ascertain the current status of ICT integration in South African schools. This study followed advise from Islam and Aldaihani (2022) that a qualitative research approach should involve collecting and analyzing data that does not involve numbers but text to understand a phenomenon. Hence, this study used this approach to collect and analyze audio- and text-based data. This study employed a descriptive research design to understand the aforesaid phenomenon. According to Mishra and Alok (2022), this design is the most appropriate for adequately and methodically describing a situation, which served as the study's guiding principle.

This study was conducted on a population of thirty-six public secondary schools in the Tshwane North region, Gauteng Province, South Africa. A non-random sampling technique was used to purposefully sample ten (10) teachers and one curriculum specialist. This was with a view to soliciting people with specific ICT knowledge characteristics to participate in a research study (Bhardwaj, 2019). Henceforth, ten teachers and one curriculum specialist were purposefully sampled. Simultaneously, data was collected through interviews and open-ended questionnaires. The entire experience took 12-20 minutes for teachers and 10-12 minutes for the curriculum specialist. The data was thematically analyzed. A thematic analysis technique, as echoed by Clarke, Braun, and Hayfield (2015), was used to create, analyze, and interpret the patterns that emerged from the data. All ethical conduct was followed by adhering to all commands placed in the ethical clearance sought from the ethics committee affiliated with the authors. It is important to note that reliability and validity are used to evaluate the quality of the instruments for data collection in quantitative research studies, while trustworthiness is used in qualitative studies. As a result, the consistency of open-ended questionnaire responses was checked and compared with responses from interviews to check synergy and triangulate. This study was in line with Moon's (2019) view that all questions asked were there to measure what was supposed to be measured. In other words, validity is the extent to which the instrument selected reflects the reality of the constructs that are being measured (Moon, 2019). For the credibility of interviews, the researchers spent enough time with teachers to better understand the responses and the context in which they were given. This was in line with Cope's (2014) observation that, in order to achieve credibility, the researcher could spend long periods of time with the participants in order to understand them better and gain insight into their lives.

4. Theoretical Framework

This study employed Roger's (2003) version of Diffusion of Innovations (DoI). The idea of diffusion is not new, as it has been tested since the 1960s. According to Roger (2003), the Diffusion of Innovations entails strategies for spreading new ideas through channels of communication over time. These innovations are initially perceived as uncertain and too risky. So, in order to eliminate this uncertainty, most people search for groups like themselves that have immersed themselves in the new idea. This study is in line with Rogers's views as it seeks to learn how to move beyond the challenges facing South African schools in integrating ICT. The Diffusion process comprises five basic stages, including knowledge, persuasion, decision-making, implementation, and confirmation. The first step is gathering knowledge, in which an adopter is exposed to an innovation without any prior idea. The next stage of the theory is about persuasion, in which a prospective adopter is open to the idea and holds a perspective about purchasing. Additionally, decision-making occurs in the next stage, in which the eventual process of either considering or rejecting the new innovation is emphasized. The core process of decision making depends on awareness, opinion, consideration, preference, and purchase intention. Aside from that, the stage of implementation at which the product is deployed is taken into account. Finally, the stance of confirmation occurs, in which end users or technology adopters evaluate their decision and illustrate whether or not they want to continue the progress. These stages are hinged on each other in a time-ordered manner, as represented below in Figure 1.
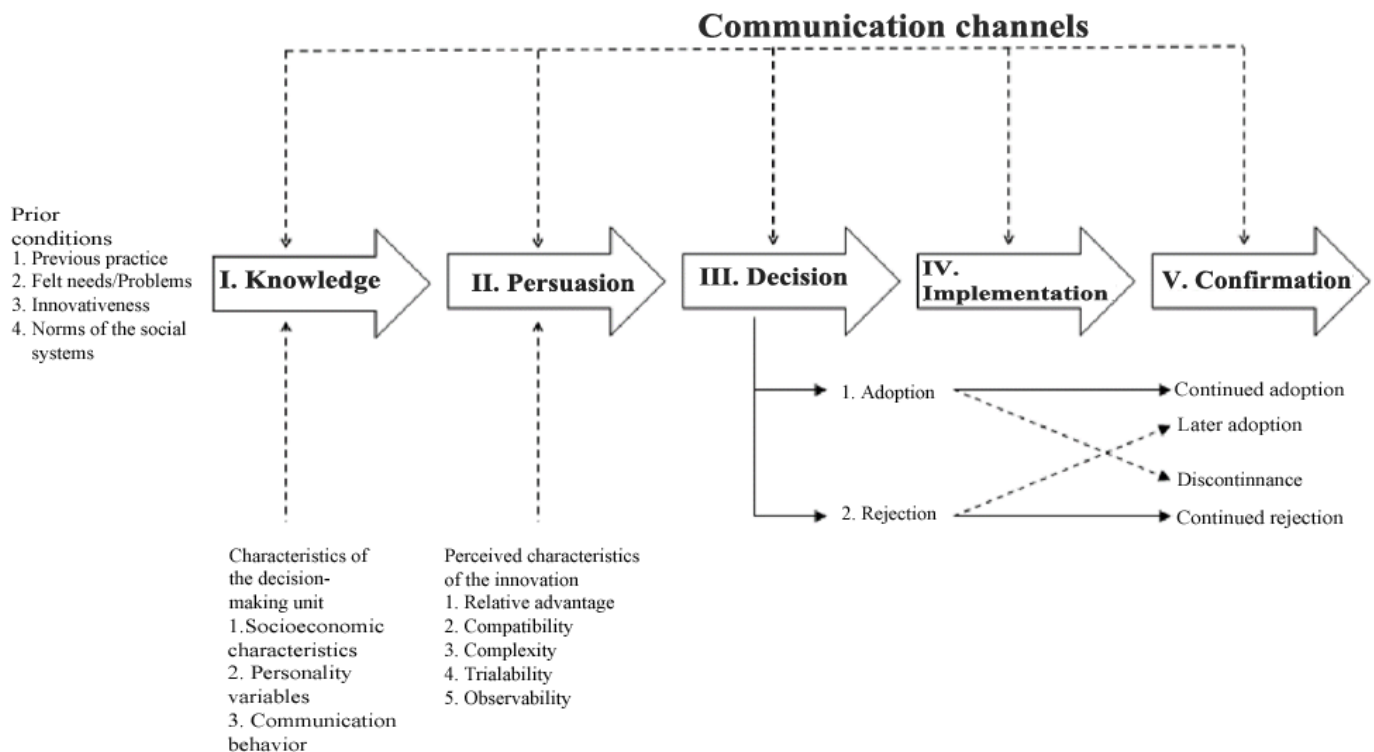
Figure 1. Stages model in the innovation-decision process.

