

A Paperless Classroom: Importance of Training and Support in the Implementation of Electronic Textbooks in Gauteng Public Schools

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Abstract: The Gauteng Department of Education (GDE) is responsible for managing and administering public and registered private educational institutions within this South African province. The GDE has introduced a Paperless Classroom project where prioritised schools are provided with smartboards, laptops and tablets to teachers and learners in targeted grades. This study aims to add to the corpus of knowledge on Information and Communication Technologies (ICT) in education by establishing whether schools in Gauteng are ready to adopt and implement electronic textbooks in their classrooms in terms of support and training. The focus of this study is on the training and support, as the GDE received an influx of requests from these teachers on receiving additional training and better support shortly after receiving the ICTs. The study followed a pragmatic approach using a parallel concurrent mixed-method design where quantitative and qualitative data were collected using an online questionnaire and an interview protocol. Purposive sampling was used to collect quantitative data and 55 responses were received, whereas both purposive and convenience sampling were used to collect qualitative data and 20 participants were interviewed. The study used the Technology Acceptance Model as a theoretical framework through which the study was conducted. The Perceived Usefulness construct focused on the usefulness of electronic textbooks, while the Perceived Ease of Use and the External Factors are constructs facilitating and enabling the use of electronic textbooks. Quantitative data analysis was done using SPSS. Interviews were transcribed and thematically analysed. Most respondents were not satisfied with the training they received. It was entry-level basic training and did not help schools use ICTs and address the technical glitches they experienced pedagogically. The quality of the devices was not up to standard. The e-textbooks had licensing issues, and only a limited number were available. Although technical support was provided, it was not adequate. Many systemic issues such as maintenance and replacement plans of the devices, safety, update, and the licensing of the electronic textbooks should still be addressed for successful implementation. The results of the study may offer some insights before the roll-out of electronic textbooks is done to the whole province. Furthermore, the study may also provide clues to the South African provinces that may envisage introducing ICT in education. Within the nine provinces in South Africa and in the education community worldwide, the information provided by this study can be of great significance for the envisaged training and the support needs of the schools on the use of ICTs in education.

Keywords: electronic textbooks, Technology Acceptance Model, tablets, smartboards, ICT integration

1. Introduction

The popularity and availability of the internet and connectivity have encouraged the use of Information and Communication Technologies (ICTs) in schools (Tay et al., 2014). Many countries have introduced policies or initiatives to improve learner achievement through the use of technology. The use of ICTs in education is promoted by the United Nations (UN) in its 2030 Agenda for Sustainable Development (UN General Assembly, 2015). In a very broad sense, this type of sustainable development aims at improving the state of nations and the world itself. The Sustainable Development Goals (SDGs) are viewed as a roadmap to achieving a better and more sustainable future for all, by addressing the global challenges humanity faces. The fourth goal, SDG4, deals with education and aims to “develop education systems that foster quality inclusive education and promotes lifelong learning opportunities for all” (UNESCO, 2017, p. 7). More specifically, SDG4 encourages the use of ICTs to support the principles of improving access to inclusive and equitable education and providing a good quality of education for all. As we are now in the Fourth Industrial Revolution, the type of education referred to in SG4, must seek to match the needs of learners required for the 21st century. Where the Third Industrial Revolution used electronics and ICTs to automate production, the Fourth Industrial Revolution is building on the Third and is characterised by a fusion of technologies that is “combining the digital, physical and biological worlds” (Schwab, 2016, p. 60). Schwab (2016, p. 7) further stated that “... governments and institutions are being reshaped, as are systems of education, healthcare and transportation, among many others.”

The readiness to use ICT in South African classrooms depends on various external and internal factors that may limit or enhance their use. The external factors that may enhance the use of technology in the classroom include, among others, access to infrastructure, internet connectivity, timeous training and readily available support, and the existence of an ICT policy, while the internal factors relate to the teachers' attitudes, beliefs, confidence and ICT skills (Fleming, Becker and Newton, 2017; Mathipa and Mukhari, 2014). This article focuses on two of these external factors, namely training and support. In the Gauteng Province of South Africa, the Gauteng Department of Education (GDE) has invested a massive amount of money into providing schools with ICTs and training and support in the use of these resources is also provided. The focus of this study is on training and support, as the first author, who works at the GDE, noticed an influx of requests from Gauteng teachers on receiving additional training and better support. Attention was paid specifically to the perceptions of teachers concerning the training and support provided to schools by the GDE in their drive to integrate educational technologies into the classrooms, and specifically, the introduction of electronic textbooks. The latter is important, as the COVID-19 pandemic has forced most countries from face-to-face to online teaching for some period of time in 2020 to 2022 and possibly in the future and many researchers have shown to value of the use of electronic textbooks in online teaching (Arham et al., 2021; Escudero et al., 2021; Oktafiani, Widiatningrum and Retnoningsih, 2021). Escudero et al. (2021), concerned that young children need face-to-face interaction, conducted a study on American four-year-olds where face-to-face versus online learning via electronic textbooks were explored, and found that not only do electronic books have many advantages over traditional methods, but their children's performance was comparable across face-to-face and online testing modes; thus, eBook online learning was successful. Arham et al. (2021), in their study on 171 Malaysian students on the use of eBooks for online learning, found that it is very successful and provided recommendations for even more improved success, such as the creation of tutorial videos on how to navigate eBook platforms. Oktafiani, Widiatningrum and Retnoningsih (2021) who conducted a study on 36 Indonesian learners found that the use of eBooks in online learning encourage learner-centered learning as the learner is more involved and not depend as much on a teacher.

