The acceptance of interactive whiteboards in intermediate phase educators' teaching practice

By Kirsten Pringle

Submitted in partial fulfilment of the requirements for the Degree in Magister Educationis in the Faculty of Education, University of Pretoria.

Supervisor

Dr M. Mihai

Declaration

I declare that the dissertation, which I hereby submit for the degree of Magister Educationis at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Ethics clearance certificate

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Dedication

I dedicate this work to the following people:

Firstly, I dedicate this dissertation to my grandparents Sydney and Philemena Prince. Thank you for always loving me unconditionally. Pa and Ma, you will always be my number one. This one is for you.

Secondly to my mother Berenise Pringle, thank you for pushing me to reach for the stars and chase my dreams. You have played an enormous role in my academic development, and very often at your own you expense. May God bless you always.

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Abstract

Education is the front line for the growth and expansion of ICT and is therefore regarded as essential for national improvement. For this reason, modern educators are required to move away from traditional teaching methods and start progressing towards "smart" teaching and learning. This is to ensure that teaching and learning are understood and retained by Generation Z learners. The purpose of this study was to explore the acceptance of interactive whiteboards in intermediate educators' everyday teaching practices. Two intermediate phase educators were selected from five different Quintile 5 ranked primary schools, each to participate in this study. The educators were chosen through convenient and purposive sampling. The approach used to acquire knowledge in this study was qualitative research. For this study, semi-structured interviews and lesson plans were used as part of the data collection. In the findings of this study I discovered that educators generally have an optimistic attitude towards the Interactive Whiteboard (IWB). The findings indicated that this attitude is due to educators finding the IWB useful and easy to use. However, for the IWB to be used to its optimal capacity, educators need to have structured, adequate, and differentiated training. Furthermore, educators should find a way to incorporate learner interaction with the IWB. Interactive whiteboard training and workshops need to happen on a continual basis for educators to use the board effectively and confidently. The School Governing Bodies should create an ICT budget to assist educators with the upgrading of IWB resources. Educators with more experience in using the IWB can offer brief workshops internally to incorporate learner interaction with the IWB.

Keywords: Information Communication Technologies, Interactive whiteboards, intermediate educators, technology acceptance, training, usefulness.

Language editors' disclaimer

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Chapter 1: Introduction and background

1.1 Introduction

The arrival of the twenty-first century has led to numerous technological advancements that influence the everyday aspects of people's lives. At the centre of this technological advancement is Information Communication Technology (ICT). ICT in an educational context denotes "the use of computer-based communication that incorporates into daily classroom instructional process." (Ghavifekr & Rosdy, 2015, p. 175).

South African educators are not only required to plan lessons that teach learners academic content, but also to promote the Department of Basic Education's main aim "to advance high order thinking skills such as comprehension, reasoning, problem-solving and creative thinking to enhance employability for learners outside an educational institution" (Department of Basic Education, 2011, p. 88).

Education in ICT makes this aim realistic as ICT can accommodate learners with different knowledge, skills, and values (Kutluca et al., 2020). Furthermore, the technology can help educators reorganise teaching surroundings effectively in line with the requirements of the class. If successfully implemented, ICT can produce efficiency and productivity. Interactive whiteboards are an important instructional device in a classroom because of their ability to change the mode of instruction. If utilised correctly, the IWB can provide better prospects for educators and learners to access quality content using databases, mind-mapping, guided discovery, brainstorming and simulation (Ghavifekr & Rosdy, 2015). This agrees with Hendawi and Almamari (2020) who suggest that the IWB plays a critical role in the teaching process that the conventional whiteboard cannot, namely the use of video, audio, simulations and experiments (Hendawi & Almamari, 2020). Using the IWB can create an environment of excitement and pleasure for learners to enjoy the learning process (Hendawi & Almamari, 2020). In a study conducted by Tsayang et al. (2020), the findings showed that the various functions of the IWB give learners the opportunity to participate in various learning activities during lessons (Tsayang et al., 2020).

1.2 Background

The objective of this research was to collect data from educators who work in Quintile 4 and 5 ranked primary schools based in Johannesburg, Gauteng. The South African government has grouped the country's public schools into five quintiles for the intention of distributing financial assets (Ogbonnaya & Awuah, 2019). The grouping of schools is based on the schools' geographical areas. This includes each area's average income, unemployment rate and general literacy level (Ogbonnaya & Awuah, 2019). Quintile 4 and 5 schools' finances assume that parents can afford to pay school fees, therefore requiring less government support than schools in lower quintiles (Ogbonnaya & Awuah, 2019).

For this reason, a school ranked in quintiles 4 and 5 would refer to a wealthy or affluent school (Van Dyk & White, 2019). The higher the quintile rating of the school, the more affluent the school governing bodies tend to be. Most quintile 4 and 5 schools' funding and facilities are supervised by a school's management team and the school's governing body. This results in organisational advantages for the school (Van Dyk & White, 2019). Due to this strong support system, quintile 4 and 5 ranked schools are most likely to have ICT in place to align with the Department of Education's ICT goals in schools. A big part of integrating ICT in schools is ensuring that every educator is trained in the necessary skills and knowledge to manage educational ICT in their classrooms. It is assumed that due to this strong support system, quintiles 4 and 5 should have ICT strategies in place to assist educators and learners in seeing the value of educational ICTs.

1.3 Rationale

As an educator who has recently had the privilege of entering the teaching profession at a quintile 5 primary school, I have noticed that many of my colleagues struggle to accept and adapt to the use of ICT, particularly interactive whiteboard (IWB) devices installed by the SGB. Unfortunately, educators who have been in the profession for several decades have not had the privilege of being exposed to ICT-based learning strategies like recent graduates. Most older generation educators struggle to accept ICT devices and ICT-based learning strategies, as they are comfortable using traditional teaching that includes hard copy textbooks and chalk boards. In addition, they have no prior experience in teaching with educational technology such as interactive whiteboards (Al-Faki & Khamis, 2014).The main

challenge these educators face is the rapid change of technology in an educational context (Al-Faki & Khamis, 2014).

From observations, I have seen how Generation Z primary school learners in grades 4-6 grapple with knowledge concepts when educators use traditional methods of teaching. Generation Z refers to people born after 1995 whose inclination is to be digital citizens who are fast decision-makers highly connected through ICT (Cilliers, 2017). The ways of learning for Generation Z children are different from children of the previous generations (Shafie et al., 2019).Generation Z learners are very dependent on technology since their everyday lives are surrounded by it (Shafie et al., 2019).Therefore, educators can no longer teach using the chalk-and-talk method (Shafie et al., 2019).

These learners would like to see current pictures or videos on complex concepts to better enhance their understanding. Cilliers (2017) suggests brains of Generation Z learners are structured differently to earlier generations because of their external environment. Generation Z's brains are wired to complex visual imagery which in turn makes visual forms of learning more effective (Cilliers, 2017).

For educators to ensure that teaching and learning is understood and retained by Generation Z learners, they need to move away from blackboard teaching and start progressing towards "smart" teaching and learning. Tobail et al. (2016) state that educators and learners are now part of an innovative generation where on a global level, classrooms are rapidly moving away from traditional blackboards and chalk in favour of interactive white boards and laptops (Tobail et al., 2016). These issues have motivated this study on what contributes to intermediate educators' acceptance of interactive whiteboards in their teaching practice.

1.4 Problem statement

The acceptance of interactive whiteboards can be seen as a problem for educators because education is rapidly moving away from a teacher-centred methodology to a more learner-centred methodology (Mayer & Girwidz, 2019). Ultimately, this requires a higher level of technology use which educators are expected to deal with confidently (Johnston, 2013). Should educators continue with traditional teaching methods, learners will struggle to interpret and understand content (Johnston, 2013).

South African public schools must adhere to the ICT strategies provided through the Department of Basic Education. One of the general aims of the ICT policy (2004) is that “every South African manager, teacher and learner in the general and further education and training bands should become ICT capable, that is, to use ICTs confidently and creatively to help develop the skills and knowledge they need as lifelong learners to achieve personal goals and to be full participants in the global community” (Padayachee, 2017, p. 38).

This means educators from older generations must reorganise their traditional teaching methods to adapt to the younger generation’s technological method of learning (Johnston, 2013). Although many educators in quintile 4 and 5 schools have IWBs installed in their classrooms, inadequate support and guidance on how to use the board could result in educators not using it (Al-Rabaani, 2018).

Furthermore, common difficulties are faced by educators when using the IWB and it is not limited to the time it takes to prepare lessons, especially for those inexperienced with educational technology (Alparslan & Ve Gcbay, 2017). This obstacle combined with the educator’s lack of skill can lead to lower confidence when using educational technology (Alparslan & Ve Gcbay, 2017).

1.5 Purpose statement

The purpose of this study was to explore intermediate educators’ acceptance of interactive whiteboards in their teaching practice.

1.6 Research questions

1.6.1 Primary research question

What contributes to intermediate educators’ acceptance of interactive whiteboards in their teaching practice?

1.6.2 Sub research questions

1. Which resources are needed to assist educators when using interactive whiteboards?
2. What challenges do educators face when using interactive whiteboards?
3. What benefits do educators experience when using interactive whiteboards?
4. What training did educators receive on interactive whiteboard usage and how effective was the training?
5. How easy or useful is it for teachers to use interactive whiteboards?

6. What are the attitudes of educators when using the interactive whiteboard?
7. What support do teachers using IWBs receive from the school management?

1.7 Limitations of the study

Five primary schools in Johannesburg were investigated in this study. The educators who took part in this study had previously used the IWB. Therefore, the findings of this study should not be generalised to other settings.

1.8 Significance of the study

The study has noteworthy repercussions for the researcher and tertiary based institutions, because this study planned to assess the knowledge gaps connected to a researcher's personal experiences, perceptions and difficulties associated with returning the findings to participants (McElfish et al., 2018).The objective of this study was to add to the current body of literature related to information communications technology education in South Africa, specifically the IWB. Policymakers and stakeholders may celebrate the incorporation of ICT in the classroom. However, with the growing presence of IWBs in primary schools there is also an additional need for further investigation on the topic (Gregorcic et al., 2018). However, if the main stakeholders -the educators- do not want to accept and use ICTs in the classroom, the Department of Education's ICT vision will not be met. The findings of this study can assist school management teams and school governing bodies to motivate educators with their acceptance of ICT, particularly the interactive whiteboard for educators in their respective schools. Furthermore, the findings of this study can guide the Gauteng Department of Education in refining their goals to prepare schools in becoming paperless, especially in the intermediate phase.

1.9 Overview of chapters

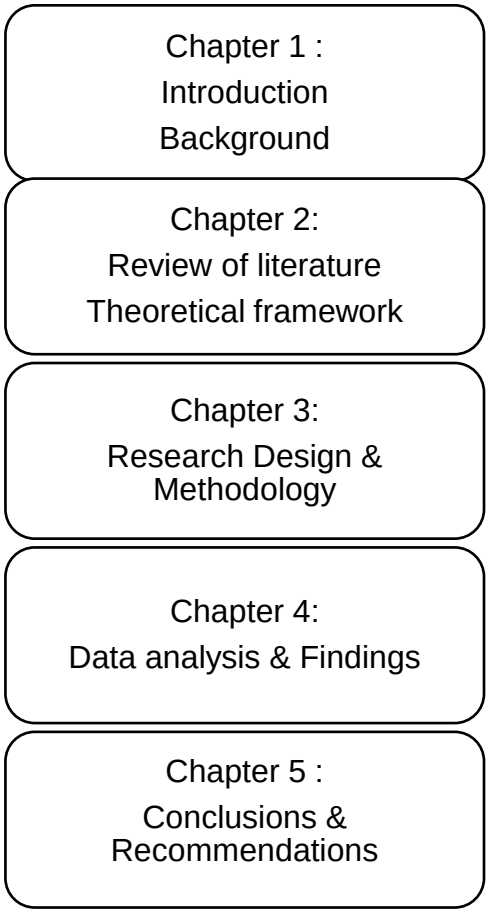

Figure 1: Typical dissertation structure (Roberts, 2010).

Chapter 1: For this chapter, the researcher provided a brief introduction, background, problem statement, rationale, purpose statement, research questions, limits, and significance of this study.

Chapter 2: This chapter ties the appropriate literature to the research questions and provides an overview on ICT education, status of ICT in the world, status of ICT in South Africa, advantages, and disadvantages of IWBs, attitudes of educators who use IWBs and the theoretical framework.

Chapter 3: Consists of the sampling, data collection process, data analysis, methodological process, and ethics for this study.

Chapter 4: The researcher coded participants' data according to themes and sub themes using the ATLAS t.i software program .The findings were provided concurrently with a discussion in association with the literature review and theoretical framework.

Chapter 5: This final chapter is directed at giving recommendations of the findings discussed in Chapter 4. Furthermore, this chapter will provide conclusions, recommendations, limitations, and contributions for this study.

1.10 Conclusion

ICT in an educational context provides better prospects for educators and learners to access better content whilst cultivating the value of teaching and learning (Dlamini & Mbatha, 2018). In this chapter, an outline of the background was presented from which the study would be examined. In addition, this chapter also described the rationale and motivation for choosing this topic. The research questions listed provided further information for data collection.

Chapter 2: Literature review and theoretical framework

2.1 Introduction

This chapter introduces the literature review and provides the background to the research questions which contribute to intermediate educators' acceptance of interactive whiteboards in their teaching practice. Malkawi et al. (2020) describe the IWB as a revolution in communications technology and digital display tools, due to the significant benefits it brings to classroom teaching (Malkawi et al., 2020). This chapter will examine ICT education, status of ICT in the world, status of ICT in South Africa, advantages and disadvantages of IWBs. Finally, this chapter will look at the technology acceptance model as the theoretical framework underpinning this study.

2.2 ICT in education

The progression of ICT globally has encouraged many countries to move forward and compete for an advantage in several disciplines (Hermawan et al., 2018). Information and communication technology is regarded as an effective tool for the advancement of education as it is a powerful agent for change (Choudhary, 2020). This is due to ICT having the capability to bring together conventionally separated educational technologies such as games, databases, television and books to the classroom (Livingstone, 2012). Educational technologies provide learners and educators with opportunities to adapt learning and teaching to societal needs (Ratheeswari, 2018). For educational institutions, using ICT in education means meeting the government's expectations by producing graduates who possess techno-managerial skills (Amutha, 2020). These changes give rise to both benefits and challenges to schools who must implement ICT in the classroom (Livingstone, 2012).

2.2.1 Benefits of ICT in the classroom

Educational ICT in schools broadens educators' and learners' access to education. ICT implemented at school level is anticipated to enrich educational outcomes by strengthening the quality and effectiveness of teaching and learning (Assan & Thomas, 2012). Shafie et al. (2019) state that positive characteristics of educational ICT in schools are its convenience, relevance and interactivity. Stakeholders in the education sector agree that educational ICTs provide educators and learners with opportunities to improve quality in education (Kachakova, 2020). This agrees with authors Dzakpasu et al. (2020) who state that the main advantage of having ICT in the classroom is that education becomes less costly and more affordable for educators and learners (Dzakpasu et al., 2020). It is inferred that whenever a user perceives technology to help improve their work performance or bring benefits to their work environment, the user will be willing to accept it (Matikiti et al., 2018). This argument is reinforced by Saripudin et al. (2020), who found that the use of educational ICT by educators can help explain challenging concepts so that students can easily grasp them (Saripudin et al., 2020). Ibrahim et al. (2016) also revealed that ICT integration in classrooms and laboratories can assist educators in creating a more efficient and effective environment, where real life skills are easier to teach and be understood by learners (Ibrahim et al., 2016). Henderson (2020) elaborates that ICT serves as a tool for curriculum variation because it encourages individual learning. In a traditional classroom setting, an educator must cater for different learning styles and abilities. Educational ICT therefore gives educators an opportunity to make learning accessible for children with different learning needs (Henderson, 2020). In addition, educators can use ICT to further enhance learners' learning experiences by offering feedback personalised to a learner's individual needs (Rerung, 2021). Baek et al. (2008) also discovered that one of the biggest motivators for having educational ICT is mostly based on convenience (Baek et al., 2008). Educators can save time by creating and storing material resources through ICT platforms and devices (Holiver et al., 2020). These resources can be modified and used at a later stage (Brabander & Glastra, 2020).

In addition, the IWB functions can assist educators to overcome the time pressure when facilitating lessons (Linh & Duyen, 2021). As a result, educators feel less stressed when teaching (Linh & Duyen, 2021). Scholars such as Jayamani (2019)

notes that one convenience of having ICT in the classroom is that its features can surpass time and space (Jayamani,2019). Lessons are delivered through "electronic media such as the Internet, intranets, extranets, satellite, broadcasts, audio/videotape, interactive TV and CD-ROM" (De Souza et al., 2017, p. 284). The COVID-19 pandemic disrupted the lives of people around the globe (Bhat, 2021). This resulted in the closure of many educational institutions by governments to reduce the spread of COVID-19 (Bhat, 2021). As a result, the online learning approach allowed teaching and learning to be carried out anywhere and at any time based on agreements set by educators and learners (Butarbutar et al., 2021). Overall, this allowed learners to access resource material at any time convenient to them (Das, 2019). Educational ICT has become one of the attractive factors in enhancing the motivation of learners in the classroom. This is because present-generation learners are receptive to technological changes and are attracted by modern technology (Ogegbo &Ainal,2020).This statement agrees with Shanmugam & Balakrishnan (2018) who state that educational ICT has become one of the attractive factors in enhancing the motivation of learners in the classroom. This is attributed to the way ICT assists educators in presenting lessons, creating diverse teaching activities while making lessons enjoyable and interesting for learners (Shanmugam & Balakrishnan, 2018). For learners to achieve reliable learning that is necessary for the 21st century, learners need to be taught a 21st century learning paradigm. This type of paradigm highlights the need for learners to have critical thinking skills, problem-solving skills, and collaboration skills (Putra & Linuwih, 2020). Mokoena et al. (2020) suggest that the advantage of using the IWB in teaching is its visual impact and interactivity (Mokoena et al., 2020).This is because the IWB can encourage co-operation amongst leaners and assist in improving whole-class teaching (Mokoena et al., 2020).Furthermore, educators can facilitate these sessions by giving learners a chance to exhibit their work with the aid of the IWB (Zakaria & Khalid, 2016).