Note: Roger (2003).

Figure 1 above depicts the DoI stage process.

Knowledge stage: It is a stage where each person acquires knowledge about the existence of innovation and learns more about it. The critical questions that one asks are how, what, and why to determine what and why innovation works. This subsequently creates awareness, procedural knowledge, and principled knowledge (Roger, 2003). In the context of this study, ICT is innovation, and teachers frequently look to specialists for knowledge about innovation.

Persuasion stage: During the persuasion stage, individuals elect a favorable or unfavorable attitude towards the innovation (Roger, 2003). In fact, they become psychologically involved with innovation and search for new ideas. For one to develop a favorable or unfavorable attitude towards the innovation, they need to perceive how the new idea applies to future situations before deciding whether or not to try it.

Decision stage: At this point, a person decides whether to accept or reject the invention. According to Rogers, adoption refers to choosing to fully implement an innovation as the optimal course of action, whereas rejection refers to choosing not to accept an invention (Roger, 2003). When viewed in this light, adoption would represent an ICT (innovation) integration into the teaching and learning process.

Implementation stage: This is a stage when a person uses innovation (ICT). As the new notion is really put into practice during implementation, overt behavior change occurs (Roger, 2003). To lessen the level of ambiguity about the effects, the implementer (teacher) may require technical support from change agents and others.

Confirmation stage: This is a stage where one has already taken a decision but needs concurrence but is still at liberty to change it (Roger, 2003). As a result, the attitude that was created throughout the persuasive stage is more important at this point because that is when adoption or discontinuance takes place. At this point, there are two distinct forms of cessation: replacement discontinuance and disillusionment discontinuance. When a person (a teacher or a student) stops using an innovation (like ICT) in favour of a superior innovation in its place, that behavior is known as a replacement discontinuance. When a person (teacher or learner) stops using an innovation (ICT) because they are disenchanted with how well it performs, this is known as a disillusionment discontinuation.

This enlisted process can be essentially replicated in the chosen context to ensure a greater degree of development paradigm management. Furthermore, complying with the key requirements present in current ICT domains for educational processes can help deploy the framework.

5. Findings and Discussions

As a reminder, this research project was concerned with exploring the current landscape of ICT integration in South African schools. This research question was answered using qualitative data such as semi-structured interviews and open-ended questionnaires, where thematic analysis was used to make sense of the data. Henceforth, when exploring the current status of ICT integration in South African schools, this study discovered that ICT integration in schools depended on the following:

- Availability of ICT tools.
- The use of available tools for learners' tasks.
- Teacher professional development in ICT.
- Availability of ICT policies in schools.

The abovementioned themes are elaborated upon below.