2. Context

South Africa, as a developing African country, has nine provinces. Although Gauteng is the smallest of the nine provinces in South Africa, it is highly industrialised and urbanised. It is, therefore, not surprising that the GDE launched the Paperless Classrooms programme that focused on establishing digital classrooms in schools and included the roll-out of smartboards, tablets, laptops, connectivity, and training regarding the use of the new infrastructure (GDE, 2014). The programme unfolded in phases, and the schools sampled in this study were all part of the second phase of the programme that benefitted schools in 2017.

The GDE is investing a massive amount of money into driving the Paperless Classroom initiative and announced a R17 billion investment in it (Monama, 2016). With pilot phases well underway, the GDE invested in excess of R800 million in the 2015/16 financial year (GDE, 2015). In the 2016/17 financial year, the GDE allocated a further R1 billion to the transformative *ICT in Education* initiative (GDE, 2016). In the 2017/18 and 2018/19 financial year, the GDE allocated a further R274 million (GDE, 2017) and R238 million (GDE, 2018) for the continued roll-out of e-Learning strategy. In the 2019/20 financial year, the GDE allocated R815 million for e-learning devices and e-LTSM with the aim of transforming township schools into functional ICT-enabled learning spaces (GDE, 2019). However, Atabek (2019) states that technology integration in education still encounters obstacles despite the significant investment. This is why training and support are of great importance.

The discussion that follows focuses on the literature relating to electronic textbooks and ICT in education, and the theoretical framework for this study. The methodology follows, and finally, the results and findings, as they relate to the training and support that have been provided to the schools that benefitted from the Paperless Classroom project.

3. Literature review

Due to the global technological revolution of the 21st century, the education sector and especially secondary schools were bound to be affected. Progress in the field of education technology will result in teachers having to adapt to new ways of teaching and learning that include the use of ICT (Mathipa and Mukhari, 2014). It is argued that the adoption of technology in the classroom, and specifically the introduction of electronic textbooks, could be beneficial to the schools (Chigona, Chigona and Davids, 2014; Masango, Van Ryneveld, and Graham, 2019).

3.1 Readiness to integrate ICT in Education: A South African perspective

Readiness to integrate ICT in education can be categorised into two elements: the state's readiness to integrate technology and the readiness of schools to do so. The state would involve the government bodies, both national and provincial, while the schools would include, among others, the school's governing body, the principal, the teachers and the learners.

In South Africa, the White Paper on e-Education of 2004 acknowledged the magnitude of providing ICT with the necessary infrastructure required by schools (Nkula and Krauss, 2014). This dilemma was widely supported in the existing literature that states that considerable investment was required for the implementation of ICT in Education project (Department of Education (DoE), 2004).

Despite the factors hindering the implementation of the ICT in Education project in South Africa, local researchers have urged the Department of Basic Education (DBE) to acknowledge the huge potential reform that can be brought about by e-textbooks (Nkula and Krauss, 2014). It was argued that the DBE, together with the provincial departments of education, should use the opportunity that ICT in education reforms can bring by introducing educational technology into all the schools (Lee, Messom and Yan, 2013). Sadly, the provincial departments of education often embark on silo bound initiatives to implement ICT in Education projects due to the lack of a national comprehensive ICT policy from the DBE (Mathevula and Ulwizeyimana, 2014). However, the adoption of electronic textbooks into South African classrooms was anticipated to be a preferred mode of teaching and learning in future, as some provinces have already moved towards implementing the prescripts of the White Paper on e-Education (Lee, Messom and Yan, 2013).

3.2 Electronic textbooks

Electronic textbooks are books on a particular academic subject that are available in digital format and can be used in the classroom for curriculum delivery (Gakibayo, Ikoja-Odongo and Okello-Obura, 2013) and other academic purposes (Al-Mashaqbeth and Shurman, 2015; Lee, Messom and Yan, 2013). In most cases, the introduction of electronic textbooks in a school is a welcome change from the usual use of printed paper-based textbooks (Masango, Van Ryneveld and Graham, 2019). However, the adoption and use of electronic textbooks occur at a slow rate and, as a consequence, the potential benefits are not being fully realised as yet (Masango, Van Ryneveld and Graham, 2019; Pérez-Sanagustín et al., 2017).

In Gauteng, the electronic textbooks that are available for use in public schools are those that are listed on the National Curriculum Assessment Policy Statements (CAPS) catalogue, which was developed by the national DBE (GDE, 2017). Public schools in South Africa are only allowed to use textbooks that appear on the CAPS catalogue as core textbooks and those that are not in the catalogue, as supplementary textbooks. Schools are advised to select their electronic textbooks from the titles that are available at the time. These titles are then automatically preloaded onto the tablets, laptops and smartboards given to prioritised schools. It is, therefore, clear that Gauteng schools that benefitted from the Paperless Classroom project should, in theory, have been able to integrate electronic textbooks into their classrooms, as they do have access to the necessary hardware and at least some electronic textbook titles.

3.3 Parental involvement

Parents are important stakeholders in education. The involvement of parents in the education of their children motivates learners and increases their academic achievement (Fang, 2018; Heath, Maghrabi and Carr, 2015; Ramorola, 2013). However, not all parents can be involved in the schooling of their children due to various factors, including long working hours (Fleischmann and De Haas, 2016).