2.2.2 Challenges of ICT in the classroom

Despite the many benefits of ICT in the classroom, researchers such as Liu & Pange (2015) have mentioned that stakeholders in education may have encountered several challenges in ICT. Lim et al. (2021) argue that this modern technology may have increased schools' burdens with additional running costs and pressure to keep

up to date with the latest technology. Schools must first have the initial investment to put ICT in place with the cabling, the internet and then the maintenance of the software and hardware in the long term (Lim et al., 2021). Judge (2013) further suggests that even if schools are privileged to have fully working and well-maintained ICT facilities, learners need more than one hour a week to prepare for life in an increasing global society. School management teams act as the driving force that affects the successful integration of educational ICT at schools (Rabah, 2015).In a study completed by Rabah (2015), the author is of the view that educators look to the SMT for guidance with regards to ICT. Without guidance and vision from the school leadership, ICT implementation is limited to isolated projects like investment into general school resources or educator training sessions (Rabah, 2015).

2.2.4 Educator training

One of the significant features of a successful education is the continuation of proficient educators who are motivated and involved (Rueda & Cerero, 2019). Teaching with the IWB must be transmitted through pedagogical content knowledge. The Technological Pedagogical Content Knowledge framework forms a part of an educator's training because it best describes the kinds of knowledge educators need to integrate ICT in the classroom (Zhang & Tang, 2021). Authors Gonzales & Gonzales (2021) describe the TPACK model as the basis for ICT integration in teaching (Gonzales & Gonzales, 2021). This model requires educators to have a comprehensive understanding of the presentation concepts combined with technological and pedagogical techniques to teach (Gonzales & Gonzales, 2021). For educators who have only used computers and outdated ICT, the TPACK model can assist them in adjusting their pedagogy to modern ICTs such as the IWB (Muslem et al., 2018). The TPACK framework classifies three kinds of knowledge used to incorporate ICT (Lefebvre et al., 2016). The first is technological knowledge, which links to knowledge about the IWB. It includes its resources, and the skills educators need to complete various tasks (Lefebvre et al., 2016). The second is pedagogical knowledge which represents teaching and learning (Lefebvre et al., 2016). Lastly, content knowledge describes the subject matter stipulated by the curriculum (Lefebvre et al., 2016). However, to facilitate a learner-centred classroom using TPACK, it becomes the school and educator's responsibility to

create these new teaching approaches that will work hand-in-hand with modern educational ICT (Samsonova, 2019). Teaching and learning cannot be transformed if ICT does not connect to pedagogy (Samsonova, 2019). Mou (2016) suggests that educators who have a positive attitude can learn to use educational ICT quickly and more effectively (Mou, 2016). However, if educators show a negative attitude or disinterest in using educational ICT the incorporation of technology will be obstructed because the educator will prefer to stick to their old style of teaching (Mou, 2016). This could be caused by educators' insufficient ability and knowledge in the field. Muñoz et al. (2017) suggest that some educators are anxious about exposing their lack of technological competence in front of their learners.

In the meantime, tech-savvy learners are gradually putting pressure on their educators, expecting them to be specialists and good examples in the area of educational ICT (Muñoz et al., 2017). Therefore, educator training programs should offer occasions for educators to acquire and practise the 21st century skills (Cretu, 2016). This statement agrees with authors Göçen et al. (2020) who state that educational systems need to be revolutionised to help educators gain 21st century skills and to enthusiastically participate in the 21st century. However, stakeholders are struggling to provide ongoing professional development for educators because of the large numbers of teachers that need to be reached (Tondeur et al., 2016). Furthermore, there is a need for regular updates in relation to continuing developments in ICT (Tondeur et al., 2016).

This agrees with a statement made by Savec (2017) who argues that schools need to engage in the continuous care and readiness of modern ICT devices in the classroom. Therefore, it is up to schools to make continuous advances in training educators to become aware of these new developments (Vos & Lautenbach, 2012). Furthermore, subject specific ICT resources accompanied with training, needs to be provided to educators to expand their development in related ICT knowledge (Savec, 2017). This is further supported by Ahmed & Kazmi (2020), who suggest that in some instances there are no updated resources available to educators except those found on the internet. Educators who lack computer skills will find it difficult to incorporate resources into curriculum-based lessons (Ahmed Kazmi, 2020). Vos & Lautenbach (2012) suggest that educators' professional development should entail the personalisation of training opportunities (Vos & Lautenbach, 2012).

This is due to the fact that training curriculums tend to take the top-down approach & often do not approach problem-solving issues because the training activities tend to be more theoretical than practical (Akarawang et al., 2015). Akarawang et al. (2015) suggest this could be due to a limited training budget. Furthermore, poor after-training assistance means that educators will find it difficult to practically implement knowledge gained at the training sessions. However, it is hard to accommodate in school environments due to the sharing of available resources. Furthermore, it is up to educators to take responsibility for their own personal growth in ICT (Vos & Lautenbach, 2012). Lack of time to participate in training makes educators stay away from ICT, which means they cannot grow professionally in using ICT (Goktas et al., 2009).

2.3 Status of ICTs in the world

2.3.1 The United States

The United States (US) Education Department started a technology and literacy project during the Clinton administration in 1996 to improve ICT overall in education (Başak & Ayvacı, 2017). The main goal of the project was to assist the nation's learners to become digitally literate by the start of the 21st century (Han et al., 2018). By 2005, nearly all public schools had access to the internet with thirteen million computers made available to learners (Kozma, 2011).

In 2017, the plan evolved to rethink the role of ICT in education (Han et al., 2018). The policy now includes transformation facilitated by ICT as well as research and development that could assist educators with learning and teaching (Han et al., 2018). According to Trainin, et al., (2016) IWBs are the most used ICT in US elementary schools. IWBs are believed to be a promising technology with a strong possibility of increasing learner achievement (Trainin et al., 2016). This has led to a few United States schools and districts purchasing and integrating IWBs in classrooms with the hope of improving learners' marks in standardized tests (Trainin et al., 2016).

It is challenging to gauge how successful the US educational policies are in terms of IWBs because the US works on a decentralised system of fifty states. Each state has a different set of priorities (Henriksen et al., 2018). However, according to a study conducted by Zang (2018), even though educators have been accustomed to using IWBs for several years, continuous professional training is still necessary,

mostly in new IWB features, in order to encourage the educators' classroom use (Zang, 2018).

2.3.2 Finland

The accomplishment of ICT education in countries around the globe can be attributed to ICT strategies in leading educational activities (Kian, 2019). Among these countries, Finland is recognised as being successful in its use of ICT in education (Kian, 2019). For Finland to progress into an information society, a national program was created (Niemi, et al., 2013). The national program mainly focused on the role of educators, specialized skills and the development of knowledge and information in ICT (Kian, 2019).

In 2004, the national curriculum framework enforced the use of computer and computer networks as a learning instrument (Koivisto, 2014). By 2010, internet connections were made available in all primary and secondary schools. This was achieved due to the continuous funding received from the Finnish government to build educational networks, equip computer labs and train educators to use ICT (Koivisto, 2014). However, according to evidence presented by a 2006 SITES study, the ICT sources and infrastructures in schools do not necessarily assist educators and schools in promoting 21st century knowledge and skills for learners (Niemi et al., 2013). Furthermore, the responsibility of preparing schools as information societies falls on the individual educator or school communities to implement (Räihä et al., 2014). As a result, the main obstacles experienced by the education sector were low usage of teaching models and practices catering to learners' active involvement and learning in ICT, and ensuring that educators' training was up to date (Sipilä, 2014).

Despite these challenges, coding became a compulsory and cross-curricular subject for both primary and middle school learners from 2016 (Wu et al., 2020). The Finnish Ministry of Education outlined coding as an essential part of the school curriculum (Wu et al., 2020). Coding is not a separate field of study but is integrated into other learning areas (Wu et al., 2020). There are age-appropriate tasks that are geared towards certain skills learners should be taught in each subject. This is to assist learners in logical intelligent thinking and problem solving (Wu et al., 2020).

2.3.3 South Korea

A similar project is seen in South Korea whereby ICT in education was successfully implemented. During the mid-1990s ex-president Kim Young Sam introduced a proposal called “Education Reform Proposal” (Pang et al., 2015). The purpose of this proposal was to implement school enhancement policies that would integrate state of the art ICT into Korean classrooms (Pang, et al., 2015). The implementation of modern technologies in the Korean public school system is propelled by its cutting-edge infrastructure in ICT (Park et al., 2019). With the nation-wide high mobile connectivity, Korean learners have access to and usage of digital devices such as tablets, smartphones and virtual reality as learning tools from an early age (Park et al., 2019).

To establish an ICT-based schooling system on national level, the South Korean government had educational ICT policies implemented from top–down (Grzybowski, 2019). The President’s Council on Information Strategies, the Ministry of Education and local offices of education were all involved in ensuring the productive application of ICT in elementary and secondary schools (Kim, 2016). The President’s Council’s role is to co-ordinate the national ICT plan including all projects under the education reform (Kim, 2016). The Ministry of Education’s position is to oversee the planning, execution and assessment of ICT projects under the national scheme (Kim, 2016). On ground level, the local office applies ICT for teaching and knowledge in schools (Kim, 2016).

According to researchers Başak & Ayvaci (2017) the most important feature that separates the Korean government’s integration of ICT from other countries, is the establishment of an educator ICT training system geared towards the educators at all post levels (Başak & Ayvacı, 2017). Korea’s notion is that efficient integration of ICT cannot take place without shaping educators to construct digital content and curriculum design using the ICT provided (Bansal & Misra, 2018). Therefore, Korea’s focus is to provide quality ICT training to educators through computer literacy and curriculum integration (Bansal & Misra, 2018). Furthermore, the Korean government provides additional ICT support to educators through distance education (Bansal & Misra, 2018). South Korea improves their ICT developments by working on a master plan that needs to be implemented every three to five years from development to implementation (Başak & Ayvacı, 2017). As of 2019, all Korean

learners receive software coding as a subject, starting from elementary schools (Park et al., 2019).

2.3.4 Portugal

In comparison to Korea, Portugal has a completely different approach to ICT implementation in schools. Since 2007, Portugal has implemented a major ICT plan for education which was moderately funded by the European Union (Abrantes et al., 2013). The goal was to give Portugal status among the most forward-thinking countries in the world for ICT implementation in public schools (Abrantes et al., 2013). The Portuguese Ministry of Education's aim was to provide rapid internet in all primary and high schools across the country. This included a ratio of two learners per computer and equipping ninety percent of educators with ICT certification (Abrantes et al., 2013).

To start this process, the Portuguese government initiated the e-little programme in 2008, which offered all primary school learners a chance to buy a low-price laptop (Pereira & Pereira, 2015). Furthermore, technology companies such as Microsoft were engaged in the project and they decided to develop training for educators and provide encouragement for the use of computers in primary schools (Pereira & Pereira, 2015). However, the project received criticism from educators, which stemmed from the belief that ICT would alter the educator's pedagogical practices resulting in learners occupying a more active role in their learning (Pereira & Pereira, 2015). Although there have been extensive ICT training programmes aimed at educators, the way in which the training is utilized limits educators' teaching practices, as the training does not develop educators' skills in all areas of the school curriculum (Costa et al., 2014).

Unfortunately, due to the economic crisis in Portugal, the investment in education was reduced, thus suspending the technological plan for education. The continuous training and use of ICT has been left dependent on school leadership to assess their individual school's circumstances (Bastos & Oliveira, 2015).

2.3.5 Turkey

Since the 1980s, Turkey has integrated ICT into their education system to improve the quality of education experienced by learners (Hazar, 2019). Turkey's Ministry of Education's aim was to prepare learners with the skills and knowledge for the

information economy (Hazar, 2019). To achieve this goal, the Ministry of Education came up with the following projects to assist with integrating ICT into education: “Computer Assisted Education 1989-1991, Computer Laboratory Schools Project 1993-1997, Basic Education Project 1997-2007, Secondary Education Project 2006-2010 and the FATİH Project in 2010” (Hazar, 2019, p. 955). Between 1998 and 2008, Turkey’s Ministry of Education invested more than US $1 billion into ensuring ICT integration would take place in schools as part of the basic education program (Uluyol & Sahin, 2016). Turkey’s most recent investment came in the form of the “Movement to Increase Opportunities and Technology or Firsatlari Artirma ve Teknolojivi İyileştirme Hareketi (FATİH)” (Duran & Aytaç, 2016, p. 66).The intention of the FATİH project was to create fairness in education and improve the use of ICT in schools (Duran & Aytaç, 2016). The FATİH project’s intention was to provide tablets to 700,000 educators and to set up 570,000 IWBs in classrooms (Duran & Aytaç, 2016). Furthermore, the Ministry hoped to set up networks that could connect to printers and cameras (Duran & Aytaç, 2016).

However, according to statistics from the Turkish Ministry of Education, only 2,259 tablets were given to educators whilst only 9,435 classrooms were equipped with IWBs (Duran & Aytaç, 2016). Despite the Ministry not reaching its initial goal, there were positives that came out of the FATİH project. Positive aspects of the project showed that educators’ teaching methods improved which led to improved motivation by the learners (Çoruk & Tutkun, 2018).

However, there were some educators who had negative views on the FATİH project. The negative features of the project showed the scarcity of technical staff and inadequate internet, which lead to uncertainty on how long infrastructure support would be provided (Çoruk & Tutkun, 2018).

2.3.6 United Kingdom

In the United Kingdom (UK), the use of ICT is stipulated in the formal curriculum as compulsory for both primary and high schools (Savage, 2010). The government of the UK established the “British Education Communications and Technology Agency” (Byker, 2014, p. 89) in 1995 to promote digital literacy amongst learners in primary and secondary schools in Britain (Byker, 2014). Between 2003 and 2004, the UK first introduced IWBs into primary schools. Providing £10 million to support the IWB implementation, the UK was the first to champion the use of new ICT as

part of Britain's National Strategy (Hockly, 2013). For Britain to remain competitive in the globalized world, it was believed that IWBs would present better learning in a holistic class setting (Hockly, 2013). The British Education Communications and Technology Agency promoted the IWB as offering original and appealing training infrastructure to assist with growing learner motivation (Tatli & Kiliç, 2016).

By 2015, most UK primary schools replaced all other teaching devices with IWBs, with primary schools having the highest dominance compared to secondary schools (Balta & Duran, 2015).It was introduced mainly to primary schools as an educational tool to advance literacy and numeracy (Aflalo et al., 2018). However, complaints came from multiple organisations regarding the meagre quality of England's national ICT curriculum (Larke, 2019). Issues brought up were that England had not produced enough computer and IT technicians over the years. Furthermore, graduates performing non-technical jobs have substandard ICT skills for the workplace (Larke, 2019).

As a result, learning to code became an important educational policy geared towards improving programming skills and computational thinking (Williamson, 2016). The UK continues to emphasise ICT integration in schools with their main belief that educators can use ICT to transform learning (Byker, 2014).

While this may be true, research performed by the BECTA suggest educators lack basic competency with ICT because new teaching strategies have not been fully investigated by policymakers (Barreto, 2018). A combination of factors show the barriers for educators adopting new ICTs. Factors including beliefs, knowledge, skills, ICT training experience and support are often linked to unsuccessful ICT integration in schools (Noh et al., 2016).

2.3.7 China

At the beginning of the twenty–first century, China decided to restructure its education curriculum from educator-centred instruction to learner–centred instruction (Sang et al., 2018). To improve learner-centred instruction, constructivist ICT lessons were introduced into classrooms (Sang et al., 2018). The Ministry of Education in China proposed the ten-year expansion blueprint of ICT education from 2010-2020 to further develop and guide national information technology integration (Li et al., 2019). Chinese educational policy makers developed its ICT

policies based on funds available in the economy to ensure ICT goals remained attainable, as China has varying inequalities amongst urban and rural areas. This presents a challenge in implementing ICT policies (Alamin et al., 2015).

The Ministry of Education encouraged areas with a high level of economic development to exceed ICT goals on their own while the underdeveloped areas would be supported by the government on all levels to grow in ICT education (Alamin et al., 2015). Furthermore, nine Ministries of China announced the important task of increasing educational ICT. This proposal intended to bring support and participation from different enterprises to form a collaboration in endorsing ICT in education (Li,et al., 2019). Despite the Ministry of Education's effort, the growing economic and social inequalities amongst urban and rural districts have led to an enormous educational gap (Wang et al., 2019). Resource disparity is one of the main factors that contribute to the educational gap. Due to city-focused polices favouring urban schools, most high-quality educational resources tend to be allocated there (Wang et al., 2019). In addition, most urban classrooms are furnished with multimedia projects to endorse the utilization of ICT for learning and teaching (Lu et al., 2015).

Due to the shortage of ICT facilities and network environments in rural schools, ICT equipment is not commonly used in teaching (Lu et al., 2015). However, according to Yang et al., (2018) the educational gaps are less about access and more dependent on educators' utilization. Therefore, the focus should be allocated to educator training and evaluation of ICT integration to support utilization of ICTs in rural zones (Yang et al., 2018).

2.3.8 Vietnam

In 2009 the Vietnam Department of Education and Training decided to implement their national strategy for educational ICT (Tran & Stoilescu, 2016). The government put forward a new innovative curriculum; new methodologies to transfer knowledge, updated ICT and new professional training for educators (Tran & Stoilescu, 2016). Vietnamese learners have been described as passive learners who struggle with problem solving (Quang et al., 2015). This directly impacts on technical skills needed for ICT careers (Quang et al., 2015). Thus, this leads to unsatisfactory preparation for learners as the future qualified workforce (Quang et al., 2015). All major stakeholders in education agreed to the possibilities of educational ICT to

update the curriculum by promoting blended learning (Peeraer & Van Petegem, 2015). Furthermore, the community was asked to participate and support ICT in education.

In emerging countries like Vietnam one of the obstacles to adopting ICT in educational backgrounds is the absence of ICT infrastructure and educational devices required for the implementation process (Mai & Hong, 2014). In a study conducted by Pham et al. (2019) Vietnam's educators claimed that despite having the ICT in class, they lacked the time and patience to focus on integration because of the variety of tasks they have besides teaching (Pham et al., 2019).

2.3.9 Brazil

Brazil started using computers at the beginning of the 1970s. Universities were the first to experience computers in education (Valente & Almeida, 2020). However, the inclusion of ICT in basic education took place during the 1980s based on the representation of public policies by the Ministry of Education (Valente & Almeida, 2020). The creation of ICT related activities is related to the skill set of each school. Due to the mixed socio-economic levels of families within different geographic regions, this leads to a pattern of inequality in school environments (Tomczyk et al., 2021). Brazil's private schools are in wealthy regions with greater access to ICT and trained educators. Brazil's government schools have less ICT resources which reflects a lack of educator training to use ICT (Tomczyk et al., 2021).