5.1. Availability of ICT Tools

In this digital era, using ICT tools in the classroom is becoming the order of the day, given that almost half of the jobs available in the world require some set of ICT-related skills (Ghavifekr, Kunjappan, Ramasamy, & Anthony, 2016). It therefore follows that teachers are somewhat compelled to teach using ICT tools, and schools should ensure

their availability all the time. In this regard, teachers were asked to determine the tools that are available to them and what they use them for. Below are some of their views:

> *"We have access to the Internet, but then it is limited by the fact that we cannot really access the Internet when we are in class. We have the smartboards. And the department also offered laptops to the teachers."* Teacher A (Interviews).
> *"Smartboards, projectors, and laptops…only those three. We use them every day only in grade 12, not in lower grades."* Teacher B (Interviews).
> *"We recently received the laptops, and we only have two projectors, which we as educators have to share."* Teacher F (Interviews).

Looking at the above, it seems teachers have laptops, and their classrooms are mounted with smartboards. While this is progressive, internet coverage is a huge hindrance for them, especially during instruction. Munje and Jita (2020) postulate that the internet coverage instability of networks in classes is a key demotivator among teachers and learners to enjoy learning with technologies. This is worrisome as internet knowledge is time-consuming and learners need emerging knowledge and skills to become active participants in modern society (Shah & Empungan, 2015). However, with a lack of an operative instrument like internet, it becomes a fictitious exercise to integrate ICT into the teaching and learning process. This corroborates the views of teacher J; see the extract below:

> *"I have reported to the school principal to assist us in having string internet coverage in our classrooms since some of the physical science components I teach require visuals. I tried to save the videos, but they take up space on the laptops and make it very slow to function."* Teacher J (Open ended questionnaires).

Clearly, the lack of internet in classes makes teaching a hard process. This is supported by Shah and Empungan (2015): whenever there are inadequacies or incomplete or broken resources in ICT, teachers tend to develop a negative attitude towards the use of ICT tools to enhance teaching and learning. However, as the following theme unpacks, this study continued to investigate whether learners and teachers used ICT tools for general learners' tasks without being subject-specific.

5.2. The use of Available Tools for Learners' Tasks

Research has indicated that throughout the last decade, teachers largely used ICT tools to augment their current pedagogical practices, rather than regurgitating exercises that prompt the use of ICT, adding variation to day-to-day classroom activity, and providing learners with opportunities for independent work with peers (Koh, 2013). Therefore, teachers were asked whether they give learners tasks that prompt them to use the ICT tools and also indicate the time (duration) given to the learners to interact with those tools, and this is how they responded:

> *"No, we normally discourage learners from using the smartboard without the supervision of the teacher because if we allow them, they misuse these tools by playing games."* Teacher B (Interviews).
> *"No, I have not given learners the work that prompts them to use the ICTs because in our school we don't allow learners to come with cell phones. Therefore, I, as an educator who specializes in CAT (Computer Applications Technology) as a subject, am willing to use ICTs, but I cannot because of the school policy that prohibits learners from bringing their cell phones to school."* Teacher D (Interviews).
> *"No, I do not. Simply because I do not use ICTs tools, I just give the learners regular work referring to the textbook."* Teacher G (Interviews).

While teachers B, D, and G indicate that they fear that learners could use ICT tools for non-educational purposes and see textbooks as an efficient knowledge dissemination tool, Teacher E had a different view; see except below:

> *"Yes. I cannot really tell exactly how long I allow the learners to interact with ICT tools because sometimes over the weekends I send them assignments, and it might take them the whole week to complete."* Teacher E (Interviews).

The above interview findings highlight the various views of the teachers based on the use of available tools for learners' tasks. It emerged that the majority of the participants do not give learners tasks that prompt them to use available ICT tools due to insufficient ICT tools and school policies that prohibit learners from bringing cell phones to school. As a result, this negatively affected the use of ICT tools in teaching and learning. In support, Abel, Tondeur, and Sang (2022) claim that teachers' perceptions about ICT integration in schools influence the adoption of technologically advanced pedagogies to foster new instructional practices and implement new initiatives. These differentiated views compelled researchers to check if they had been trained to teach and facilitate ICT in their schools, hence the next theme.

5.3. Teacher Professional Development in ICT

According to Dlamini and Mbatha (2018), schools have been experiencing deficiencies in terms of coming up with professional development activities that would aid teachers in becoming digital citizens and make their instructional practices technologically saturated. As such, Moila, Mji, and Simelane-Mnisi (2021) aver that it is in the interest of education that teachers become technologically and digitally literate to accelerate the soft skills required by the outside world. When asked about the ICT training programs planned for them to be equipped with ICT skills, teachers responded in the following manner:

> *"Yes, the Mathew Goniwe workshop is the one that was provided to us. Once in three months."* Teacher B (Open -ended questionnaire).
> *"Yes, quarterly."* Teacher C (Open -ended questionnaire).

Some teachers recorded it differently.