Parental support provided to children on matters relating to ICT usage is termed parental e-nvolvement (Gu, 2017). Parental e-nvolvement helps learners to access electronic information resources that, in turn, is helpful in schooling (Heath, Maghrabi and Carr, 2015). However, most parents are unable to provide support on the technological aspect of the ICT used in the classroom because of the technological challenges they experience themselves (Gu, 2017; Heath, Maghrabi and Carr, 2015; Ramorola, 2013). Many of the ICT devices and the recent applications used in schools are also new and foreign to parents who may find themselves willing, but unable, to assist (Heath, Maghrabi and Carr, 2015). It is important to realise that the burden of training and support is on the teachers themselves, and if they do not feel empowered and confident in their skills relating to electronic textbooks and ICTs, the seamless integration thereof may be hampered.

4. Theoretical framework

The theoretical framework underpinning this study is the Technology Acceptance Model (TAM), as developed by Davis, Bagozzi and Warshaw in 1989. Figure 1 shows the TAM model, which we adapted to include and highlight training and support with regards to the implementation of electronic textbooks in public schools. Another adaption is the fact that we use the abbreviations Perceived Usefulness (PU), Perceived Ease of Use (PEoU), Attitude towards use (AU) and Behavioural Intention of Use (BI) which differs from the abbreviations on the TAM figure that is licenced under CC BY 3.0 (TAM, 2020). The adapted TAM focuses on the influence of training on the PU and PEoU variables, and the influence of ICT support on the actual use variable. The external factors are those factors that facilitate and influence the internal factors. The internal factors are the PU, PEoU, AU, BI and the actual use.

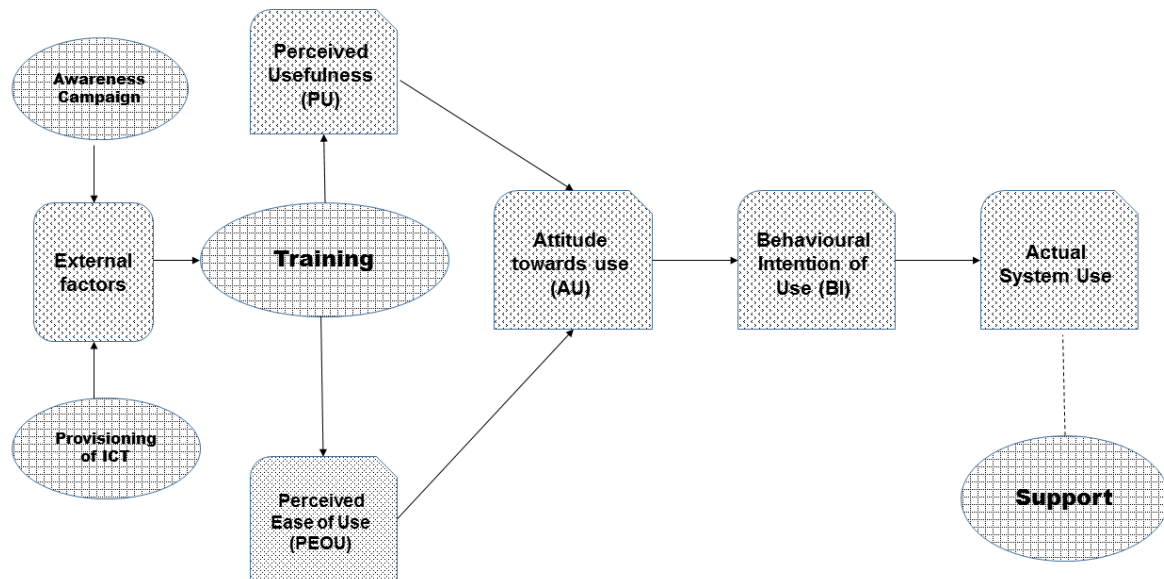


Figure 1: Adapted Technology Acceptance Model by Davis et al. (1989) licenced under CC BY 3.0 (TAM, 2020)

The beliefs and viewpoints of stakeholders such as the principals and the teachers in the sampled schools were regarded as important internal factors when looking at the integration of electronic textbooks in the classroom. To have a positive attitude towards the integration, adequate support, both externally and internally, is required. External support is typically provided by stakeholders outside the school milieu, such as the DoE, parents and other private organisations; whereas school governing bodies, principals, and often experienced teaching staff provide internal support.

The AU of electronic textbooks can only be reinforced by the PU, the PEoU by the teachers and learners alike, and their positive AU and BI to use the electronic textbooks in the school environment as depicted in Figure 1. With a positive attitude about perceived usefulness, users will know the importance of using ICT and electronic textbook integration. Users with a positive attitude on perceived ease of use will view ICT and specifically electronic textbooks as easy to use and integrate into teaching and learning. Moreover, Li and Choi (2014) found that the social capital of a school had a direct influence on teachers' receptivity towards technology use.

5. Method

A concurrent mixed-method design was used for the study because both qualitative and quantitative research were done simultaneously (Fetters, Curry and Creswell, 2013; Hadi et al., 2013; Johnson and Christensen, 2012). The researchers collected and analysed the data, interpreted and inferred findings that were both qualitative and quantitative (Hadi et al., 2013). Quantitative information is measurable as it involves numbers and quantities; however, it ignores an individual's feelings and emotions. On the other hand, a qualitative method is used to gather in-depth information about a certain issue, but is subjective in nature. A mixed-method design

holds the advantages of both approaches and provides a better understanding of research problems than either approach alone (Molina-Azorin, 2016).