2.4 ICT policies in South Africa

For this study, it is imperative to understand the realities of ICT policies and plans for basic education in South African schools. Information and communication technologies are becoming essential to the lives of South African citizens (Assan & Thomas, 2012). In 1994 the South African government decided to initiate a new education system which provided a similar type of schooling for all South African learners regardless of race and culture (Mathipa & Mukhari, 2014). Integrating ICT into pedagogy has been part of the education restructure since 1994 (Combrinck & Mtsatse, 2019). Ten years later, the ICT draft policy, called the White Paper on e-education, was established by the Department of Basic Education (Combrinck & Mtsatse, 2019). The White Paper serves as the main policy for e-learning in South African schools. According to the White Paper document, this policy aims to ensure that "every South African manager, teacher and learner in the general and further

education and training bands will be ICT capable. That is, use ICTs confidently and creatively to help develop the skills and knowledge they need as lifelong learners to achieve personal goals and to be full participants in the global community" (Padayachee, 2017, p. 38). Once implemented, government hoped that learners and educators would have computer literacy skills and access to ICT resources by 2013 (Combrinck & Mtsatse, 2019). In 2018, the Department of Education published a new ICT policy related to educator professional development. This policy is called the Professional Development Framework for Digital Learning. According to Dlamini and Mbatha, (2018), despite the Department of Basic Education investing a lot of funds into ICT education, the country still struggles with educators' professional development in ICT. This leads to wasteful expenditure on ICT resources if educators do not know how to use it (Dlamini & Mbatha, 2018). The purpose of this policy is to help develop capable educators who can use ICT to enrich teaching and learning (Aitchison, 2018). The policy offers stakeholders guidelines to improve their professional development (Aitchison, 2018). The informative section of the policy explains how the SAMR model aligns with other national frameworks (Hlengiwe & Thomson, 2019). In addition, the policy includes various educator activities and workshops that form around the framework (Hlengiwe & Thomson, 2019).

2.5 Status of ICT in South African schools

The new policy prescribed that all schools use ICT to find ways to improve and enhance teaching (Mathipa & Mukhari, 2014). However, as part of the aspiration of making South Africa an information society, many urban public schools were fitted with computer laboratories and internet connectivity to realise the national objective of an information society (Mathipa & Mukhari, 2014). In 2014 Mpumalanga's Department of Education launched the OR Tambo Maths, Science and Technology Academy. With the main goal of expanding the value of teaching and learning within the province using technology, IWBs, data projectors, plasma televisions and documents were provided to 101 high schools and feeder schools close to the academy (Khoza et al., 2019).

According to author Immelman (2015), private education in South Africa has expanded from five hundred and eighteen schools in 1994 to one thousand six hundred and eighty one schools in 2014 (Immelman, 2015). Most of these schools are situated in Gauteng (Immelman, 2015). This increase in numbers possibly

indicates that parents do not trust the public school system (Immelman, 2015).The findings of the study further discovered that a computer centre is an important feature when parents choose a school for their child (Immelman, 2015). Private school stakeholders go to great lengths to invest in the latest educational ICT and infrastructure. This is possibly why private schools have better access to ICT. According to the study, government should look to the private sector as a guide to implementing ICT infrastructure in the public school system (Malero et al., 2015). The growth in the private school sector is propelled by middle class South African parents desiring high quality education, based on the reality that government administration is not building new schools in wealthy areas.

Padayachee (2018) states that although there has been minor advancement in e-education since 2011, the changes that exist are very limited (Padayachee, 2018). In 2019 the Department of Basic Education admitted that the acceptance of ICT in schools has not progressed as scheduled due to the many inadequacies in the system (Padayachee, 2018). Currently, there are still South African schools that are inadequately resourced and lack basic ICT infrastructures and facilities (Chisango et al., 2020).Unfortunately, these developments are highlighted by difficulties in integrating ICT into rural schools (Dzansi & Amedzo, 2014). It is generally argued that there is a great gap amongst technologically innovative countries and emerging countries. Numerous developing countries are struggling to close the digital divide (Msila, 2015). The digital divide can be defined as the “gap between those people who have access to digital technologies and information via the internet, and those who do not” (Nyahodza & Higgs, 2017, p. 39). Pholotho & Mtsweni (2016) argue that due to South Africa’s geographic challenges such as valleys and mountainous terrain, it becomes problematic to install ICT structures in rural areas (Pholotho & Mtsweni, 2016). In the instance of rural areas, the implementation of ICT infrastructure is obstructed by the lack of electricity, security, and maintenance (Pholotho & Mtsweni, 2016). This is coupled with parents’ inability to pay school fees to manage the upkeep of technology, as well as the general disregard of schools on the part of government (Ojo & Adu, 2018).

This is partly because of the changing curriculum and lack of extensive ICT execution and training that is required for South African educators to become knowledgeable with using ICT within the educational context (Adu & Galloway,

2015Educators need patience, training and support to explore and test educational ICT (Khoza et al., 2019). Educators' fear of ICT should be anticipated and recognised during the implementation phase (Khoza et al., 2019).

Educators mainly control the development and innovation of ICT in public schools since they are the ones who use ICT for the progression of education (Msila, 2015). However, if the educators' knowledge and skills in using educational ICT are not at a place where they are at ease, educators will not be confident enough to use it when enriching learning (Gumbi, 2019). This is in support of the academics who state that many older African educators were deprived of sufficient training in the teacher colleges, and this has proved problematic for stakeholders to create professional development courses that could address the inadequate skills that some educators possess (Van Jaarsveld & Van der Walt, 2018).

Furthermore, most South African government schools have policies that prohibit learners from using their personal digital devices on school premises (Mwapwele et al., 2019). These policies directly conflict with the Department of Education's ICT objectives (Mwapwele et al., 2019). For example, in a report targeting ICT usage by Mathematics educators in Kwa-Zulu Natal and Gauteng, Vadachalam & Chimbo's (2017) findings suggest that the lack of operative training by stakeholders is an area of concern as educators' training needs are not being met (Vadachalam & Chimbo, 2017). Although the South African government has ICT programs like the Vodacom Mobile education program to assist educators with ICT across the nine provinces, there is a concern that the initiatives focus on computer skills without upskilling educators with the necessary skill set to benefit fully from ICT usage (Mathevula & Uwizeyimana, 2014). Educators then lack the skill to design custom-made class activities that increase learning by using educational ICT (Gumbi, 2019). When the quality of ICT educator training is low, educators will not reach educational goals and teaching and learning deteriorates (Gumbi, 2019).The skill set should include how to adapt content material and design differentiated activities using the same resources (Mathevula & Uwizeyimana, 2014).

The researchers recommend that a detailed training programme should be tailored and executed for each staff member making sure that the educators are skilful in using ICTs to teach learners (Chimbo & Vadachalam, 2017). As of 2018, the

Northern Cape, Western Cape and Gauteng are the only provinces who made noteworthy developments in implementing ICTs in schools. The remaining provinces still need to meet the Department of Education's ICT standard as stated in the 2004 White paper and the 2018 Professional Development Framework for Digital Learning (Ojo & Adu, 2018). The result is that South African schools are behind with ICT development compared to other countries globally (Adu & Galloway, 2015).

2.6 The status of the use of IWBs in the world

The IWB can occasionally be referred to as an electronic whiteboard or SMART board (Firmin & Genesi, 2013). IWB systems were created by experimentation in the 1980s largely in higher education faculties (Miller & Glover, 2010). Since then, there has been a world-wide interest in using the IWB (Giannikas, 2021). According to Akar (2020) IWBs are expected to become even more extensively used in the next five years due to their many benefits (Akar, 2020). Notably, the COVID-19 pandemic has dramatically advanced the education sector years ahead with the use of online teaching and learning methods that were implemented in a short period of time (Grenčíková et al., 2021). Some of these changes have pushed schools further towards the advancing Fourth Industrial Revolution (4IR). This revolution is described as the "vital interaction between human and machines" (Elayyan, 2021, p. 23). The Fourth Industrial Revolution (4IR) has brought about newer technologies such as robotics, coding and artificial intelligence which competes with current multimedia classrooms (Recalde et al., 2020). The purpose of these tools is to actively engage learners in scientific and engineering practices whilst improving their knowledge in various disciplines (Akgunduz & Mesutoglu, 2021). Therefore, multimedia classrooms are gradually becoming outdated due to obsolete equipment and singular application modes (Zhan et al., 2021). However, the Fourth Industrial Revolution (4IR) is only at an early stage of expansion, and it may bring improvements in education or cause bigger complications for schools that are not prepared to adapt (Recalde et al., 2020).

The interactive whiteboard (IWB) can be defined as "a combination of a large, touch-sensitive electronic board with a data projector, specialised software and a computer" (Jang & Tsai, 2012). The whiteboard shows the projected image from either the computer or laptop with the benefit of using a stylus or finger for direct

input (Jang & Tsai, 2012). “Software provides a variety of functions including those that replicate non-digital technologies such as flipcharts, dry-wipe boards, overhead projectors, slide projectors and video players” (Hennessy & London, 2013, p. 5).

Figure 2: Basic Framework of Interactive Projection System (Kudale & Wanjale, 2015)

2.6.1 Different Types of Interactive Whiteboards

There are assorted brands of smartboards available on the market with a combination of diverse hardware and software features (Ahmad et al., 2017).

2.6.1.1 Resistive touch based interactive whiteboard

The resistive touch sensitive interactive whiteboard requires an input device for the user to interact with the IWB (Kudale & Wanjale, 2015). The coating which is stretched over the surface of the board contacts the conductive material when pressed (Kudale & Wanjale, 2015). This type of whiteboard is straightforward to use but is costly for schools to purchase.

2.6.1.2 Electromagnetic pen based interactive whiteboard

The electromagnetic pen based IWB is a tool that allows interacting using specific pens on an electromagnetic surface (Oliveira et al., 2015). Despite the high-end writing recognition ability, the board only works with specially designed pens (Oliveira et al., 2015). Furthermore, the board does not allow for two or more users at the same time (Oliveira et al., 2015).

2.6.1.3 Infrared interactive whiteboard

An infrared interactive whiteboard is a large interactive display that links to a computer and projector (Khan et al., 2012). The infrared board is usually attached

to a partition or floor stand (Khan et al., 2012). The user can use their finger, pen and other input device over the image projected on the whiteboard (Khan et al., 2012). The image is seized by its interference with infrared light at the surface of the board (Khan et al., 2012).

2.6.1.4 Interactive whiteboard via an interactive projector

The interactive projector comes with a built-in camera which can be used remotely (Kudale & Wanjale, 2015). The camera senses the location of the IR pen when it connects with the board (Liu & Cheng, 2015). This means educators and learners use it to control applications from a distance without having to change the classroom dynamics (Liu & Cheng, 2015). This IWB costs more than the traditional system. However, the board does experience operating problems when there is a loss of line between the stylus pen and the projector (Kudale & Wanjale, 2015).

2.7 Uses of the IWB

When children reach the primary school age, technological tools form part of their learning at school (Tahir & Arif, 2016). The IWB is an example of such a tool as interactive whiteboards were first introduced to elementary/primary schools as a support tool by various countries to improve learners' literacy and numeracy skills (Aflalo et al., 2018). According to Aflalo et al. (2018) IWBs can be found in roughly 60%-90% of classrooms in Britain and Holland, 60%-70% of the classrooms in Denmark and Australia and less than 20% of the IWBs can be found in Korea, China, Italy and Israel (Aflalo et al., 2018). The utilization of interactive whiteboards in primary schools has improved in recent years especially in countries whose focus is teaching English as a foreign language subject, and Mathematics at primary school level (Cadamuro et al., 2020). The English langauge has risen in popularity and so has the need for qualified educators to instruct learners in the language (Shyamlee & Phil, 2012). It is expected that language educators use educational ICT such as IWBs, multimedia and the internet in their classrooms (Han & Okatan, 2016). In the English foreign language (EFL) context, the use of IWBs endorses the use of reliable resources and content in the classroom (Dashtestani, 2019). According to Lin & Chu (2018) an IWB can create an interactive environment for learners by providing them with engaging learning opportunities (Lin & Chu, 2018). Children could use the IWB to acquire textual editing and revision skills (Al-Tarawneh, 2021). The review function on the IWB allows the learners to use

different colours to help them find expressions in the text (Al-Tarawneh, 2021). The highlighting option on the board helps learners concentrate on the responses (Al-Tarawneh, 2021). Cadamuro et al. (2020) suggest that using technology-based language activites will provide learners with a correct and suitable way to learn a language (Cadamuro et al., 2020). For example, in the past teachers and learners would use a dictionary to search for the meaning of a word, but now with technology in the classroom they can easily search for the words using a computer or laptop connected to the IWB for language (Cadamuro et al., 2020). While using the IWB, the educator could teach easily while building an interest in learning the English language (Cadamuro et al., 2020). The success of the IWB in a language lesson is that it encourages class discussion and while the educator is navigating the teaching from the board, they can still interact with the class (Mohammed et al., 2016).

The IWB allows the educator to concentrate on the learners' language construction and conversations (Mohammed et al., 2016). The projection also makes it easier for a whole classroom to read a text together at the same time (Mohammed et al., 2016). Furthermore, author Alhumsi & Shabdin suggest that the IWB can promote the teaching of EFL by aiding with linguistic components while promoting oral skills (Alhumsi & Shabdin, 2016). The IWB promotes oral skills in two ways. According to Ağir & Şen (2014), teachers can record and save applications onto the board. Should the teacher wish to play them later, the sound bite can be replayed on a computer using Windows Media player (Ağir & Şen, 2014). The learners can save their speeches and are able to listen to them again at a later stage. Ağir & Şen further elaborate that the IWB can transform handwritten notes written on the board in other formats which can be converted to computer text (Ağir & Şen, 2014). In a study conducted in Turkey by İstifçi, et al. (2018), it was observed that IWBs give learners an opportunity to share their questions and answers without revealing their names or identities (İstifçi et al., 2018). With additional functions, the IWB offers additional tools such as interactive response systems which is controlled remotely (İstifçi et al., 2018). This option of the IWB assists learners with overcoming timidness and embarrassment which are among the common problems in language learning (İstifçi et al., 2018).

It is considered a norm that as people advance themselves in acquiring mathematical knowledge and skills, they will start to feel excited about the subject

(Soydan, 2015). The use of IWBs is one of the most efficient methods that provide learners with the chance to appreciate the subject while they learn mathematics with concrete objects (Soydan, 2015). IWBs have been found to be particularly useful in teaching mathematics (De Vita et al., 2018). Maintaining the tempo in a mathematics lesson is vital to reaching a lesson's objective (Young et al., 2017). The IWB increases the pace of mathematics lessons because the educator does not have to spend time conceptualizing the next question or rewriting examples on the board (Young et al., 2017). Concerning mathematical instruction, Esteves et al. (2015) propose that the IWB supports the learning of specific mathematical topics by using simulations, videos and animations which would be problematic to recreate in real-life situations (Esteves et al., 2015).

As a visualization tool, the IWB can manoeuvre both abstract and concrete mathematical constructs for learners to see on a large screen (Chamblee, 2016). With the IWB, learners obtain critical thinking skills that are essential to answering pre-algebra problems (Minor et al., 2013). Learners have an opportunity to engage themselves in the pre-learning process. This type of learning is entrenched in intellectual and social settings (Minor et al., 2013). In Minor et al.'s (2013) study, the findings indicated that learners were enthusiastic about the lesson when the IWB was used and displayed the motivation to work in small groups on mathematical problems (Minor et al., 2013). Classroom activities form an integral part in primary school mathematics (Lan, 2018). Active learning involving the IWB integrates data handling so that primary school children could study data handling actively and meaningfully (Abdullah et al., 2019). Using the IWB program which has built-in functions allows children to picture all data in tables, charts and graphs clearly (Abdullah et al., 2019). For learners to become proficient in mathematics they must practise regularly (Lan, 2018). Educators can further reinforce concepts by designing and creating a variety of activities that include games and pictures (Lan, 2018). Redman and Vincent (2015) observed in Swedish upper primary schools how the use of IWBs by educators give learners better opportunities to share and extend their thinking (Redman & Vincent, 2015). As a result, there was greater communication between the learners and teachers on how to solve mathematical problems (Redman & Vincent, 2015). However, studies conducted by Kutluca et al. (2019) suggest that despite the increase in learners' motivation in the mathematics

classroom, the IWB does not have much influence on their academic achievement (Kutluca et al., 2019).

2.8 The status of the use of IWBs in South Africa

"The South African government, by means of the DBE, has turned to new technologies to help improve teaching and learning to redress the past inequalities in schools" (Graham et al., 2020, p. 749). To remain current in a global setting, South Africa's education department has ICT policies and plans in place to execute ICT in education (Makgat & Awolusi, 2019). This included IWBs, with the hopes of improving the achievement and engagement among learners. However, the state-funded distribution of ICTs has been unequal with some districts struggling to distribute textbooks let alone installing IWBs in classrooms (Prinsloo & Sasman, 2015).

Schools found in wealthy communities have better access to ICTs than schools found in poorer communities (Chisango & Lesame, 2019). Township schools are generally poorly resourced as they grapple to overcome the backlogs brought by apartheid (Van Jaarsveld & Van der Walt, 2018). Despite the Department of Basic Education's paperless project, IWBs are still susceptible to theft and damage during service delivery protests and theft by organised criminals who use angle grinders to remove IWBs from classroom walls (Prinsloo, 2020). Therefore, there is limited to no ICT infrastructure for teaching and learning in township schools (Chisango & Lesame, 2019).

In a study conducted by Chisango & Lesame (2019) in Gauteng secondary schools, it was established that only the grade 11 and 12 classrooms have interactive whiteboards installed in them (Chisango & Lesame, 2019). Those educators have access to content that could not be accessed by other educators in the same school, thus leading to ICT inequality (Chisango & Lesame, 2019). Furthermore, there is inadequate IWB teaching in subjects such as African languages (Olika et al., 2019). Not all 11 official languages are integrated with the board (Olika et al., 2019). Furthermore Dlamini & Mbatha (2018) argue that South African stakeholder's purchasing of IWBs is outpacing educators' training facilitated for them (Dlamini & Mbatha, 2018). Mokoena, et al., (2019) suggest more time and resources should be invested in educators' professional development to build confidence in educators in using various features of the board (Mokoena et al., 2019).