> *"Not for all teachers, but only the visually impaired. They are offered these trainings three times per term."* Teacher D (Open -ended questionnaire).
> *"Not yet. I have not been to any training."* Teacher F (Open -ended questionnaire).
> *"No, the school does not, but the department provides one; they usually host workshops where selected or willing teachers attend the training on using smartboards."* Teacher G (Open -ended questionnaire).

Indeed, Champa, Rochsantiningsih, and Kristiana (2021) claim that most teachers do not receive adequate training for ICT, and those who are trained decline motivation to use them over time due to defective resources, and that schools do not factor in time for ICT learning in their lessons. Nikolopoulou and Gialamas (2016) highlight that without proper guidance and the required skills among the teachers, traditional teaching will continue to threaten

the progress of 21ˢᵗ century learning diversity aimed at promoting world-inclusive skills. Do schools have an ICT policy?

5.4. Availability of ICT Policy in Schools

It is common practice for schools to have policies that govern how ICT is integrated into the administration and educational operations of schools. This is to avoid possible disturbances between traditional operations, which are there to ensure quality promotion, and the inventions, which are trial and error in most schools. According to Bolaji and Jimoh (2023), policies assist in determining the kinds of tasks learners engage in and keeping lifelong records of working strategies that could be used to improve performance. As most learning subjects require problem-solving skills, it is pertinent to have policies geared towards enhancing learners and teachers' skills in solving real-life problems through ICT integration. In this regard, teachers and a curriculum specialist were asked to explain the extent to which ICT policies were being placed and implemented in schools. See extracts below:

"*Unfortunately, not…if it there is one...well I have never seen it.*" Teacher B (Interviews).

"*I have never seen it.*" Teacher C (Interviews).

"*For now, I can't really tell. There's no policy.*" Teacher D (Interviews).

"*We don't have policies of our own as a school.*" Teacher E (Interviews).

"*We just received our laptops a week ago, and we have not received any policy yet.*" Teacher I (Interviews).

"*I believe they have. It is just that I'm not using it, so I don't have that. If there is a policy, then I don't have it. But I believe that everything has a guideline; everything has a manual, so I believe the teachers who are using these ICT tools have that policy on how to use them.*" Teacher H (Interviews).

This is how a curriculum specialist responded to the same concern.

"*Yes. Implementation of the ICT integration policy is central to the daily operation of the e-Learning unit. Teachers are aware of the e-Education Policy from the Basic Education Department. However, I am not sure if teachers are aware of the GDE ICT policies pertaining to the devices supplied to schools and their usage management. ICT Policy implementation by schools is guided by the continuous support provided by e-Learning officials. Teachers depend on what these officials require or provide as support, as opposed to their understanding of the policies.*" Curriculum specialist_1 (open-ended questionnaire).

Ramnarain and Ndlovu (2023) highlight that the Department of Basic Education (DBE) and the Department of Communication (DoC) created the Electronics and Communication Transaction Act No. 2005 of 2002 to guide ICT initiatives in South Africa and the E-Education White Paper, adopted in 2004, to encourage the development of technical skills in education. The goal of this policy was to ensure that every learner in the general and further education and training (FET) bands is able to use ICT confidently and creatively to develop skills and acknowledge the need to achieve personal goals (Department of Basic Education (DBE), 2011). It emerged from the interviews that the majority of the teachers stated that they do not have an ICT policy in place at their schools. This was clearly surprising because teachers were not aware of ICT integration policies. Could it be that teachers and curriculum specialists do not work closely with one another, as others were not aware but only a specialist was aware?

6. Conclusion

This study has sufficiently determined that the impact of ICT in education has become pertinent as it facilitates the teaching and learning process, creates a conducive learning environment, and helps learners develop creative thinking and self-confidence. However, it was also discovered that the lack of adequate ICT tools was a major determinant of ICT integration in the teaching and learning process. In this case, it was evident from the data findings that while policies were in place, teachers were not aware of them and could not activate their innovations because of poor internet coverage in their classrooms. Consequently, this study concludes that there are still challenges in integrating ICT in schools, but there are opportunities that can be used to augment the integration. This includes the installation of pocket Wi-Fi in each classroom to enable sufficient internet coverage so that teachers and learners can learn through updated learning applications and videos.

7. Recommendations

This study recommends that there should be the creation of technology-specific classrooms that can be closely monitored to avoid laptop dysfunction and a lack of maintenance. Curriculum specialists should make their roles active to capacitate teachers with policy information and implementation strategies so that they can stay motivated to integrate ICT. Also, this study recommends that augmented reality and artificial intelligence now run most parts of our lives, and schools could consider them as inclusions in their instructional activities.

8. Limitations of the Study

It is common knowledge that a limitation associated with qualitative studies is that there is a constraint on the extent to which a study can go, which sometimes affects the end result and conclusions that can be drawn. This study was limited to Tshwane North District School, Gauteng Province, South Africa.

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