In 2017, the GDE prioritised 356 out of the 2 080 schools in 15 district offices in Gauteng to receive ICTs and training and support on the use of them, and these 365 schools form the population of this study. These 356 schools were listed on an ICT beneficiary database provided by the e-learning section of the GDE. For the quantitative component of the study, all 365 prioritised schools were purposively sampled and 55 responses were obtained. The sampling method was purposive as these schools had the unique qualities of receiving ICTs and training and support on the use of them. For the qualitative component of the study, 35 schools in the Tshwane West district were conveniently and purposively sampled from the population of 356 schools due to their close physical proximity to the researcher and 20 participants agreed to be interviewed; convenience sampling due to close physical proximity and purposive sampling due to the unique qualities of receiving ICTs and training and support on the use of them.

An online questionnaire was developed using Google Forms and sent via email to collect the quantitative data. For qualitative data, an interview protocol was developed. Both instruments focused on the aspects of the readiness of schools to integrate electronic textbooks into their classrooms by exploring schools' perceptions about the training initiatives and support structures provided to the schools.

The target audience of this study was principals, deputy principals and ICT coordinators.

Data collected from the questionnaire was processed quantitatively, while the interviewees' data were processed qualitatively. The GDE permitted the collection of data from February to September 2017. The designation of respondents who completed the questionnaire and the participants who participated in the interviews, as depicted in Figure 2, show a greater number of school ICT coordinators for both the questionnaire and the interview. The ideal group of people to answer the questionnaires, and to participate in the interviews, were the principals and ICT coordinators of the schools, however, deputy principals were also considered and accepted if they were either acting on behalf of the principal or were acting as the school's ICT coordinators.

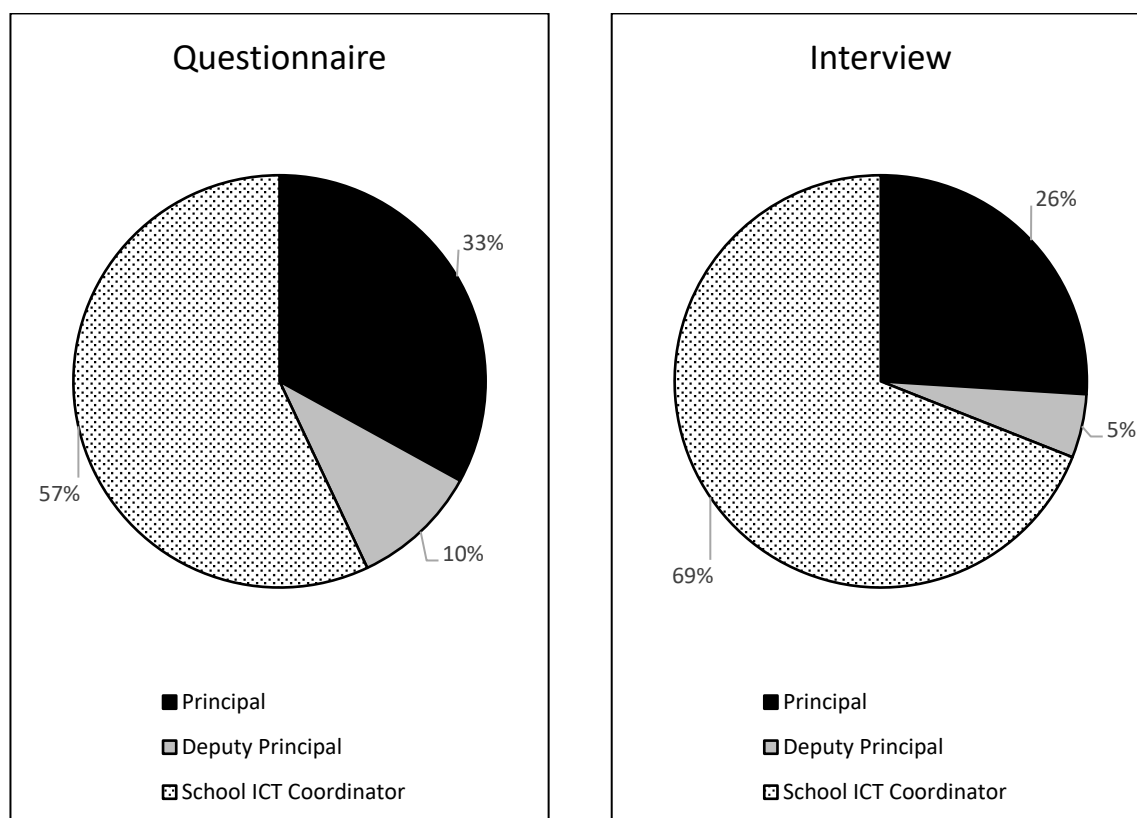


Figure 2: Designation of respondents to the questionnaire and participants in the interviews

A Cronbach alpha measure of internal consistency was calculated to measure the reliability of the questionnaire. The overall Cronbach alpha value was above 0.6, showing that the questionnaire was valid and reliable (Goforth, 2015).

The recordings of the interviews were transcribed and coded using thematic analysis. The interviewees were given code names for principals and/or deputy principals with suffix PRINC1 to PRINC6, and school ICT coordinators with suffix COORD1 to COORD13 to the prefix INT.

6. Results and Findings

The results and findings for both quantitative and qualitative data are presented with a focus on the training initiatives and support structures provided to schools.