Educators' ICT professional development is not being delivered in a systematic and meaningful way even though there is a need for educators to grow in ICT skills and competencies (Dlamini & Mbatha, 2018). In the study conducted in the Tshwane North District, educators indicated that the duration of IWB training was insufficient (Mokoena et al., 2019). Educators continued writing on the IWB using their fingers as they did with chalk on a normal chalkboard (Mokoena et al., 2019).

Furthermore, educators had to develop their own lessons as the textbook materials integrated with the board often did not load correctly or were insufficient (Mokoena et al., 2019). Most schools in South Africa are still underprivileged and most of the educators and learners do not enjoy the same ICT opportunities as their more privileged colleagues and peers (Van Jaarsveld & Van der Walt, 2018).

2.9 The advantages of interactive whiteboards

The IWB offers interactive teaching methods as a means for educators to connect learners who are used to external stimulation (Rukljač & Draženović, 2015). This is further supported by Kutluca (2019) who found that the IWB has an encouraging influence on the educators' teaching roles by allowing them to create visual lessons for learners, making abstract content concrete for learners and attracting individual learner's attention (Kutluca, 2019). According to Brečka & Olekšáková (2013) the main advantage of the IWB is that educators' preparation for a lesson is simplified in terms of improved quality of presentations as well the ability to use the internet while connected (Brečka & Olekšáková, 2013). In a different study conducted by Alshaikhi (2017), the findings revealed that educators' attitudes towards the IWB can be seen as generally optimistic due to the benefits offered by the board (Alshaikhi, 2017). According to Alshaikhi (2017) educators display great satisfaction in making lessons more appealing and interesting for learners by colouring and highlighting key information and content when using the IWB.

Bennett & Lockyer (2008) further revealed that the IWB can assist educators in saving time on lesson preparation (Bennett & Lockyer, 2008).The educator can retrieve documents or ready-made lessons from the IWB or directly from the internet to use on multiple occasions (Malkawi et al., 2020). In addition, the educator can explain the subject content by just touching the screen or using a digital pen connected to the board (Bidaki & Mobasheri, 2013). The same lesson can be saved and retrieved again for revision purposes, thus saving the educator teaching time,

but also helping the learner to remember the previous lesson more quickly should educators wish to do a revision lesson (Bidaki & Mobasheri, 2013). Esteves et al. (2015) are of the view that the IWB can inspire educators to change their pedagogy. The more frequently the educator uses the board, the more professional development is encouraged for the educator to incorporate (Esteves et al., 2015).

Educators can also use higher order questioning techniques to test learners' understanding against collective meaning (Rukljač & Draženović, 2015). Tosuntas et al. (2015) revealed that a meaningful contribution made by the IWB to the teaching process is that it allows for the employment of several learning styles for the children and flexibility in the teaching process for the educators, thus decreasing the workload of educators and increasing the participation of the learners (Tosuntas et al., 2015). Furthermore, the motivation levels of learners with learning disabilities are increased as these learners can now learn in different ways from their peers (Essam et al., 2012). Learners who are visually inclined have a chance to see their work projected and receive instant feedback based on the work completed (Essam et al., 2012). Auditory learners can use the multiple software features to interact with the board while tactile learners can use diverse colours to write on the board (Essam et al., 2012). Overall, the IWB provides better opportunities for collaboration and interaction with the whole class compared to other educational ICT (Esteves et al., 2015).

Gashan & Alshumaimeri (2015) propose that the main advantage of the IWB is that learners can better facilitate content knowledge through simulation activities that are shown in a collaborative manner (Gashan & Alshumaimeri, 2015). This allows for a higher level of learner engagement and sharing of knowledge when the learners use interactive games on the IWB (Bennett & Lockyer, 2008). For learners who are timid, the IWB can help them overcome their fear and embarrassment of working at a traditional blackboard as the IWB features make it easier to involve them in the learning process (Akilbekovna, 2021). This finding agrees with Al-Faki & Khamis (2014) who state that with the IWB learners can now see and feel their learning with the use of finger touch. Learners can draw and manipulate a shape and text through the IWB (Al-Faki & Khamis, 2014). Educators can also use higher order questioning techniques to test learners' understanding against collective meaning (Rukljač & Draženović, 2015). According to Kim and Jang (2020) the educator-centred method

to learning can be adjusted using digital technology that offers the means to convert classrooms into learner-centred environments by providing meaningful engagement for learners and educators (Kim & Jang, 2020).

2.10 The disadvantages of interactive whiteboards

Despite the many advantages there are many possible disadvantages to using the IWB; the first disadvantage of the board is its structure. The structure of the IWB can negatively affect the health of learners and educators (Koçak & Gülcü, 2013). In a study completed by Önal (2017), it was discovered that the IWB can negatively affect the eye health of learners and educators because of radiation emission (Önal, 2017). Should educators use the IWB for an extended period, the brightness and reflection from the board can cause headaches for both learners and educators (Önal, 2017). Furthermore, depending on the placement of the IWB it cannot be seen by some learners (Koçak & Gülcü, 2013). Scholars Alparslan and Ve Gcbay (2017) suggest that the main problems in using the IWB are the technical problems such as calibration and shortage of technical staff to help look after the board over a period of time (Alparslan & Ve Gcbay, 2017). It is also noted by Sasman & Prinsloo (2015) that educators lack the technical skills themselves to effectively utilise the IWB in their classrooms (Sasman & Prinsloo, 2015). These problems include the educator using the wrong settings, sudden shutdowns, inferior colour, settings and screen blocking due to viruses (Tosuntas et al., 2015). In a study led by Yapici and Karakoyun (2016) teachers' main complaint was about the lesson time lost while waiting for the board to switch on or turn off (Yapici & Karakoyun, 2016). Having limited to no internet access sometimes prevents educators from using specific features on the board. Furthermore, not all versions of IWB software loaded to the school network can be used by subject specific educators (Collins, 2019). In the South African context, educators need a backup lesson should there be unscheduled loadshedding, leading to no electricity to switch the board on (DeSilva et al., 2016). The IWB requires a large amount of preparation prior to use, as educators must create lesson content before presenting the lesson. For educators who struggle with ICT in general, this can be very time consuming (Gursul & Tozmaz, 2010). Mercer et al.'s (2010) research suggests that educators have external pressures to "get through" the curriculum which means that the IWB may reduce thinking and input time for the learner, thus leading back to the traditional

method of teaching (Mercer et al., 2010). This finding is expanded by Al-Qirim (2016) who implies that educators may use the IWB as a presentation tool by failing to use the various interactive features provided by the board (Al-Qirim, 2016). Furthermore, educators may overload the board with too much content causing learners to suffer from information overload (Brečka & Olekšáková, 2013). This may lead to lack of attention and motivation in learners (Tosuntas et al., 2015).

In a study conducted by Sarıoğlu & Saraby (2017), the findings showed that training programs were insufficient in providing educators with the necessary skills to adapt the IWB into their specific teaching practices (Sarıoğlu & Saraç, 2017). According to Olivares & Castillo (2018), this is because educator training tends to place emphasis on how educators use technology rather than focusing on educator content (Olivares & Castillo, 2018). Transformation in educational practice is dependent on the support and attitudes of educators (Ahmed & Kazmi, 2020). According to findings, despite educators having an IWB available in their classes, they do not use them efficiently (Korkmaz & Cakil, 2013). Most educators stated that they mostly feel the need to use the IWB when they want to share pictures with learners or to make drawings when necessary (Korkmaz & Cakil, 2013). Furthermore Bıçak (2019) argues that because the training given to the educators is theoretical in nature, it does not attract the educator's attention and therefore will not show any interest in implementing skills taught (Bıçak, 2019).

2.11 Theoretical Framework

The theoretical framework can be described as the structure that can support or hold a theory of research in a study (Kivunja, 2018). For successful implementation and use of technology, the user's willingness is a vital factor (Kamal et al., 2020). A choice of an individual to willingly accept recent technology is known as technology acceptance (Kamal et al., 2020). To gauge the acceptance of interactive whiteboards in educators' teaching practice, the Technology Acceptance Model (TAM) was employed for this study (Walker et al., 2019). The TAM was adapted from the theory of reason action by Davis in 1986 (Abdullah et al., 2016). The TAM was specifically made for modelling the acceptance of information systems and information technology (Abdullah et al., 2016). The main objective of the TAM was to track the influence of how external factors effected the beliefs and attitudes of computer users (Abdullah et al., 2016). The technology acceptance model has been

classified as one of the most prevalent research models in predicting the common practice and acceptance of information systems and technology by single users (Surendran, 2012).The technology acceptance model has been thoroughly researched and peer reviewed by different researchers that study individual technology acceptance behaviour in various information system settings (Surendran, 2012). The TAM is a theoretical framework that "models the process of acceptance and the usage of a new technology by a diverse group of people" (Walker et al., 2019, p. 4). In the TAM, "perceived usefulness (PU) and perceived ease of use (PEU) are the basis for understanding the user's attitude, intention and behaviour towards a particular ICT" (Lin, 2013, p. 243). "External variables in the technology acceptance model facilitate the perceived usefulness and perceived ease of use on the user's mind and attitude" (Alharbi, 2014). In addition, the TAM also proposes that the user's attitude concerning ICTs leads to behavioural intention to use it and behavioural intention to use links to actual system use (Dönmez-Turan & Kır, 2019).

The TAM is most appropriate for this study, as an educator's acceptance of the IWB is directly impacted by four important principles: perceived usefulness (PU), perceived ease of use (PEU), external variables and user's attitude (Wong, 2016).

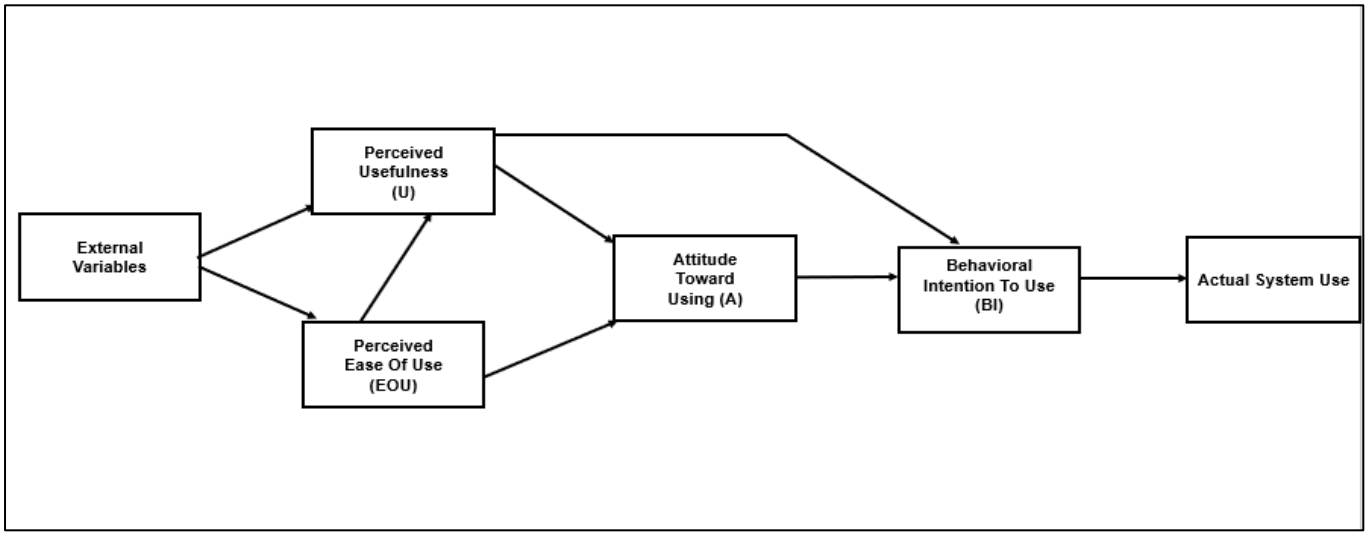

Figure 3: Technology Acceptance Model (TAM) (Davis et al.,1989, p. 985)

2.11.1 External Variables

External variables can be described as a range of variables that are anticipated to motivate the user's technology acceptance behaviour (Holden & Rada, 2011). These individual factors could consist of, but are not limited to the following i.e. prior

age, gender, experience, level of education, playfulness or anxiety of the user (Holden & Rada, 2011). These factors are typically pre-existing before the study takes place (Holden & Rada, 2011). Therefore, the external variables can influence the user's prior usage and experience as well as their confidence in technology (Dumpit & Fernandez, 2017).

2.11.2 Perceived usefulness

A user's perceived usefulness can be described "as the degree to which a person believes that using technology would enhance his or her job performance" (Scherer et al., 2019, p. 15). Understanding an educator's perception of modernization is vital to successful adoption of technology in learning (Teeroovengadum et al., 2017).

Consequently, the extent to which educators use the IWB is dependent on whether they trust that it will improve the quality of teaching and learning activities for themselves and the learners. In addition, educators will use the IWB frequently if they perceive that the IWB is useful and effective in lesson delivery. However, if educators perceive an IWB as useless it will be difficult for them to use this type of ICT in a meaningful way to support teaching and learning (Zhai & Shi, 2020).

Only when educators have a positive sentiment towards IWB they might claim it to be useful (Zhai & Shi, 2020). Therefore, perceived usefulness is considered as a gauge to measure the extent of the educator's acceptance of IWBs (Zhai & Shi, 2020).

2.11.3 Perceived ease of use

An individual's perceived ease of use is the "the degree to which a person believes that using technology would be free of effort" (Scherer et al., 2019, p. 15). A user's perceptions on ease of use is usually centred on the user's abilities, skills, competencies and experience in using the technology (Daryanto et al., 2019). For this study, the educators' perceived ease of use is decided by how stress-free or problematic it is to use an IWB based on their abilities, skills, competencies, and experience. It is also noted that the effectiveness of IWB training will determine the ease of use for educators.

2.11.4 Attitude towards use

Attitude towards use refers "to the way that an individual responds to or ignores an object" (Al-Adwan, Al-Adwan & Smedley, 2013, p. 8). According to Ghamrawi (2013) this is a key factor in determining whether educators would accept ICT as a teaching tool that they would use in their teaching (Ghamrawi, 2013).

To interpret educators' acceptance of the IWB, it is important to consider their attitudes. Should educators feel as though the technology does not enhance their job performance or is not easy to use, the user will resist using the IWB during teaching. Therefore, attitude towards use is directly affected by perceived ease of use and perceived usefulness. The TAM primarily depends on those two aspects to investigate a user's attitude towards technology (Zaineldeen et al., 2020).

2.12 Conclusion

This literature review chapter introduced and discussed Information Communication Technology in education. Aspects such as the status of ICT in the world and South Africa were discussed. Furthermore, the literature review highlighted the use of interactive whiteboards in the world and in South Africa. In addition, the TPACK model as the basis for ICT integration in teaching was discussed. The literature also revealed the advantages and disadvantages of using IWB technology. A detailed explanation was given on how the technology acceptance model underpins the theoretical framework for this study, while focusing on what contributes to educators' acceptance of the IWB.

Chapter 3: Research design and methodology

3.1 Introduction

In chapter two the literature reviewed discussed the technology acceptance model, the status of ICT in the world, the status of ICT in South Africa, the advantages, and disadvantages of IWBs as well as the attitudes of educators towards ICT and the concept of ICT integration. The current study is focused on educators' acceptance of the IWB in their teaching practice. This chapter will briefly discuss the paradigm for this study, and then address the peculiarity between the research design (qualitative method) and the research methodology (case study). Interviews were used to create data. Furthermore, this chapter consists of a description of the sampling, data collection and method for data analysis.

The importance of the research design originates from its postion as a vital connection between the theories and arguments that inform the research and the emprical data collected (Zefeiti & Mohamad, 2015). The research process for this study was directed by the research onion of Saunders & Thornhill (2015). Zefeiti & Mohamad (2015) state that the research design provides direction for collecting and examining data in a study (Zefeiti & Mohamad, 2015).The research onion model is a suitable research methodolgy which can be planned in sequence and thus used as a research approach (Melnikovas, 2018).

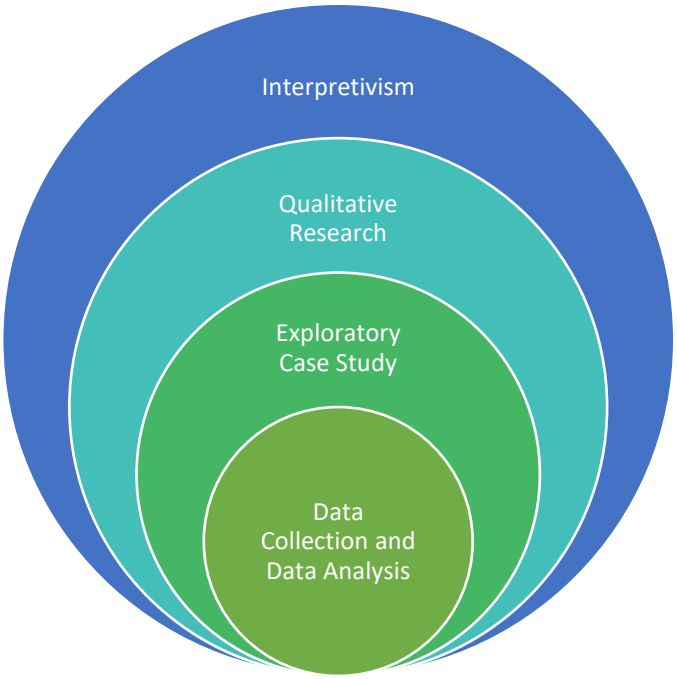

Figure 4: Research onion (Saunders et al., 2015)

3.2 Research Paradigm

A research paradigm can be described as a set of conceptual outlines that explain a particular theoretical approach to research and covers aspects of ontology, epistemology and methodology (Morgan & Sklar, 2019).

3.2.1 Ontology

A research paradigm is defined as a set of conceptual frameworks that explain a particular theoretical approach to research and covers aspects of ontology, epistemology and methodology (Morgan & Sklar, 2019). Ontology can be defined as “a philosophical pattern or view in research; it is the science or study of being and it deals with the nature of reality” (Solomon & Juliet, 2018, p. 2).The basis of ontology is whether social entities need to be recognised as subjective or objective by the researcher (Solomon & Juliet, 2018). This advocates that ontology describes the researcher’s interpretation of the reality studied. As a primary school educator and mentee, I have seen the varying degrees in which intermediate educators accept interactive whiteboards in their teaching practice. Due to this prior insight, it is presupposed that this view is inadequate in constructing a set research design by the researcher due to the difficulty of what is perceived as reality (Solomon & Juliet, 2018). Therefore, the ontological position of this research is subjective in origin.

The subjectivism branch of ontology can be described as social constructivism or interpretivism. The term interpretivism refers to “the approaches which emphasise the meaningful nature of people’s character and participation in both social and cultural life” (Chowdhury, 2014, p. 433). Therefore, interpretivism would suggest that the knowledge is shaped by discovering and interpreting the collective world of the participants and their experiences in accepting interactive whiteboards (Al-Saadi, 2014). The aim of an interpretivist study is to grasp and interpret participants’ meaning and interpretations within their environment (Al-Saadi, 2014). It is noted that researchers can never be entirely detached from their own values and beliefs as these will inevitably appear in which data is collected, interpreted and analysed (Gemma, 2018).

3.2.2 Epistemology

Epistemology is related to the source and different types of knowledge (Scotland, 2012). Epistemology conveys how events can be made known – how truths or facts can be discovered and disclosed (Maree, 2016). Its focus is on the ways of knowing and learning about the social world (Maree, 2016). In qualitative research, the researcher wants to maintain that knowledge should come from a local context and the voice of the participants should be considered (Maree, 2016) which includes considering what they say, do and feel and how they make meaning of phenomena under investigation (Maree, 2016). The importance is consequently positioned on the participants' frame of reference and how they interpret phenomena from within (Maree, 2016). Therefore it is not the researcher who conatuses what is knowledge, but what the participants understand as knowledge based on the ongoing interactions between participant and the researcher (Maree, 2016).The goal of having an interpretivist study was to grasp and interpret the significance of human behaviour and not to predict causes and effects (Solomon & Juliet, 2018).

3.3 Research Methodology

The methodology of a study generally refers to the theoretical justification of the research chosen in a specific field (Hameed, 2020). In this field, qualitative research was the chosen methodology used to acquire knowledge for this study. Qualitative research has been defined as "the investigation of phenomena, typically in an in-depth and holistic fashion, through the collection of rich narrative materials using a flexible research design" (Moser & Korstjens, 2017). Qualitative research is drawn from people's beliefs, experience and meaning systems from the perspective of the participants (Mohajan, 2018). This means that the researcher studies the participants in their natural setting to interpret their phenomena and what brings meaning to them (Aspers & Corte, 2019). The qualitative approach incorporates several significant features. The first is for the researcher to comprehend the experiences that people have (Lin & Kamal, 2019). The second feature requires that the researcher must follow a systematic and careful process that involves identifying the problem, collecting, explaining, interpreting and evaluating the data from participants (Aspers & Corte, 2019). Thirdly, the data is analysed, and the researcher generates explanations in the form of concepts or theories (Lin & Kamal, 2019). Lastly, the researcher delivers a detailed description produced from different sources of data such as documents and interviews (Lin & Kamal, 2019).

For this study, the researcher is curious to discover the factors that contribute to an educator's acceptance of the IWB. Yilmaz (2013) further elaborates that qualitative research provides the researcher with descriptive data which deepens the understanding of individual variation (Yilmaz, 2013). Each participant who participated in this study presented a unique data set influenced by their teaching experiences and perceptions of teaching using the IWB (Abdullah et al., 2016) One of the benefits of qualitative research is that it uses open exploratory research questions which place great emphasis on understanding phenomena, by taking the into-perspective approach rather than some outside perspective which helps heighten the credibility of the research design and data analysis (Maree, 2016). Qualitative research is primarily inductive in a manner whereby data is organised into groups and patterns and are further distinguished amongst those categories (Astalin, 2013). The reason for taking up qualitative research for this study is that the researcher had an opportunity to become a part of the inquiry process. This meant that the methods remained flexible and dependent on the social context. In addition, qualitative research allowed for a participant's context and the finer details to be considered (Astalin, 2013).

3.4 Research design

A research design can be described as the methods for collecting, analysing, interpreting and recording data in research (Boru, 2018). For this research, an exploratory case study was used to explore intermediate phase educators' acceptance of IWBs, considering the challenges faced by educators in accepting and using educational ICT. A case study is a general definition for "the exploration of an individual, group or phenomenon" (Starman, 2013, p. 31). A case study feature can be outlined in two ways. The first feature is that a case study examines a current phenomenon in its complexity and inside its tangible context, especially when the boundaries are not clear (Tomaszewski et al., 2020). For this study, the intention was to investigate the educator's acceptance of interactive whiteboards in everyday teaching practice. The second feature of a case study deals with the full intricacy of a research problem by incorporating numerous sources and different types of evidence (Tomaszewski et al., 2020). In this study, the numerous sources and different types of evidence refers to the resources, challenges, training, benefits, ease of use, usefulness and attitudes experienced by the educators when using the

IWB (Tomaszewski et al., 2020). In addition, the findings relied on several sources of evidence with data needing analysis in a triangulating approach (Ebneyamini & Moghadam, 2018).

The value of a case study is to conduct a thorough investigation of the problem within its context by understanding the matter from the educator's viewpoint (Harrison, et al., 2017).

Therefore, this research wants to understand the educator's acceptance of the IWB which is already installed in their classroom. The purpose of inquiry in this study was exploratory in design. An exploratory case study "is used to explore situations in which the phenomena being evaluated has no clear, single set of outcomes" (Baxter & Jack, 2008, p. 547). An exploratory case study was utilized because the researcher considered that there is inadequate data on the acceptance of interactive whiteboards in intermediate educators' everyday teaching practice. It is important to know if IWBs are being accepted and used in the classroom.

3.5 Research site and participants

A sample can be referred to as the overall number of things or cases which are the focus of the study (Etikan et al., 2016). The two sampling methods mostly used in qualitative studies to collect data are convenience and purposive sampling. Convenience sampling is a sampling procedure which ensures that the specific population meet particular conditions, for example: availability, geographical proximity, or the readiness of the participant to partake in the study (Etikan et al., 2016). Convenience sampling was a favoured sampling technique for this study as participants selected were readily and easily available to the researcher (Taherdoost, 2016). Purposive selection is a non-random sampling technique whereby the investigator chooses the participants based on the knowledge and experience possessed in relation to the study. This technique was used to find and select information-rich cases based on available resources (Etikan et al., 2016). For this study, purposive sampling took place. Two intermediate phase educators from five different primary schools in Johannesburg, Gauteng were invited to partake in this study, thus ten participants in total took part in this study. Each selected participant possessed a unique case influenced by past experiences and perceptions from using the IWB (DeSilva et al., 2016). To ensure that those experiences and realities were used to draw findings, each educator was required

to have an interactive whiteboard in their classroom. Furthermore, the participant must have used the whiteboard for at least a year in their classroom practice. The advantage with purposive sampling is that it provides the richest possible sources of data to answer the research question (Van Niekerk, 2013).

3.6 Data collection strategies

Data collection in qualitative research represents the range of visual or language material for understanding and analysing phenomena in social contexts (Flick, 2018). The collection aspect can refer to the natural occurrence of data based on talking, listening, observing and analysing materials. The collection process allowed the researcher to produce generalised statements by comparing and analysing various cases (Flick, 2018).

3.6.1 Semi-structured interview

Interviews are the primary way to collect data in qualitative research (Adhabi & Adhabi, 2017).To achieve a level of thick description for this research study, the semi-structured interview and lesson plans were used (Maharaj, 2016). The semi-structured interview is a common data collection technique in which the researcher invites the participant to answer a set of prearranged, open-ended questions (Given, 2008). The advantage of using semi-structured interviews for this study is that the implementation of the questions is dependent on how the interviewee responded to the questions asked by the researcher (Adhabi & Adhabi, 2017). This type of interview gives the researcher more control over the points of the interview without there being a fixed range of responses given by the participants (Given, 2008). Therefore, both the participant's verbal and nonverbal information is included in the development of a rich and relevant data set (Given, 2008).

3.6.2 Documents

Documents consist of words and images that have been produced for a purpose other than the research study, without any influence by the researcher (Gross, 2018).Documents both historical and contemporary provide a rich source of information for data collection (Joseph, 2012). The reason for asking participants for their documents is to give them an opportunity to define their own reality. In this study, the site and context from which a document is created has an impact on its content (Grant, 2019). For this study, lesson plans using the IWB from participants were included as part of the data collection process to answer research questions.

The lesson plans allow the researcher to examine how educators' attitudes and experience with the IWB change over time as educators need to adapt their lesson plans to include the IWB. The purpose of providing lessons in addition to the semi-structured interview is to increase the reliability for this study (Sekerci, 2019). Lesson plans were an effective way of examining how educators' attitudes and experience with the IWB change over time as educators need to continue to create or modify their lessons for different subject areas (Gadbois & Haverstock, 2012).

3.6.3 Field notes

Field notes are notes taken by the researcher based on the behaviour and activities of the participant within their environment (Creswell, 2014). Field notes function as evidence of behaviours or observances from participants in the field (Deggs & Hernandez, 2018). For this research, the participants were asked to demonstrate how they would use the IWB in everyday teaching. The aim of making field notes while observing participants is to construct detailed descriptions of the participants' context by requiring the researcher to thoroughly observe the participant in their context and environment (Phillippi & Lauderdale, 2017). Furthermore, field notes serve as a data source which can be triangulated by the researcher (Deggs & Hernandez, 2018).

3.7 Data analysis

Qualitative data analysis can be explained as the "process of bringing order, structure and meaning to the mass of collected data" (Hilal & Alabri, 2013, p. 1). Qualitative data analysis tracks the association between categories and themes of data seeking to strengthen the understanding of the phenomenon (Hilal & Alabri, 2013, p. 1). For this study, the researcher recorded the data according to Clarke and Braun's six-phase framework (Delahunt & Maquire, 2017).The thematic analysis provides the researcher with a flexible approach that can be adapted for the requirements of different studies whilst providing an abundant and detailed multifaceted account of data (Nowell et al., 2017). Nowell et al. (2017) found that Clarke & Braun's six-phase framework could be used extensively across a variety of paradigms and research questions. It is an approach that assists the research in identifying, analysing, organising, describing and recording themes within a data set (Nowell et al., 2017).

Table 1: Braun & Clarke's six-phase framework for doing a thematic analysis (Delahunt & Maguire, 2017)

Step 1: Become familiar with the data	Step 4: Review themes
Step 2: Generate initial codes	Step 5: Define themes
Step 3: Search for themes	Step 6: Write-up

The first phase in Braun & Clarke's six-phase thematic analysis is familiarising the researcher with the data. During this phase, the researcher reads and re-reads the interview transcripts of the participants (Kadir et al., 2020). Depending on the type of study, the data set could include interviews, field notes, documents or recorded observations (Kiger & Varpio, 2020). The purpose of acquainting oneself with the entire data set first, is that gives the researcher valuable insight into the raw data for all consequent steps (Kiger & Varpio, 2020).

The second phase is producing initial codes. During this step, the data is structured in a meaningful and methodical manner (Delahunt & Maguire, 2017). Coding refines the raw data into smaller meaningful sections (Delahunt & Maguire, 2017). With the modernisation in ICT software, electronic techniques of data coding are progressively being used to get consistency when dealing with data (Hilal & Alabri, 2013).Authors Hilal & Alabri (2013) suggest that using a computer ensures that the user works more methodically and thoroughly (Hilal & Alabri, 2013). ATLAS.ti is a software program run on the Microsoft Windows operating system designed with the intention to support the researcher in interpreting and analysing a variety of data sources (Bassett, 2012). The advantages of ATLAS.ti is that it saves researchers the time-consuming process of hand coding (Bassett, 2012). In addition, the researcher has an opportunity to decide how to organise and structure the unstructured data in a systematic way that is aligned to the methodological approach (Paulus, 2018). This study transcribed the data based on the social issues described in the study (Kadir et al., 2020). In addition, the study discussed the interview questions to achieve more methodical ways to produce the code throughout the transcribing process (Kadir et al., 2020). Thereafter, the researcher

developed the codes based on the research perceptions and objectives of the study (Kadir et al., 2020).

The third phase involves searching for themes. The researcher needs to analyse the coded and collected data to look for potential themes of border importance (Kiger & Varpio, 2020). This includes identifying the areas of similarity and overlapping between codes (Kadir et al., 2020). Significant themes give meaningful associations between data findings whilst answering crucial aspects of research questions (Kiger & Varpio, 2020).

The fourth phase includes reviewing and refining potential themes. The researcher returns to the raw data and uses the comparison method to ensure that the developed themes are based on the data (Xu & Zammit, 2020). This is to ensure that the data within the themes are significantly related to each other, and the themes should be explicit and expelled differentially (Javadi & Zarea, 2016).

Refining and reviewing themes allows for phase five, where the researcher needs to reach the essence of each theme by defining and refining the theme (Javadi & Zarea, 2016). The researcher can pinpoint the most important facet of each theme and which aspects the data set includes, thus creating a logical description of the unique insights and understanding of the larger questions (Kiger & Varpio, 2020).

Phase six is the final step which involves the write-up, the last evaluation and the description of findings (Kiger & Varpio, 2020). The researcher will compare the findings to existing literature. This is the final step of the analysis for the researcher to sum up the findings acquired from the analysis of the thematic by producing a description (Kadir et al., 2020). The purpose of the description is to provide compelling data for the study.

By using the thematic analysis method, the researcher was able to develop a rich description of the data set (Braun & Clarke, 2006). However, the trustworthiness of the research depends on the evidence that the researcher did not participate in the scenes of action (Xerri, 2018). Therefore it is imperative for the researcher to acknowledge their own theoretical positions and beliefs in relation to the study (Braun & Clarke, 2006). Reflexivity is the process whereby the researcher acknowledges, examines, and understands how their values and beliefs affect their research practice (Palaganas et al., 2017). For this study, the researcher remained

attentive when analysing the data to make sure that the researcher's values and bias did not compromise the data provided by the participants.

3.8 Methodological norms

As a teacher-researcher, it was imperative to produce a study that was fair and closely aligned with the experiences of the study's participants (Xerri, 2018). Therefore, the study's trustworthiness is based on four main criteria: credibility, transferability, dependability, and confirmability (Xerri, 2018).

Credibility can be defined as "whether the research findings represent reasonable information drawn from the participants' original data and is a correct interpretation of the participants' unique viewpoints" (Moser & Korstjens, 2018, p. 121). Credibility ensures that the research findings represent credible data drawn from the participants' initial raw data and is the exact understanding of the participants' original views (Anney, 2014). To ensure that this research is credible, participants were asked to verify the data gathered during earlier interviews to confirm whether the interpretations shared were correctly interpreted (Maree, 2016).

Transferability refers to "the extent to which the findings can be transferred to other settings or groups" (Elo et al., 2014, p. 6). To increase the transferability of the study, thick description was used. Thick description allowed the researcher to provide the reader with a full and purposeful account of the context, participants, and research designs in such a way that the reader can draw their own conclusions about transferability within this study.

Confirmability is "whether the analyses of the data was coherent and whether the interpretations based on the data were fair" (Haven & Grootel, 2019, p. 238). Confirmability is "concerned with establishing that data and interpretations of the findings are not figments of the inquirer's imagination but derived from the data" (Moser & Korstjens, 2018, p.122). As part of the confirmability for this research, an audit trail was maintained to allow any reader to trace the source of the research step-by-step through the decisions made and methods described (Maree, 2016).

Dependability establishes "that the study followed a rigorous and systematic approach by demonstrating a coherent link between the findings and the methods and methodology" (Hanson et al., 2017). To ensure the dependability of this study, the use of ATLAS.ti for coding ensured that there is an audit trail for documentation

of the research process. Furthermore, the researcher sent the research findings back to participants for authentication.

Triangulation is described in the literature as “an approach where the researcher uses either multiple methods, several theories or different data sources in order to strengthen the study’s credibility” (Jentoft & Olsen, 2017, p. 181). For this study, the methodological triangulation method was used. This allowed the researcher to triangulate data from interviews and lesson plans.

3.9 Ethical Considerations

The protection of people through the application of appropriate ethical principles is important for any research study (Arifin, 2018). Case study research presents the researcher with a unique set of ethical concerns due to the comprehensive nature of the study method (Arifin, 2018).

3.9.1 Informed Consent and Voluntary Participation

Before the researcher started with the data collection process, consent from the Gauteng Department of Education was obtained. In addition, ethical clearance from the University of Pretoria was secured for the researcher to proceed with this study. As part of the ethical considerations, the principals and educators were fully informed of the questions, and how the data and the findings would be used. Participants were adequately informed about the research and were provided with a consent letter stating their rights to access their information as well as the right to withdraw at any point from the research should they wish to do so.

3.9.2 Confidentiality

Participant confidentiality means the participant’s identity is known to the researcher, but the data was de-identified to keep the participant’s identity confidential (Fleming & Zegwaard, 2018). Considering that semi-structured interviews were used as part of the data collection process, participants’ confidentiality was protected by not revealing their names and identities during data analysis and the findings. Instead of using participants’ names, the researcher used pseudonyms with the word “participant” with an allocated number to refer to participants in this study.

3.10 Conclusion

In this chapter, the research design and methodology, the ontological position and epistemology of this study were discussed with a focus on what contributes to intermediate educators' acceptance of interactive whiteboards in their teaching practice. This was followed by the procedure used to acquire the knowledge in study, namely qualitative research. Furthermore, the sample, data collection strategies and data analysis were described according to the qualitative approach. The methodological norms and how they would be ensured in this study, were each described. Finally, the ethical considerations based on the University of Pretoria's ethical considerations were briefly mentioned.

Chapter 4: Data analysis and findings

4.1 Introduction

The purpose of chapter four is to analyse the documents and discuss the data gathered from participants. The procedure that was described in chapter three was used to analyse and interpret the data. Participants' data was imported to ATLAS.ti and was coded according to themes and sub-themes using the thematic analysis method. In this chapter, the research findings are provided with discussions in relation to the literature review and theoretical framework.