6.1 Provisioning of ICT for integration

The questionnaire found that the respondents in this study thought that it was the responsibility of the DoE to provide schools with ICT devices. The participants confirmed that the DoE did indeed provide desktop computers, laptops, and tablets for some schools through interviews. The maintenance and support to keep the devices up and running were, however, not provided. For example, when updating the smartboards at one school, all the electronic textbooks were accidentally erased, and there was no one available to upload them again. One ICT coordinator noted thus:

"...we were able to share information with the learners from these smartboards, but then all the textbooks were wiped out and then we struggled to get the technicians to fix or to recover the textbooks." [INTCOORD7]

The results also showed, on the one hand, that mobile phones were not available for use in teaching and learning, since those that were available were mostly personally sourced by teachers and learners themselves, and were thus not used for educational purposes in the classroom. On the other hand, participants confirmed that smartboards were provided in the classrooms for educational use.

6.2 Training on ICT in education

Teachers of the schools that benefitted from the Paperless Classroom project received introductory training on the use of the provisioned ICT devices and the electronic textbooks that was uploaded on them. All schools that received ICTs also received training on how to integrate and use them in the classroom. For example, training would be based on how the electronic textbooks loaded in the devices could be used in the classroom. The training provided by Matthew Goniwe School of Leadership and Governance (MGSLG) was a once-off training intervention. Table 1 shows that many teachers were only trained on how to operate the smartboard and the laptop and integrate electronic textbooks using the smartboards (74.55%); and approximately a fifth of the respondents indicated that they were trained on both smartboards and laptops (29.09%). It seems as if the focus of the training initiatives was mainly on integrating electronic textbooks using smartboards and laptops.

Table 1: ICT devices that teachers received training

ICT devices	Percentage
Smartboard	56.35
Smartboard and laptop	20.00
Laptop	9.09
iPad	3.64
Computer	1.82
Smartboard, tablet and laptop	1.82
Not applicable	1.82
Not certain	1.82
None	1.82
Missing	1.82
Total	100

The interviewees confirmed that most of the training was focused on the use of the smartboard, for example:

"Yes, I attended many training sessions about a lot of things, [for example, on] how to use smartboard."
[INTCOORD2]

The other school ICT coordinator also confirm this about the training that was provided:

We do go to Matthew Goniwe's¹ workshops, been trained about using ICT, and they teach you how to operate a smartboard. There was a workshop also in school, which was organised by Matthew Goniwe. All [the neighbouring] schools had to come to our school as we are one of the first schools that received smartboards for Grade 12. [INTCOORD4]

With training provided on how to operate the smartboards, teachers could access the electronic textbooks and draw the attention of all learners in the classroom by using them in front of the classroom. They could do this even if their learners also had access to the electronic textbooks on their tablets. The priority given to smartboard training was to ensure that teaching and learning could proceed smoothly. The use of the smartboards in the classroom did not give learners the flexibility to use electronic textbooks outside the classroom environment if they did not have their own electronic device. The type of training provided was more on operating the devices and accessing the electronic textbooks rather than on how to integrate technology pedagogically. In addition, technical training was not provided to enable users to troubleshoot in case of malfunctions.

Results have shown that teachers mainly were given entry-level training on the use of smartboards at MGSLG. When asked who they expected to be responsible for the training of teachers on ICT integration in the classroom, many respondents from the questionnaire confirmed that the district officials were the most capable, available and relevant officials to provide them with training (69.09%); shown in Table 2. "It is important to note that teachers taught themselves how to integrate technology in the classroom, as 'self-study' ranked at 7.27%". These teachers were leading as champions at their schools and provided training to their colleagues, as confirmed by one of the principal interviewees (INTPRIN6).

Table 2: Expected training responsibility relating to ICT integration-related matters

Officials	Percentage
District officials	69.09
Head office officials	10.91
School ICT coordinators	9.09
Self-study	7.27
Principals	3.64
Total	100

The interviewees also confirmed that their district officials provided training. One school principal indicated that:

We received training, yes, training was [provided] by district and then also they sent "ke reng" [how should I put it] those people of ICT. GDE provides interns to provide training and support. [INTPRIN1]

Some school principals confirmed that training and support were provided through the availability of the interns who served as technicians for the challenges that schools experience daily [INTPRIN1; INTPRIN2; INTPRIN4]. Other challenges were referred to as the support structure at MGSLG. Challenges, both on the devices and the pedagogical use of ICT, that schools and districts cannot resolve, are referred to IT specialists at MGSLG [INTPRIN2; INTCOORD7]. The initiative may have the challenge of waiting time for the intervention as the ICT may delay and compromise the teaching and learning at the school. Rather, the service provider should mediate the challenges at the school within a reasonable period.

The DBE is aware that training is a requirement for the proper implementation of technology in the classroom (Bladergroen and Buckley, 2016). As shown in Figure 3, almost three-quarters of the respondents (72.5%) mentioned that district officials provided training on the integration of electronic textbooks.

Through their e-Learning units, the district offices seem to provide training and support for schools despite their minimal staff complement. In terms of the organogram of the GDE District, the staff complement of the e-learning section is composed of two officials (GDE, 2014). The interns (ICT technicians) provided were stationed at some of the schools and were invaluable in addressing challenges experienced by teachers and learners when

¹ The Matthew Goniwe School of Leadership and Governance is an institution that is responsible for providing training of GDE officials on management and governance issues. Mostly the principals and the newly elected School Governing bodies were trained at this institution.

they ran into trouble using the devices in the classrooms. The interns were useful in addressing technical malfunctions that teachers and learners experience. The e-Learning coordinators addressed subject-specific challenges based at both head office and the districts.