Table 2: Links between the research and interview questions

Research questions	**Interview questions**
Which resources are needed to assist educators when using interactive whiteboards?	Do you use other technology in the class? If so, what technology?
What challenges do educators face when using interactive whiteboards?	What are the biggest challenges that you experience when using the IWB?
What benefits do educators experience when using interactive whiteboards?	How useful do you find the IWB? Explain why. What benefits do you experience when using an IWB?
What training did educators receive on interactive whiteboard usage and how effective was the training?	Have you received training in using the IWB? What training? Was the training adequate or not?
How easy or useful is it for teachers to use interactive whiteboards?	How easy or difficult is it for you to use your IWB? Explain why. How has your lesson planning changed since the use of the IWB? How do you use the IWB in your class? For which activities?
What are the attitudes of educators when using the interactive whiteboard?	What are your attitudes towards using an IWB? How do the learners feel about using the IWB? Their attitudes? Which factors will influence you to use / not use the IWB?
What support do teachers using IWBs receive from the school management?	Have you received training in using the IWB? What training? Was the training adequate or not?

Table 3: Alignment of themes and sub themes to the researchers' primary and sub-research questions

Research Questions	**Themes and sub-themes**
What are the biggest challenges that you experience when using the IWB?	Theme 1: Challenges educators experience when using the IWB Sub-themes : ▪ Load shedding ▪ Technical problems ▪ Appropriate content
How useful do you find the IWB? Explain why. What benefits do you experience when using an IWB?	Theme 2: Benefits and usefulness educators find in using the IWB Sub themes: ▪ Interactive classrooms ▪ Recycle notes ▪ Health benefits ▪ IWB usefulness
Have you received training in using the IWB? What training? Was the training adequate or not? What support do teachers using IWBs receive from the school management?	Theme 3: Training received by educators Sub-themes: ▪ IWB training ▪ Support received from the school management team
How easy or difficult is it for you to use your IWB? Explain why.	Theme 4: IWB ease of use
Which factors will influence you to use / not use the IWB?	Theme 5: Factors influencing IWB usage
How do you use the IWB in your class? For which activities? How has your lesson planning changed since the use of the IWB?	Theme 6: Lesson planning and activities Sub-themes: ▪ IWB activities ▪ Learners using the IWB
What are the attitudes of educators when using the interactive whiteboard?	Theme 7: Educators' and learners' attitudes towards the IWB Sub-themes: ▪ Educators' attitudes towards the IWB ▪ Learners' attitudes towards the IWB

4.2 Participants' background information

Table 4 gives the personal history of the participants in this study. As part of the data collection process, two intermediate phase educators were selected from five different quantile five primary schools to partake in this study: thus ten participants in total. The participants were labelled from numbers one to ten with their ages ranging between 26 and 56 years of age.

Table 4: Participants background information

Background				
Participant	***Age***	***Grades Taught***	***Experience in the teaching profession***	***Experience in using the IWB***
1	32	6 & 7	9 years	4 years
2	56	6	34 years	10 years
3	28	4 & 6	3 years	1 year
4	54	6	32 years	10 years
5	49	4 & 5	24 years	2 years
6	44	5	23 years	3 years
7	26	6 & 7	4 years	1 year
8	27	4 & 7	5 years	4 years
9	59	4 & 7	38 years	6 years
10	32	4 & 5	4 years	2 years

As seen in the table above, each participant presented a unique data set influenced by their teaching experiences and insight of teaching using the IWB (DeSilva et al., 2016).The participants' teaching experience using the IWB vary between 1 to 10 years.

4.3 Data Analysis

The data set for this study was analysed using Clarke & Braun's six-phase framework. This framework assisted the researcher in identifying, analysing, organising, describing and recording themes from the semi-structured interviews (Nowell et al., 2017). The themes and sub themes to the researcher's primary and sub-research questions.

4.3.1 Semi- structured interviews

4.3.1.1 Theme 1: Resources needed to use the IWB

The IWB is an accumulation of previous educational ICTs such as the blackboard, TV, overhead projector, CD player and PC with the bonus of being interactive (Wang et al., 2018). All participants that were selected came from quantile 5 primary schools and IWBs were already installed in their classrooms. Educators were asked if they used additional technology in the classroom. The resources mentioned below were used in conjunction with the IWB.

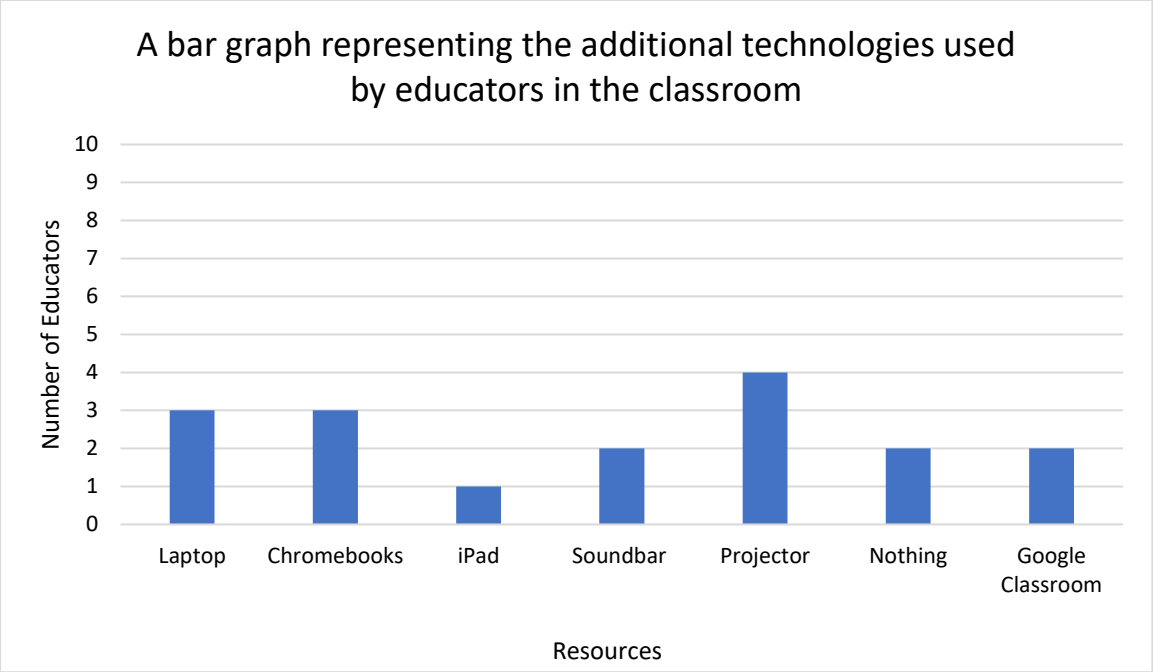

Figure 5: Resources used by educators

While all government schools receive some funding and support, communities around these schools generally contribute extra finances to acquire and maintain educational ICTs. These types of schools' educational environments stand out from schools that have fewer accessible resources (Han & Okatan, 2016).

4.3.1.2 Theme 2: Challenges educators experience when using the IWB

To understand what contributes to an educator's acceptance of the IWB, the study had to investigate what challenges educators experience when using the IWB. Most participants mentioned that load shedding was the main challenge experienced when using the IWB. This was closely followed by IWB calibration issues,

connectivity issues, lack of maintenance and finding appropriate content for learners.

a) Sub-theme: Load shedding

Despite all the participants coming from affluent primary schools with numerous ICT resources, the findings showed that during times of load shedding or power cuts, the IWB was rendered useless. Educators mentioned having to improvise last minute lessons or rewrite work from the laptop directly onto the whiteboard if no backup lessons were prepared in an event where the board could not be used. Participants responded as follows to the load shedding issue.

Participant 6: "Load shedding causes issues as it can't be utilized."

Participant 1: "Electricity problems and then need to rewrite work that is prepared on the computer."

Participant 3: "It can be a challenge when there are power cuts or outages when least expected and suddenly your lesson can't go has planned; forcing one to improvise."

Due to these unpredictable situations, participants do not necessarily have the backup lesson when the whiteboard cannot be used. Participants need to improvise lessons should this happen. De Silva et al. (2016) are of the opinion that in the event of external factors such as unscheduled load shedding, educators need to have a backup plan for their lessons should they not have access to electricity to switch the board on. Olelewe & Okwo (2017) suggest that educators start to develop feelings of incompetence when there is no electricity to use IWBs for teaching activities - especially when a lesson must change instantly.

b) Sub-theme: Technical problems

In conjunction with the load shedding challenges mentioned by participants, technical problems such as connectivity issues and IWB calibration were the next biggest challenges when it came to using the IWB. It is noted that in most cases despite the technical problems, participants did not stop using the board, only in the event of load shedding. The participants listed several technical problems when using the IWB:

Participant 10: "Challenges like load shedding, Wi-Fi connections, constant software updates, keeping up with new systems, hardware problems."

Participant 9: "IWB calibration. Load shedding. Slow Wi-Fi. Outdated laptops."

These problems are regarded as the biggest issues in IWB classes.

Technical skills are required for the functioning of the board, which can become a burden for educators who are not proficient in dealing with ICTs and would prefer to avoid it (Malkawi et al., 2020). Alparslan & Ve Gcbay (2017) agree that one of the main concerns in using the IWB are the technical problems such as calibration. Alparslan & Ve Gcbay (2017) also acknowledge the need for qualified technical staff to help educators look after the board over a period. Mokoena et al. (2019) are also in agreement that one of the many difficulties faced by educators in using the IWB is the lack of internet connectivity, which can occur during power outages or when there is bad weather. The authors suggest that these challenges often become the cause of educator frustrations (Mokoena et al., 2019).

c) Sub-theme: Appropriate content

Before educators have a chance to use the IWB, it is important that they find content that is age-appropriate and relevant to the curriculum. This can be very time-consuming for educators who are not yet accustomed to technological resources used in the classroom. Participants mentioned that lesson preparation and finding resources can be challenging. This is reflected by the quotations below:

Participant 1: "I would say the preparation of lessons and finding relevant and appropriate lesson content remain the biggest challenge."

Participant 3: "It means planning has to be done in more detail."

Participant 9: "Skilled staff are more excited/motivated to use the IWB."

From the above quotations, it seems that participants need additional time to plan their lessons compared to traditional teaching methods. Participants must sift through a lot of content on the web to locate appropriate content for their classes. This requires participants having to plan lessons in detail, with more skilled participants feeling more inclined to use the IWB. The participants' views are supported by Young et al. (2017), who suggest that educators using a traditional board cannot rapidly change and form new content the moment a new ICT becomes

available in the classroom (Young et al., 2017). The IWB requires a large amount of preparation prior to use, as educators must create lesson content before presenting the lesson. Creating resources to use in the lesson takes a vast amount of time and effort (Firmin & Genesi, 2013). Gursul & Tozmaz (2010) propose that for educators who struggle with ICT in general, this can be a very time-consuming and stressful practice.

4.3.1.3 Theme 3: Benefits and usefulness educators find in using the IWB

To determine what contributes to educators' acceptance of interactive whiteboards in their teaching practice, educators' perceptions on how useful the board is needs to be uncovered. The extent to which educators use the IWB is dependent on whether they believe that it will enrich teaching and learning activities. In addition, educators will use the IWB frequently if they perceive that the IWB is useful and effective in lesson delivery. Based on the data analysis, the following sub-themes emerged: interactive classrooms, recycled notes, health benefits and IWB usefulness.

a) Sub-theme: Interactive classrooms

Most of the participants mentioned that the benefit of using the IWB is the ability to create interactive lessons. The participants mentioned the following benefits of using the IWB in their everyday practice:

Participant 1: "It creates a more interactive and inclusive classroom that leads to equal academic opportunities for all the learners present. It also makes the coverage and presentation of certain subjects and topics a lot easier to explain and provides learners with in-depth content coverage."

Participant 9: "More interactive teaching. Your markers do not run out. No dust accumulation."

Participant 7: "Learners have a better understanding of what I am trying to explain."

Participant 5: "Interactive teaching. Incorporating games from the net to make lessons fun."

Interactive whiteboards can have numerous encouraging effects on learning and teaching overall (Lai, 2019). In this study, the findings suggest that the participants find that the benefits and the usefulness of the IWB outweigh the challenges experienced when using the IWB. Participants mentioned that the IWB made the classroom more inclusive by creating interactive teaching and learning. Unlike the

traditional board where participants use direct instruction, learners can now better understand concepts using games and illustrations with the benefit of saving work for the next class, or for learners who were absent. Participants' views are supported by Gashan & Alshumaimeri (2015) who suggest that educators can better facilitate content knowledge through simulation activities that are exhibited in a collaborative manner.

This allows for a higher level of learner engagement and sharing of knowledge when the learners use interactive games on the IWB (Bennett & Lockyer, 2008). Kaya and Yazia's (2018) statement further support participants' views that the use of IWB in education assists educators in prioritizing learners according to their individual learning styles (Kaya & Yazici, 2018).

Participant 6: "It's more illustrative and assists a lot when trying to explain angles and other concepts."

The benefit of using IWBs in Mathematics is important with regard to increasing a learner's attention span and making it easier for learners to grasp and understand geometry in Mathematics (Tunaboylu & Demir, 2017).

b) Sub-theme: Recycle notes

One of the added benefits that the IWB can offer participants that a traditional chalkboard cannot is the ability to save, edit and reuse electronic presentations and notes. Participants responded as follows:

Participant 2: "While preparing work, you are keeping it electronic which means it can be reused. Less paper needs to be printed on. If children are absent, I can go back and show them what was done while not in attendance."

Participant 4: "Save core notes to use for next class/es."

Although lesson planning is initially time consuming when using the IWB, participants can save time during the actual lesson by reusing it for several classes. Furthermore, participants do not have to waste time on preparing and printing worksheets for learners when everything can be projected through the board. With the option of saving notes and presentations for learners, participants can make minor adjustments to content without having to rewrite work on a traditional chalk board. Once content has been erased from the chalkboard, it cannot be recovered

and educators will have to write out the work again if they need it (Muttappallymyalil et al., 2016).These findings agree with Wang, et al., (2018) who elaborate that the IWB enables educators to save and print what is projected on the board (Wang, Dostál, & Bučková, 2018).

This includes additional notes made during the lesson with the benefit of reducing duplication of notes for the next class. Kaya and Yazici (2018) said the IWB also makes it feasible to revisit topics taught whenever it is necessary. The benefit of this feature allows participants to quickly arrange material for learners to catch-up. Participant 8 emphasised that teaching is more interactive which means less time is spent explaining work on a chalkboard (Kaya & Yazici, 2018).This is supported by Alshaikhi (2017), suggesting that educators display satisfaction in making lessons more appealing and interesting for learners, by colouring and highlighting key information and content whilst using the IWB (Alshaikhi, 2017).

c) Sub-theme: Health benefits

Participants prefer the health and convenience of the IWB over the many disadvantages of the traditional chalkboard. Chalk dust from traditional blackboards is known for creating respiratory conditions for any educator with asthma (Callanan, 2014). The IWB is easy to clean with a dry cloth and cleaning alcohol.

Participant 8: "No dust accumulation."

Participant 2: "I will always use the IWB before a chalkboard as I don't like the feel of the chalk or the dust."

d) Sub-theme: IWB usefulness

All participants mentioned finding the IWB extremely useful in the classroom. Participants mentioned covering content in less time and in innovative ways. Less time is spent writing on the board, giving the participants more time to see if learners grasped concepts. Participants revealed the following:

Participant 1: "Extremely useful. The use of the IWB enables us as teachers to teach and cover content in ways that have not been possible in the last ten years; it also allows teachers and learners to actively use the internet at any given time."

Participant 8: "Extremely useful. It takes less time to conduct lessons and do corrections when using the IWB. There is no need to erase previous work and there is no limited 'space'."

Participant 5: "I personally find it a very useful tool to have in the classroom as it allows for a lot of creativity and keeps the learners enthusiastic about the lesson."

Participant 10: "Very useful. Promotes interactive learning, creates more interest in the learners."

Participant 6: "It's quite useful as I explained before, it's illustrative and caters for visual learning as well."

The numerous features on the board allow for engaging and meaningful learning on various curriculum topics (Bakadam & Asiri, 2012). Based on the participants' responses, the IWB has become an extremely useful teaching tool. The reason for this is that participants can deliver lessons in creative and fun ways whilst covering curriculum content. Participants enjoy the visual features of the board and the chance to connect to the internet during the lesson. Participants reiterated the fact that content could be easily saved and reused at a later stage. The IWB can provide an endless list of advantages like original material (Majzlík, 2010).

This is further supported by Brečka & Olekšáková, (2013), who suggest that one of the IWB's advantages is that educators' preparation for a lesson is simplified in terms of improved quality of presentations as well the ability to use the internet while connected to the board (Brečka & Olekšáková, 2013). Bennett and Lockyer (2008), who state that the IWB saves time on lesson preparation, because the time it takes to rewrite and erase instructions and information from a traditional board is eliminated by having a prepared lesson uploaded and ready to use, is substantiated by the above quotations (Bennett & Lockyer, 2008). The IWB keeps learners interested and motivated whilst enabling educators to improve their teaching practices (Lefebvre et al., 2016).

4.3.1.4 Theme 4: Training received by educators

Training gives the user an opportunity to feel involved in the application process and an understanding on how the system can be used for their benefit (Sitthidah & St-Maurice, 2016). The purpose of training is to either upgrade existing knowledge and

skill sets or to build new ones (Sitthidah & St-Maurice, 2016). The findings from this study indicated that eight of the participants received training from the IWB companies and in one case, a participant received training from the GDE. Two participants mentioned they did not receive any training at all. Most of the participants who mentioned receiving training said the training provided at the time was mostly inadequate.

Participant 1: "I attended a course presented by the company that installed the school's IWBs and the GDE. The training was moderately adequate, I gained more knowledge form using the IWB myself."

Participant 2: "Yes, we have received with the company whose boards we use. There is always space for a refresher as you cannot always apply everything in the beginning as it can be overwhelming."

Participant 4: "Initially- before I had a chance to use it, so it made little sense."

Participant 6: "Yes, not adequate."

Participant 5: "Was offered but time is never adequate to master the skill of using the board to the fullest."

Based on the findings, most of the participants received training on how to use the basic functions of IWB from the companies that installed them. The findings further revealed that participants would have liked to have ongoing training to effectively use the IWB to its full potential. For first time users of the board, the training made little sense until participants used the board during classroom practice. Zang (2018) states that even though educators have been accustomed to using IWBs for several years, continuous professional training is still necessary, mostly in new IWB features to encourage the educators' classroom use (Zang, 2018). Furthermore, Sitthidah & St-Maurice (2016) proposes that although institutions provide training to staff, the impact of training on their investment is unknown or not transferred.

a) *Sub-theme: Support received from the school management team*

Participants were asked about the support received from school management teams concerning using the IWB. Participants mentioned that the school management teams offered support in using the IWB by way of encouragement, training and new ideas. Participants mentioned the following:

Participant 2: "Full support is given to the teachers. Encouragement and training are provided."

Participant 6: "Some do not use it. However, as a SMT member myself, I provide support to my team."

Participant 3: "They ensure that we have the necessary equipment to operate the IWB to the best of our abilities."

Participant 7: "They are always open to new ideas."

However, some participants mentioned receiving hardly any support from the school management teams.

Participant 9: "Not a lot. If the SMT could be more supportive, the whole IWB system would improve a lot. School has internal training and support as far as we can."

School management teams do not have a clear vision concerning IWBs and how they should be used in schools (Al-Faki & Khamis, 2014). School management teams initially provide once-off training in using the IWB to staff members (Al-Faki & Khamis, 2014).

Participant 4: "Training on some programmes they have subscribed to."

In participant 8's case, no training was received. Chimbo and Vadachalam (2017) recommend that a detailed training programme should be tailored and executed for each staff member making certain that the educators are skilful in using ICTs to teach learners (Chimbo & Vadachalam, 2017).

4.3.1.5 Theme 5: IWB ease of use

For this study, the participants' perceived ease of use is decided by how stress-free or difficult it is to use an IWB. It is also noted that the effectiveness of IWB training will determine the ease of use for educators. Similarly, Prinsloo and Sasman (2015) argue that educators who receive insufficient training will not be confident in the use of the board. All participants in this study said that using the board was easy. The participants responded as follows:

Participant 3: "Very basic and easy to use."

Participant 6: "It is quite easy. Not difficult at all. However, I'm interested in use of technology. Thus, I play around with it and learn more."

Participant 7: "It is easy because I wanted to learn how to use it."

Participant 1: "Extremely easy, because I have been using technology in all forms in all my subjects over the years and I have attended courses for the use of the IWB."

According to the findings, participants mentioned that using the IWB was very easy for them. It appears that participants' willingness to use the board created an intention to use it more effectively. The findings revealed that participants gained further experience in using the board by being willing to learn how to use it as individuals. The full potential of the board should be discovered and utilised by the educator (İpek & Sözcü, 2016). The educator should adapt and use this tool according to their needs in the classroom, thus making good use of the opportunities presented by the IWB classroom (İpek & Sözcü, 2016).

4.3.1.6 Theme 6: Factors that influence IWB usage

The perceived usefulness and ease of use of ICTs is influenced by the external variables. Furthermore, external variables can influence the user's prior usage and experience as well as their confidence in technology (Dumpit & Fernandez, 2017). When asked which factors influence participants to use the IWB, participants articulated mixed responses. One participant mentioned that they need more time to get through the curriculum, while two of the ten participants mentioned that the IWB is a great tool for subject content. Participant 3 mentioned that learners' positive responses to the IWB encouraged them to use it more often in the classroom. Participants responded as follows:

Participant 3: "The way the learners respond to these lessons definitely contributes."

Participant 1: "Certain subjects allow for excellent use of the IWB."

Participant 9: "Easy to use, motivated to find new information about a subject."

Participant 5: "Time management to get through the syllabus."

Akkoyunlu & Semra (2013) assert that if educators used the IWB in the correct way, learners would develop a deeper interaction with the subject (Akkoyunlu & Semra, 2013).

This is in agreement with Han & Okatan (2016) who state that as the number of hours of the IWB used in class increases, learners' appreciation of the IWB increases (Han & Okatan, 2016). IWBs offer many learning opportunities for children. The learning process through the IWB becomes easy, exciting, and understandable for learners thus creating an optimistic attitude in learners (Han & Okatan, 2016). Maheswaran and Jeyanthi (2013) agree with participants' views that educators who are keen to use the IWB will tend to embrace its usage and explore the prospects that it brings into the classroom (Maheswari & Jeyanthi, 2013).

Despite there being positive factors, which influence participants in using the IWB, participants also mentioned factors that will influence them not to use the IWB. Most participants mentioned load shedding as the main factor for not using the IWB.

Participant 3: "The only time I won't use it is if I am unable to due to a power outage which has been the case a few times."

Participant 7: "Loadshedding because we have to go back to basics."

Researchers Yalman & Basaran (2020) suggest that any technical issue will ruin the flow of the lesson and power cuts result in an undesirable influence on an educator's classroom management (Yalman & Basaran, 2020).With the amount of time wasted for the IWB to get ready to use after a power cut, this can lead to learners getting distracted.

4.3.1.7 Theme 7: Lesson planning and activities

Lesson planning can be effective in examining how educators' attitudes and experiences with the IWB change over time. This includes looking at how educators continually develop or modify their IWB lessons for subject areas (Gadbois & Haverstock, 2012). Participants mentioned that since using the IWB, lesson planning has changed in many aspects, mainly that teaching and learning is now learner-centred, with lessons catering for different learning styles. Participants mentioned the following about lesson planning:

Participant 2: "It changes all the time. The more I learn, the more I use it and thus the more I change my prep and the use of the board."

Participant 9: "Saving time, find better/correct information, speeds up a lesson, immediate related information concerning content, different topics."

Participant 8: "Lessons have become way more interactive and can cater to various learning styles."

Participant 5: "Drastically able to move away from lecture method to interactive learning."

Based on the above findings, educator lesson planning has changed considerably since the introduction of the IWB. The more participants use the board, the more lesson planning must be adapted. It appears that participants' lessons have become more interactive, catering for a wider range of learning styles in the classroom. Most participants have also mentioned moving away from direct instruction as a method of teaching to interactive learning. As mentioned previously, participants find the pace of the lesson moving more quickly.

Alghamdi and Higgins (2015) suggest that although educators may take longer to plan and organise their lessons using the IWBs, the positive effects increase educators' motivation and focus to introduce different learning methods using multimedia resources (Alghamdi & Higgins, 2015). The IWB reduces time wasted on transitions and the overall time on delivering teaching instructions (Young & Hamilton, 2017). The board offers educators the freedom to switch between new and old examples because the content is pre-loaded on the laptop to be projected onto the board (Young & Hamilton, 2017). Educators find that using the IWB can quicken the tempo of the lesson, making lessons more exciting and interesting for learners.

Furthermore, the IWB's interactive style motivates learners to learn (Chen & Tsa, 2013). Mohamed et al. (2019) agree with participants that IWBs assist educators in arranging their classrooms in ways that address the needs of the learners with different learning styles for example: kinaesthetic, visual and auditory (Mohamed et al., 2019). Learners are now able share and describe their work through interaction. The use of the IWB encourages collaboration and interaction (Mohamed et al., 2019).

a) IWB activities

Educators' duties not only include what they do in the classroom when learners are present, but also the preparation in their lesson plans and learning activities that

include the IWB (Lefebvre et al., 2016). The findings indicated that educators mostly use the board in subjects such as Mathematics, Technology and Language.

Participant 1: "I use the IWB mostly in Technology for drawing sketches and the presenting of videos and academic content."

Participant 9: "Languages for reading/comprehension."

According to Hoa & Trang (2020) one educational ICT that can enhance educators' teaching quality and learners' achievement in language is the IWB. The IWB can facilitate learners' vocabulary through noticing, retrieval and creativity (Hoa & Trang, 2020).

It would be effective for educators to design interactive vocabulary activities serving as the lesson's threads (Hoa & Trang, 2020). Participant 6 mentioned using the IWB for Mathematics activities:

Participant 6: "Maths, angles, shapes, area, perimeter, measurements, 3D shapes, NS pictures, animal anatomy etc."

Kutluca et al., (2019) argue that learners usually have difficulty in understanding Mathematics because of how abstract the subject is. The use of the IWB encourages a strong association between knowledge and practice, particularly in Mathematics (Kutluca et al., 2019). Learners can experiment, envision and test mathematical concepts using the board. The IWB enhances Mathematic lessons by allowing the educator to use different resources to answer questions (Young & Hamilton, 2017).

b) Learners' use of the IWB

Participants were asked if learners could use the IWB as part of the lesson. The findings showed a mixed response from participants. Some participants allowed learners to use the board when presenting their own work, completing activity examples or for research. However, some participants felt that learners could damage the board. Participants mentioned the following:

Participant 8: "If they are presenting their own work. When they do a presentation and require media."

Participant 10: "Research, virtual images."

Participant 2: "If there is a drag and drop activity. Completing Maths problems when time permits, for corrections."

Hendawi and Nosair (2020) mention that the IWB has many ways to enrich learners' learning experience. The use of IWB technology provides learners with additional support in content knowledge and skills using optical features (Hendawi & Nosair, 2020).

The IWB reduces the weighty responsibility of the educator and gives learners a chance to practise using the IWB themselves (Hasan & Ibraheem, 2018). Lee and Jen (2015) suggest that learners should become passionate in the IWB learning process by actively seeking out knowledge instead of being spectators (Lee & Jen, 2015). Learners relish interacting with the board by manoeuvring texts and images, therefore providing more opportunities for interaction and discussion (Hasan & Ibraheem, 2018).

However, despite the positives mentioned in allowing learners to use the IWB, there are participants who do not allow learners to use the IWB at all. Participants mentioned the following:

Participant 6: "It's difficult to allow all learners to use it, however learners experiencing difficulties with angles they can come to the board to see how the measurements actually take place."

Participant 1: "The learners are not allowed to use the IWB."

Participant 3: "Personally I don't allow learners to use it themselves as they could damage or break something, but they do get to watch interesting and fun educational videos and explanations etc."

Participant 9: "Learners do not use our IWB."

Al-Faki and Khamis (2014) argue that educators need to shift from the old view where the educator's role is to transmit knowledge to a new view where learners gain knowledge (Al-Faki & Khamis, 2014). Gursoy and Celikozb (2017) further elaborated that traditional teaching methods tend to create submissive students, which leads to rote learning and boredom (Gursoy & Celikozb, 2017). Al-Rabaani (2018) suggest that educators could still be in the habit of traditional chalk and talk

despite having IWB in their classrooms, hence learners are not allowed to use the board (Al-Rabaani, 2018). However, Tombak (2019) argues that learners could damage the board or calibration setting if they use the board outside of its intended purpose (Tombak, 2019).

4.3.1.8 Theme 8: Learners' and educators' attitudes towards the IWB

To interpret educators' acceptance of the IWB, it is important to note the users' attitudes. Should educators feel as though the technology does not enhance their job performance or is not easy to use, the user will resist using the IWB during teaching. Therefore, perceived usefulness affects a user's perceived ease of use and attitude towards using technology (Al-Adwan et al., 2013). Based on the findings, all participants' attitudes towards the board can be described as optimistic. Participants felt that the board is a great tool for educators and learners that allow a variety of teaching and learning opportunities. Participants mentioned the following:

Participant 3: "I am all for using the IWB."

Participant 9: "Curious for learning."

Participant 8: "IWB is a great tool for teachers and learners alike."

Participant 2: "Very positive, as it provides endless learning opportunities."

Participant 6: "Interested, keen, excited."

From the above findings, participants generally have a positive attitude towards using the IWB. The participants feel at ease with the board and excited when it comes to using the features for teaching and learning. Participants believe the IWB is a useful tool for educators and learners. Participants' views are reflected in a statement made by Alshaikhi (2017): "Educators' attitudes towards IWB are generally optimistic because of the many benefits offered by the board". Gashan & Alshumaimeri (2015) mention the reason why educators display a favourable attitude towards IWB technology, is because learners are better engaged in the lesson and find that educators' lessons with IWB are more stimulating than traditional methods of teaching (Gashan & Alshumaimeri, 2015). Furthermore, authors Gursoy and Celikozb (2017) suggest that lessons where the IWB is used

have become stimulating and enjoyable for both learners and educators (Gursoy & Celikozb, 2017).

a) Learners' attitudes towards the IWB

A major factor in determining what contributes to educators' acceptance of interactive whiteboards in teaching practice are the learners' attitudes towards the IWB. All participants mentioned that learners' overall attitudes towards the boards are generally positive. Participants mentioned the following reasons:

Participant 6: "They are also keen and interested and like to engage when discussions take place. Visual learning caters for those learners that absorb more by using this tech."

Participant 2: "They are also enjoying it, especially with the ability to use the Chromebooks during certain lessons."

Participant 4: "Generally, enjoy especially with colour, sound, movement or interactive activities."

Participant 3: "They absolutely love it."

Participant 5: "Love being involved in especially games and competitions."

Participant 10: "More interactive. They relate more. Generation Z and millennials happen to be more tech savvy, we have to keep up with them."

Based on the above quotations, learners' attitudes towards the board are extremely optimistic. This agrees with authors Hoa and Trang (2020)'s statement that learners' degree of excitement and interest in a lesson is considerably upgraded when learners experience the interactive functions of the IWB (Hoa & Trang, 2020). This is due to the characteristics of young learners who love ICT and want to learn with the support of up-to-date ICT equipment like the IWB (Hoa & Trang, 2020). Educational ICTs have produced a large amount of information that cannot be taught through traditional teaching methods (Akcay et al., 2015). The IWB can make learning more efficient by using three major senses of seeing, hearing and touching, and because of the interactivity aspect between learners and educators (Gürbüztürk, 2018).The IWB contributes to learning by increasing learners' motivation in the lesson (Gürbüztürk, 2018).

4.4 Document analysis

For this study, lesson plans using the IWB from participants formed part of the data collection. The lesson plan is the vehicle that supports and assists educators and learners in their educational journey (Louw & du Toit, 2010). A lesson plan has different parts which is not always put together in the same way (Louw & du Toit, 2010). The main purpose of the lesson plan is to facilitate the acquisition of intended outcomes in compliance with the relevant assessment standard (Louw & du Toit, 2010).

The researcher's intention was to examine how educators' attitudes and experiences with the IWB change over time as educators need to continue to develop or modify their IWB lessons for different subject areas.

4.4.1 Lesson plan documents and teaching material

A flourishing teaching and learning practice require a careful selection and arrangement of teaching items and resources (Musingafi et al., 2015).The choice and selection of learning content and teaching methodologies take place during the lesson planning stage (Musingafi et al., 2015). For this study, lesson plans formed part of the data collection tools to answer research questions. The lesson plans provided the researcher with an opportunity to examine how educators' attitudes and experiences with the IWB change over time. Table 5 shows the numbering of these lesson plan documents.

Table 5: Lesson plan documents

Document Number	Name of Document
1	Lesson Plan for English Home Language Grade 4
2	PowerPoint for English Home Language Grade 4
3	Lesson Plan for Grade 5 Mathematics
4	Word document for Grade 5 Mathematics

4.4.2 Lesson plan document for English Home Language Grade 4

This lesson plan details the teaching process that should be followed during the actual lesson. Participant 5's lesson plan shows the content area, topics, learner activities, concepts, skills and assistance to learners with barriers. The lesson duration for each concept is 3 hours, except for listening and speaking which consists of 1 hour and 10 minutes. The participant indicated that IWB and

worksheets were used as a resource during each lesson presented. The participant intended to incorporate the IWB specifically for listening, reading and writing activities. There is no reference of how the IWB was used during the participants' actual lessons. The participants further mention giving an extra activity to learners at their discretion.

LESSON PLAN
TERM 4

Subject:	**ENGLISH HL**	**Grade:**	**4**
Duration:	**6 hours x 2 per week**	**Week:**	**5&6 [28 Oct – 01 Nov 2020]**

Content Area:	Topics:	Duration:
Listening and Speaking	Listens to advertisements	40 min x2
Reading and Viewing	Reads information text: advertisement	1hr 30 min x2
Writing and Presenting	Writing advertisements	1hr 20 min x2
Language Structure and Use	Revision of Semester 2 Assessment 1.5 Language Test	1 hr 40 min x2

Concepts and Skills	Resources
Listening and Speaking: Can we believe adverts?	Worksheets and whiteboard
Reading: Is advertising taking us for a ride? Reading: Can we believe print media?	Worksheets and whiteboard
Writes an advertisement: Uses content appropriate for purpose and audience; Uses appropriate visuals and layout for the purpose.	Worksheets and whiteboard
Word level work: conjunctions Sentence level work: adjectives, adverbs Spelling and punctuation: exclamation mark, colons, capital letters	Worksheets

Learner Activity
Listening and Speaking: Can we believe adverts? We will be looking at the effect of the media and advertising in our lives. Place the learners in groups so that they can easily discuss the questions posed about the content: • What are your favourite advertisements? Are they from the Internet, the TV or the radio? • Is advertising really necessary? • Are advertisers trying to trick us? What do you think? • How much do you know about propaganda techniques? • What do you think of the idea of using babies and children in adverts?
Reading and Viewing: Reading: Can we believe print media? This text looks at the construction of print media and some of the techniques used by advertisers. Learners answer the questions.
Writing and Presenting: 'Writing: Create an advertisement' Write an advertisement
Language: Completes worksheet activities.

Assistance to learners with barriers:
Individual assistance given and extra activity provided on the whiteboard. Study notes given in preparation for the examination.

Figure 6: Document 1: A two-week lesson plan for Grade 4 English Home Language

4.4.3 PowerPoint for English Home Language Grade 4

The aim of this document is to show how the participant would use a PowerPoint presentation during a Grade 4 English home language lesson using the IWB. Microsoft PowerPoint is one of the most versatile and powerful programs in the Microsoft Office package and can be used by teachers and learners for a variety of purposes in the classroom (Louw & du Toit, 2010). Educators can use this program in conjunction with the IWB to project text and photos that contribute to the lesson's learning outcomes (Louw & du Toit, 2010). Participant 5 used the DBE workbook for Grade 4s as a guide to create their PowerPoint. During the lesson, the participant put learners into small groups and presented them with newspaper article features using the IWB. The learners worked in groups with their own worksheets to correctly match the feature to its correct place. Once all learners completed the activity, the participant moved onto the next slide which showed the learners the correct answers.

Figure 7: Document 2: PowerPoint for English Home Language Grade 4

4.4.4 Lesson plan document for Mathematics Grade 5

This lesson plan document shows a one-hour lesson plan for Grade 5 Mathematics. Participant 6 used a generic lesson plan given by the DBE in a Word document format when preparing for mathematics lessons. The mathematics lesson is divided into sections three to eight. Section 3 indicates that the educator should use DBE workbooks and textbooks as the main resource for the lesson. In addition, the lesson gives the educator guidelines on how to revise topics covered in previous lessons. Section 7 gives a suggestion that the lesson should be presented with a class activity at the end to give learners a chance to practise the concept taught during the lesson. The lesson plan does not include the IWB as a school resource, as this generic lesson plan caters to educators and schools who do not have ICT as a resource in their school.