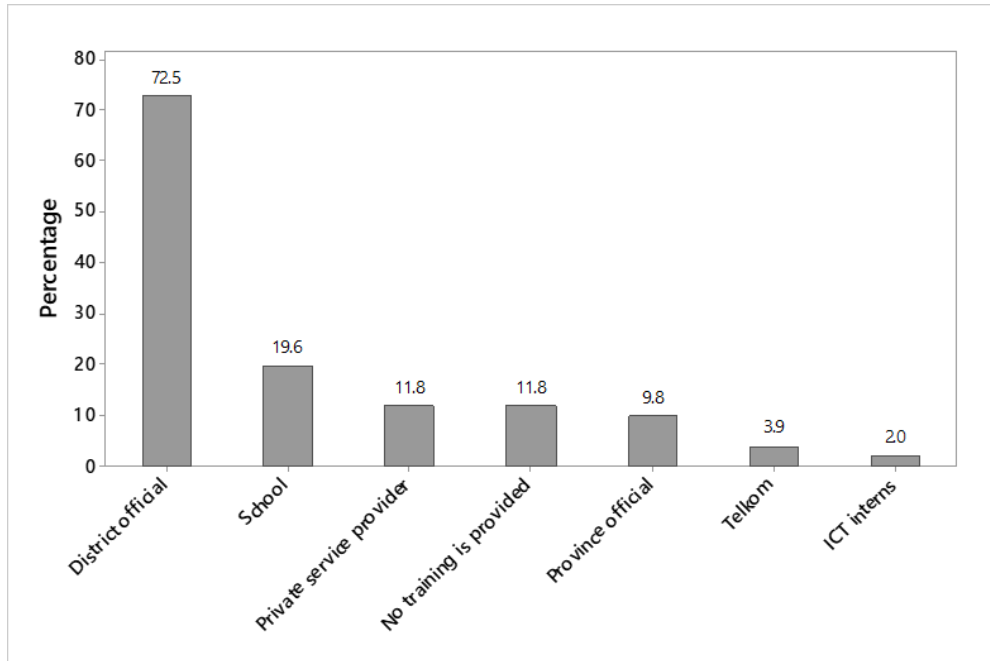


Figure 3: Trainers on the integration of electronic textbooks

6.3 Organising workshops

Participants reported that workshops were essential for school teachers to grasp the teaching and learning possibilities that become a reality because of the availability of ICT, and to become competent in the use of ICT in the classroom [INTCOORD3]. Many respondents agreed that training initiatives were taken by schools, the district offices, and the head office, respectively, in organising workshops on the integration of technology in classrooms. Despite the confirmation that district officials are the most relevant trainers on ICT integration, respondents agreed that schools (81.82%), district offices (92.73%) and head offices (87.28%) were collectively responsible for organising workshops, as shown in Table 3. The frequencies translate to more than 80% of respondents who agreed that workshops were organised for teachers.

Table 3: Organise workshops for teachers

Level of agreement	School (%)	District offices (%)	Head office (%)
Totally disagree	1.82	0.00	0.00
Disagree	5.45	1.82	3.64
Neutral	10.91	5.45	9.08
Agree	69.09	76.36	74.55
Totally agree	12.73	16.37	12.73
Total	100	100	100

Although the results indicate that workshops were organised for schools, the rate at which electronic textbooks were integrated into the classrooms was still low, mainly because of the challenges relating to the infrastructure and the technical glitches experienced (Heath, Maghrabi and Carr, 2015; Hernandez, 2017; Pérez-Sanagustín et al., 2017). Regular training seems to be required for schools to overcome some of the challenges posed by the inability to operate the devices. It also appears as if there may be room for improvement as far as the scope and depth of the training interventions are concerned.

6.4 Support on ICT integration

Schools were supported on ICT integration through visitations, workshops, teacher encouragements, collaborations and parental involvement.

6.4.1 School visitation (on ICT integration)

The respondents indicated that district officials (specifically the e-Learning coordinators) visited their schools to provide support on integrating technology in the classroom. Almost a third of respondents mentioned that district officials do visit either monthly or quarterly (27.27%); as depicted in Table 4.

Table 4: School visitation on ICT integration in the classroom

Visitations	Percentage
Quarterly	27.27
Monthly	27.27
Once off visit	23.64
Half-yearly	9.08
No visits	3.64
Irregular	3.64
When the need arises	1.82
Whenever invited or there was a need too	1.82
Weekly	1.82
Total	100

The rate of school visitations was important for the schools so that intervention measures can be taken to mediate barriers to ICT integration and the implementation of electronic textbooks. Therefore, the success of implementing electronic textbooks will depend largely on the frequency rate of school visitations. A high rate of school visitations increases the opportunity for feedback so that the response time for support can be quicker as well. The school visitations could be increased as part of the support for ICT integration.

6.4.2 Support initiatives for ICT integration in the classroom

Responses on initiatives taken to support the integration of ICT were analysed and categorised as encouragement, collaboration, and parental involvement. Stakeholders who encourage teachers to integrate ICT will be discussed first.

Teachers need regular encouragement to use the technology provided to schools for teaching and learning (Bladergroen and Buckley, 2016). Respondents were asked to highlight their level of agreement on how schools, districts and head offices encouraged them to integrate ICT in education. More than 70% of respondents were in agreement that schools, district offices and head office do encourage teachers to integrate ICT in the classroom, as shown in Table 5.

Table 5: Stakeholders who encourage teachers to integrate ICT

Level of agreement	School (%)	District offices (%)	Head office (%)
Totally disagree	0.00	1.82	0.00
Disagree	1.82	1.82	1.82
Neutral	9.09	9.09	20.00
Agree	70.91	70.91	63.64
Totally agree	18.18	16.36	14.54
Total	100	100	100

Although there seems to be partial support in place for teachers to integrate and use electronic textbooks, there were still challenges that teachers' experience. There are no adequate resources that teachers can be motivated to integrate. There is still a lack of proper and comprehensive maintenance of the ICT devices. Next, stakeholders who encourage teachers to collaborate is considered.

The competency level of all the teachers at particular schools and district offices is not the same; therefore, collaboration is invaluable so that teachers can benefit from each other (Hamid et al., 2015). On determining their level of agreement, respondents indicated how they were encouraged to collaborate on ICT issues. Table 6 shows the frequencies on the level of agreement on the encouragement of teachers to collaborate with their peers within and outside the school. Between 69% and 73% of the respondents were in agreement that teachers were encouraged by schools to collaborate on subject-specific projects.

Also, the district offices use a social media communication medium, namely a WhatsApp group of the Tshwane West district. The medium helped address some challenges experienced by teachers and serve as a communication medium for planned meetings and workshops [INTCOORD5]. Next, parental involvement in ICT activities is considered.

Table 6: Stakeholders who encourage teachers to collaborate

Level of agreement	School (%)	District offices (%)	Head office (%)
Totally disagree	1.82	0.00	1.82
Disagree	10.91	7.27	5.44
Neutral	18.18	20.00	23.64
Agree	58.18	56.37	54.55
Totally agree	10.91	16.36	14.55
Total	100	100	100

Parents are typically expected to help learners with their homework and other projects (Gu, 2017). Schools often expect parents to be aware of the ICT in Education project and thus be able to help their children use ICT for learning (Heath, Maghrabi and Carr, 2015). The respondents indicated in Table 7 their level of agreement regarding parental involvement in ICT activities. Although many respondents agreed that parents were involved in the ICT activities, a significant number of the respondents, as depicted in Table 7, were neutral on this subject (school = 25.45%; district offices = 27.27%; head office = 29.09%).

Table 7: Parental involvement in ICT activities

Level of agreement	School (%)	District offices (%)	Head office (%)
Totally disagree	3.64	3.64	3.64
Disagree	21.82	21.82	25.45
Neutral	25.45	27.27	29.09
Agree	38.18	41.82	38.18
Totally agree	10.91	5.45	3.64
Total	100	100	100

As it does not seem as if parents are playing a huge role in supporting their children regarding ICT, schools have to ensure that they have mechanisms in place to fulfil that role. Once again, though: If teachers themselves don't feel confident in their ability to use ICT, it is unlikely that they will be able or willing to support the learners in their classes in a meaningful manner. Next, external service providers on ICT integration is considered.

The support provided by the external service providers was minimal. Most respondents indicated that there was no external support provided for the integration of electronic textbooks in the classroom. Seventy-three percent of the respondents mentioned that there was no support from external providers. However, two school ICT coordinators reckoned that the external service providers provided mobile tablet trolleys for use by learners in the grades that GDE did not allocate. One school ICT coordinator confirmed:

I feel we are receiving special care. Why am I saying so? After we got the sponsorship from Telkom, the district partnered with Telkom, and they have given full support, full ICT support to the school.
[INTCOORD6]

It may, therefore, be worthwhile to investigate the used external service providers as an additional support structure when new technologies are introduced in schools. Next, maintenance of ICT is considered.

Although schools had access to infrastructure and were trained at MGSLG on smartboards, laptops, tablets, and electronic textbooks, there were still challenges regarding their maintenance. All electronic textbooks used in schools require the renewal of the annual license as well as the unavailability of the relevant textbooks in the devices.

The maintenance of the ICT devices was a challenge for schools because regular use of the devices depended on their smooth and ongoing operation. Due to a lack of updates, the devices were often infected with viruses and were either non-operational or lagged in response time. The interviewees mentioned the following regarding viruses:

"...and if educators also can acquire viruses their laptops, the whole lesson is disturbed." [INTPRIN6]

"... it keeps on loading because there is a virus inside the laptops. Those are the barriers that even though we have anti-virus protection, anti-virus programs end up being the virus because it is not updated regularly." [INTCOORD9]

With regular maintenance, an updated anti-virus program will run on all the devices to operate optimally. The schools also indicated that the devices provided were of poor quality as they froze within a week of their starting to use them [INTCOORD12]. One interviewee suggested that the DoE should:

"...make sure that there is enough finance for maintenance of this hardware." [INTCOORD4]

The maintenance issue also relates to the challenge of the annual licensing fees for electronic textbooks. If the licences for the electronic textbooks are not renewed, then they cannot be opened on the devices provided to schools.

7. Discussion

Initial training was provided on the use of ICT devices and electronic textbooks in the classroom. The training was mostly at an introductory level and focused on using smartboards and electronic textbooks by teachers. Recent literature has emphasised the need for continuous training and for teachers in ICTs (Iqbal, 2017; Perry; 2018; Saal, Graham, and Van Ryneveld, 2020). While this study did not explore the curricula covered as part of the training initiatives, it was clear that teachers did not get sufficient exposure to why they needed to adopt electronic textbooks in their classrooms. It seems that the same teachers do not necessarily perceive the electronic equipment in class as useful and that even though they are superficially aware of the benefits, they are not yet convinced that it is worth the effort.

There was no confirmation of any training provided to the learners on tablets or for teachers to support learners in case they experienced technical glitches. On support, the GDE, as an external variable, provisioned the ICT necessary for use in the classroom. The role played by the Provincial Department of Education, the school, the school governing body and vendors of electronic textbooks seemed to have enhanced the perceived ease of use on the teachers and learners. Yet, the adoption of electronic textbooks was not realised.

Technological devices are liable to technical glitches and challenges (Heath, Maghrabi and Carr, 2015). Any technical glitches may delay the start of the lesson, even though technicians are on-site at the schools. There should always be constant support to schools experiencing technical malfunctions so that they can adopt and integrate technology in the classroom. Recent literature has shown the importance of support to teachers who work with technology (Kruger, 2018; Liao, 2018). The support provided through the project, though minimal, went a long way in encouraging both teachers and learners to use technology to access electronic textbooks. One principal has the following suggestion for technical problems experienced in the classroom:

"We need, let me say, classroom-based interns. This one serves the whole school, and the teachers would have to [face] challenges in the classroom." [INTPRIN4]

Some schools were lucky enough to be provided with an intern who served the role of technical support. However, there was only one technical staff member who needed to support the entire school. Logistically, one person alone cannot provide sufficient support to all the paperless classrooms, especially not when teachers are not yet comfortable in doing their own troubleshooting. Teachers may be able to turn on the smartboards and open an electronic textbook. Still, if something out of the ordinary happened, they were handicapped and reliant on the support of a technical person. Not all schools got technical interns, and in cases where one was deployed, they did not always have the necessary know-how to troubleshoot themselves; teachers often needed to wait for days or even weeks for the next visit from the district officials before a technical problem was addressed. This meant that teachers no longer trusted the technology and became demotivated to invest time and effort in preparing their lessons around the availability of electronic textbooks.

The quality of the devices provided to the schools was also a cause of concern. The low-quality devices often needed maintenance and/or endless repairs, which had a negative effect on teachers' willingness to embrace the use of electronic textbooks in their classrooms as teachers sometimes have to wait a long period of time for maintenance/repairs to be done. As confirmed by participants (INTCOORD2; INTPRIN1; INTCOORD6), the department responds very slow in addressing the maintenance problems experienced by schools. The maintenance issues are reported, and in one instance, the smartboard had been not working for more than

three months (INTCOORD6). The other challenge faced by schools was the security risks that came along with ICT. These risks included, for example, viruses infecting computers, smartboards, laptops and tablets, which in turn affected the smooth functioning of hardware and resulted in distracting from the teaching and learning processes. One ICT coordinator summarised:

1. “they [Department of Education] must provide us with the e-textbooks that we need,
2. networks [Internet]
3. anti-viruses for both laptops and the smartboards
4. learner tablets of good quality”. [INTCOORD12]

8. Conclusion and Recommendations

The GDE has succeeded in certain components of the ICT in Education project, such as the provisioning of the hardware for the learners, teachers and the classrooms. While teachers are critical of the quality, and in some cases, the quantity of the ICTs provided, the first constructive steps towards implementing electronic textbooks have been taken. Most teachers were also aware of the GDE’s Paperless Classroom project and appreciated the Department’s commitment to supply the latest educational technologies to them.

However, how the project has been rolled out has been questioned. The implementation of the Paperless Classroom project requires a systemic approach where the phasing-in of the ICT and electronic textbooks start at the entry grades in the secondary schools or at least at the lowest grade of a particular phase, for example, Grade 10, where the roll-out can then progress logically through the phase to the final year (Grade 12). It seems as if the introduction of technologies and electronic textbooks in the later years, e.g. Grades 11 and 12, a lot of anxiety and disturbance were created among learners and teachers (INTCOORD5).

The initial training given to teachers at MGSLG appeared to be insufficient in enabling the teachers to embrace technology integration and do troubleshooting fully. Another shortcoming in training is the fact that it was a once-off intervention. As it is hardly possible for teachers to learn all they need to know in a single training session, it is recommended that training interventions be designed to be ongoing and that the pace be slow enough for teachers to grasp without feeling overwhelmed. It may furthermore be beneficial to revisit the topics that have been addressed. Without exploring the nature of the themes discussed, it is obvious that many teachers have not yet grasped the pedagogical value that electronic textbooks can add to a classroom.

There seem to be certain components of the support structures that are still lacking, such as the maintenance of hardware, the software updates, the technical support in the classroom, safety and security issues, and the availability of electronic textbooks for all the subjects in the targeted grades. The district office team should be trained as a core group that will be readily available to provide necessary support within a reasonable time frame. Support to schools cannot be left to the IT technicians based at the schools only because they may not be able to provide support on pedagogical practice. The IT technicians can only assist in solving technical glitches experienced by teachers and learners. Technical glitches may be resolved by the IT technician, such as login and updates, while the huge ones, such as non-operation of the devices, maintenance and power outages, may require an external service provider that normally takes a longer time to access.

During this lull period, the electronic textbooks may not be accessed, thus hampering teaching and learning at the schools. Where possible, the Department of Education should consider loaning ICT hardware such as smartboards, laptops and tablets in case schools experience non-operation of their devices. The Department of Education interventions can help mitigate the delay experienced when the broken or damaged devices are still repaired. The intervention can ensure that the use of ICTs does not compromise the process of teaching and learning.

Training and support on ICTs in schools are two of the main factors that contribute to the successful implementation of electronic textbooks for teaching and learning. Without training and support, teachers will lack guidance and a positive attitude towards electronic textbooks and thus result in the prolonged and unsuccessful implementation of electronic textbooks in the classroom.

A final recommendation is that similar studies to this one can be done using teachers and learners, as this study only made use of principals, deputy principals and ICT coordinators.

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