3. RESOURCES:	DBE textbook (LB and TG). DBE workbook
4. PRIOR KNOWLEDGE:	In Grade 4 the learners learnt: • Multiples of 1-digit whole numbers to at least 100

5. REVIEW AND CORRECTION OF HOMEWORK (suggested time: 10 minutes)

Homework provides an opportunity for teachers to track learners' progress in the mastery of mathematics concepts and to identify the problematic areas which require immediate attention. Therefore it is recommended that you place more focus on addressing errors from learner responses that may later become misconceptions.

6. MENTAL MATHEMATICS (5 minutes)

Learners should answer the following questions as fast and accurate as they can.
Questions on multiples of 6 and 4.

7. LESSON PRESENTATION/DEVELOPMENT (Suggested time: 20 minutes)

Teaching activities	Learning activities (Learners are expected to:
In this lesson we are going to learn about factors. Revise with the learners that factors are numbers you can multiply to get another number. *Factor: a number that divides evenly into another number or a whole number that divides equally into another number.* Example 1: 2 and 3 are factors of 6 because 2 x 3 = 6. A number can have more than two factors Example 2: What are the factors of 15? 3 x 5 = 15, therefore 3 and 5 are factors of 15. **Activity** Find the factors of10. 1 x 10 = 10; 2 x 5 = 10 Therefore factors of 10 are 1; 2; 5; 10 Ask the learners if they can think of any other examples.	Answer verbally. Work together with the educator.

8. CLASSWORK (Suggested time: 20 minutes)

Learners should complete the following activity using the method they were taught in class.
DBE Workbook 1: Worksheet 44a question 1 (pages 128– 129)
Learners should individually find the factors of:
a. 15
b. 24
c. 90

Figure 8: Document 3: Lesson plan for Grade 5 Mathematics

4.4.5 Word document for Grade 5 Mathematics

The document shown below differs from the PowerPoint screenshot exhibited in Document 2 PowerPoint for English Home Language Grade 4. Participant 6 chose to project a prepared Mathematics worksheet using Microsoft Word. The participant created this worksheet from scratch and did not use any textbook or workbook to create the worksheet. Furthermore, there is no group work incorporated into the lesson. The participant used direct instruction as a method for teaching and learning. Each learner received a hardcopy of the worksheet below while participant 6 projected and used the worksheet as teaching material for the lesson. The teaching material included a definition and example of factors that the educator explained and demonstrated to the learners. Thereafter, the learners had to complete the table by finding factors of all the numbers up to 24 on their own.

Topic: Factors **Grade: 5** **Date: _____**

- A factor is a number which divides exactly into another number with no remainder.
- All positive integers (except for 1) have at least 2 factors (1 and the number itself).

Examples

3 x 4 = 12 so 3 and 4 are factors of 12
5 x 6 = 30 so 5 and 6 are factors of 30
4 x 7 = 28 so 4 and 7 are both factors of 28

Complete this table to find the factors of all the numbers up to 24.

NUMBER	FACTORS	NUMBER	FACTORS
1	1	13	
2	1,2	14	
3	1,3	15	
4	1,2,4	16	

Figure 9: Document 4: Word document for Grade 5 Mathematics

The researcher's intention was to examine how educators' attitudes and experiences with the IWB change over time as educators need to continue to develop or modify their IWB lessons for different subject areas. Based on the findings, it is apparent that participants use Microsoft Office as a tool to prepare lesson plans and teaching materials. Furthermore, the findings revealed that participants used Microsoft Word to create worksheets, which are used in conjunction with the IWB during lessons. It is assumed that the participants are users of ICT and that they can incorporate ICT into their classroom. The findings further revealed that there is no guideline on how educators should incorporate the IWB into their lessons. Instead, educators use the board in a way that is easiest for them. In several cases, the participants use the IWB more as a presentation tool, while participant 6 used a direct instruction as a method of teaching. It is evident from participant 6's lesson plan and PowerPoint that using the IWB as a resource in the classroom can encourage collaboration and interaction between learners when used in a group work setting.

4.5 Summary of findings

The findings below were the main findings that appeared in the study, thus informing the research questions.

4.5.1 Challenges educators experience when using the IWB

The findings revealed that despite educators having all the resources available for them to use the IWB, in the event of load shedding or power cuts, the IWB cannot be utilised. Participants mentioned having to improvise lessons or copy work from the laptop onto the whiteboard when load shedding occurs. Load shedding is the main point of frustration for educators who have spent time on planning and creating lessons to use on the IWB. The second biggest challenge mentioned by the participants when using the IWB was the technical problems that occurred. Participants struggled to use the IWB as a result of outdated laptops, slow Wi-Fi connection and no software updates. The findings show that the challenge of finding appropriate content was mostly based on the increased amount of time it takes to find and prepare lessons when using the IWB, compared to traditional lesson planning. There was mention of educators needing a certain skill set to use the IWB.

4.5.2 Benefits and usefulness educators find in using the IWB

To establish what contributes to educators' acceptance of interactive whiteboards in their teaching practice, educators' views on how useful the IWB is, needs to be uncovered. The findings for this study revealed that despite the external challenges experienced by participants when using the IWB, participants preferred the benefits and usefulness the board had to offer. The degree to which educators use the IWB is reliant on whether they believe that it will enrich teaching and learning activities.

In this study, the findings discovered that IWBs made the classroom more inclusive by catering for the different learning styles and academic abilities of learners. Furthermore, participants were able to create interactive lessons using games and the internet to keep learners interested in the learning process. Participants found teaching and illustrating concepts easier when using the IWB.

The findings also revealed that although lesson planning initially takes longer in the beginning, participants can save, adjust and re-use notes for different classes or learners who are absent, which saves time on the other hand. The findings further revealed the additional health benefits of using the IWB. Participants preferred the ease of cleaning the IWB to cleaning the chalk dust of the traditional board. According to the study's findings, all participants found the IWB useful for teaching and learning. Lessons are delivered in a creative way that keep learners curious and interested in learning. Participants also revealed that the lessons conducted with the board are kept short, and there is more time to see if learners understand the concept taught. Participants frequently use the board because of the way it enriches teaching and learning.

4.5.3 Training received by educators

From the findings, it was discovered that training received by participants was only adequate in the use of the basic functions of the board. Most participants received training by IWB suppliers and, in one instance, the GDE. The findings showed participants' dissatisfaction with the training and that any further knowledge was gained through individual practise and continued use. Participants would have liked ongoing training on how to use the board more effectively. The findings of this study show that the SMT is mostly supportive when it comes to using the IWB in the schools. However, it was noted that no further guidance nor training was given by them.

4.5.4 IWB ease of use

A user's perceived ease of use is decided by how hassle-free or problematic it is to use an IWB. The findings showed that all participants found the board easy to use. This was mainly attributed to participants wanting to use the board and exploring how to use the more advanced features on their own. The study discovered that participants only experienced difficulties in using the board when the challenge of load shedding and technical issues appeared.

4.4.5 Factors influencing IWB usage

The participant's perceived usefulness and ease of use when using IWB is largely inspired by the external variables. Furthermore, external variables can influence the user's prior usage and experiences in using the board. The findings revealed that factors influencing the IWB usage varied between participants. Some participants were influenced to use the IWB more because of the positive way learners responded to educators when the board is used for lessons. The findings further revealed that other participants have more time to get through the curriculum due to the increased pace of the lesson when the board is used. Another factor that influenced participants to use the IWB is the way subject content can be presented. Participants find it easier to contextualise subjects because of the ability to use videos and illustrations for the learners to improve understanding.

4.5.6 Lesson planning and activities

The findings further showed that lesson plans were mostly created with a learner-centred approach in mind. Participants also mentioned including different learning styles in their lesson planning. When asked if learners could use the IWB during the lesson, participants presented mixed responses. There are participants who allow learners to use the board to research topics or present work to show their peers. In another instance, learners can use the board for reinforcement activities. However, there were participants who revealed that learners could damage, or break equipment linked to the board. One participant mentioned that it would be difficult to allow a class of learners to use the board. The findings further indicated that participants mostly used the IWB in subjects such as Technology, Language and Mathematics. Common findings showed that participants preferred to use videos

and illustrations to teach concepts in Technology and Mathematics. For Language, the participants mentioned using it for corrections and filling in of blank answers.

4.5.7 Educators' and learners' attitudes towards the IWB

To interpret educators' acceptance of the IWB, it is important to note the users' overall attitude towards using the IWB. Based on the findings, all participants' attitudes towards the IWB can be described as optimistic. From the findings, and as previously mentioned, participants enjoyed using the IWB due to its many benefits and usefulness. Teaching and learning were made easier, and participants enjoy that aspect. The findings showed that because participants accept and use the board in class, the learners' attitudes towards the board are also optimistic. Learners enjoy the different functions of the board, especially the colour and the sound. The interactive part of the lesson makes the learners curious, especially when games and competitions are incorporated.

4.6 Conclusion

The purpose of this chapter was to analyse and discuss the data gathered from participants. The data collected came from semi-structured interviews and lesson plan documents. The participants' data was imported to ATLAS.ti and was coded according to themes and sub-themes. In this chapter, the research findings are provided with arguments in relation to the literature review and theoretical framework.

Chapter 5: Recommendations and conclusions

5.1 Introduction

The rationale of this study was to explore the acceptance of interactive whiteboards in intermediate educators' everyday teaching practice. This final chapter is directed at giving recommendations of the findings discussed in chapter four. Furthermore, this chapter will provide conclusions, recommendations, limitations and contributions for this study.

5.2 Summary of the research

21st century schools' objectives are to equip learners with skills to use emerging ICT (Al Kandari & Al Qattan, 2020). The use of ICT can help children learn across different contexts (Al Kandari & Al Qattan, 2020). The current generation of learners - Generation Z - have a preference towards learning with technology that is more visual, interactive and instantaneous (De-Menendez et al., 2020). For educators to ensure that teaching and learning is understood and retained by Generation Z learners they need to move away from blackboard teaching and start progressing towards "smart" teaching and learning (Tobail et al., 2016). The IWB features provide a range of possibilities to facilitate educators' methods of teaching (Bourbour, 2020). The intention of this study was to explore what contributes to intermediate educators' acceptance of interactive whiteboards in their teaching practice. The literature review chapter introduced and discussed Information Communication Technology in education. Aspects such as the status of ICT in the world and South Africa were discussed. Furthermore, the literature review highlighted the use of interactive whiteboards in the world and in South Africa. The literature review also revealed the advantages and disadvantages of using IWB technology. A detailed explanation was given on how the Technology Acceptance Model underpins the theoretical framework of this study to pursue what contributes to educators' acceptance of the IWB.

In Chapter 3, the specific research design and methodology for this study was discussed. The ontological position and epistemology of this study were described concerning interpretivism, followed by the procedure used to acquire the knowledge studied, namely, qualitative research using a case study as the research design. Furthermore, the researcher explained why convenience sampling and purposive sampling were used as sampling procedures in this study. The methodological

norms and how it would be ensured in this study were each described and discussed. Finally, the ethical considerations based on the University of Pretoria's ethical considerations were briefly mentioned.

The study explored the different types of resources used to assist educators when using the IWB. Furthermore, the study looked at the challenges and benefits educators experienced when using the IWB. The study also discovered how effective the training is and how the support of the SMT assisted educators in using the IWB. Finally, the ease of use and usefulness in using the IWB as well as the attitudes of educators when using the IWB were discussed. Understanding the educator's acceptance of the IWB can help to develop ICTs, with capable educators who can be participants in the global community (Padayachee, 2017, p. 38).

5.3 Limitations of this study

The findings of this study cannot be generalised as it was a qualitative study, only consisting of ten intermediate phase educators selected from five different quantile five primary schools in Johannesburg. Only educators who have already used IWBs were asked to participate in this study. Furthermore, learners did not have an opportunity to participate in this study. The learners' experiences with educators accepting and using the board would have provided more insight and knowledge into the educators' acceptance.

5.4 Contributions of this study

This study adds to the existing literature regarding interactive whiteboard usage in a South African setting. The findings from this study can assist school management teams and the GDE in creating training programmes that could enhance educators' existing knowledge and skills in using the IWB. In addition, the findings from this study can be used as a reference by the Department of Basic Education for better IWB advancement in schools.

5.5 Recommendations

Based on the outcomes of this study, the following recommendations are put forward for stakeholders in the education field.

5.5.1 Recommendations for further study.

- Further research is required to measure whether the learners' academic achievements show any improvement after educators use the IWB for teaching and learning.
- Research on the use of IWBs in schools is generally focused on how educators use the board in schools. Further research should be conducted to see what happens when primary school learners can use the board to further develop their own knowledge, skills and understanding on various subject matters.
- A study comparing township schools and private schools in South Africa should be conducted to grasp how these schools implement and use smart boards in the classroom.

5.5.3 Recommendations for different stakeholders.

- In terms of the DBE, South Africa's White Paper on e-education should be reorganised to include modern educational devices such as the use of IWBs in teaching and learning. This will better assist stakeholders on ground-level to implement IWBs in the classroom more effectively.
- Based on the findings, it was discovered that training received by participants was only adequate in respect of the basic functions of the board. District officials and school SMTs should work together to create holistic user training to assist educators in using the board to its full potential.
- Schools should consider training and equipping an internal staff member i.e., computer teacher or technical assistant to assist educators with technical issues. The internal staff can also facilitate internal workshops to train new teachers or share new knowledge on how to use the board.
- Educators should adapt lesson plans and pedagogy to allow learners to use the board interactively and collaboratively.

5.5.3 Effective training for educators

Interactive whiteboard training and workshops need to happen on a continual basis for educators to use the board effectively and confidently. The training and workshops should be structured around technical issues for educators to troubleshoot basic issues on their own. Workshops should also be implemented for educators who would like to learn how to use the advanced features of the IWB.

5.5.4 Budget

SMTs in collaboration with SGBs should create an ICT budget to assist educators with the upgrading of IWB resources. If there are limited funds available, the SMT could ask the parent and fundraising committees to raise funds to support the cause. IWBs can also be bought in batches, or even one at a time, if enough funds are not available to supply the resources for the whole school or an entire grade. SGBs can also budget for, and purchase generators for the school to solve the problem of load shedding.

5.5.5 Learner interaction with the board

During internal subject meetings at schools, educators could brainstorm different ways to include a safe way for learners to interact with the IWB during lessons. Educators with more experience in using the IWB can offer brief workshops internally to incorporate learner interaction with the IWB.

5.6 Conclusion

Educational ICT in schools has improved educators' and learners' access to education. With the growing use of ICT implemented at school level, it is predicted to improve educational objectives by enhancing the quality and effectiveness of teaching and learning. The interactive whiteboard (IWB) is one educational ICT that is commonly used by educators in many countries because of its many benefits. The findings of this study revealed that educators generally have an optimistic attitude towards the IWB. This outlook is a result of educators finding the IWB useful and easy to use. However, for the IWB to be used to its optimal capacity, educators need to have structured, adequate, and differentiated training.

Furthermore, educators should find a way to incorporate learner interaction with the IWB. This can create high motivation to use the IWB for educators and learners. The findings of this study further suggest that SGBs, SMTs and the Department of Basic Education should come together to support and assist educators with challenges experienced when using ICT in the classroom.

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Appendices

Appendix A: Research Approval letter

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	01 July 2020
Validity of Research Approval:	04 February 2020 – 30 September 2020 2019/523
Name of Researcher:	Pringle K
Address of Researcher:	140 1st Avenue
	Bezuidenhout Valley
	Johannesburg
Telephone Number:	0749980928
Email address:	U13117174@tuks.co.za
Research Topic:	The acceptance of interactive whiteboards in educator's teaching practice
Type of qualification	Master's in Education
Number and type of schools:	5 Primary School
District/s/HO	Johannesburg East, Johannesburg Central

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

16/07/2020

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. *Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*

1

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. ***Because of COVID 19 pandemic researchers can ONLY collect data online, telephonically or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate. The approval letter will then indicate the type of arrangements that have been made with the school.***
4. ***The Researchers are advised to make arrangements with the schools via Fax, email or telephonically with the Principal.***
5. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
6. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
7. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
8. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
9. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
10. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
12. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
13. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
14. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
15. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
16. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mr Gumani Mukaturi
Acting CES: Education Research and Knowledge Management

DATE: 16/07/2020

Appendix B : Consent letter to the school principal

Faculty of Education

Dear Sir/Madam,

REQUEST FOR YOUR SCHOOL TO PARTICIPATE IN AN SURVEY FOR A RESEARCH PROJECT:

Title: The acceptance of interactive whiteboards in educator's teaching practice.

My name is Kirsten Pringle and I am currently enrolled for a Masters' degree at the University of Pretoria under the supervision of Dr. Marylie Mihai. The title of my approved research study is: *"The acceptance of interactive whiteboards in educator's teaching practice."*

The aim of the study is to investigate what contributes to educator's acceptance of interactive whiteboards in their teaching practice. Part of the data collection for this study will require educators to answer questions based on how they use interactive white boards in everyday teaching.

The survey with each educator will take approximately 20 minutes outside of dedicated teaching time. I have included here for your information a schedule of interview questions.

I hereby request your permission to allow educators to:

Participate in the interview;

All participation is voluntary. No harm or injury will come to the educators during the interview and classroom observation. Please note that the decision for educators to participate is completely voluntary and this will not affect their livelihood. None of the results obtained during the interview will be used for assessment purposes. The educators may request to leave exit the survey at any time without any explanation or consequences.

All information obtained during the research study will be treated confidentially. My supervisor and I will have access to the data. The names of educators, principal or school will not be mentioned during any phase of the study. Furthermore, pseudonyms will be used to avoid identification of the educator and school.

At the end of the study, I will provide the school with a copy of the dissertation containing both the findings of the study and recommendations. In addition, I would like to request your permission to use all data, confidentially and anonymously, for further research purposes, as the data sets will become intellectual property of the University of Pretoria. Further research may include secondary data analysis and use of the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

All the information obtained during the research study will be treated confidentially, with not even the University of Pretoria or the Department of Education having access to the raw data obtained from the interviews. At no time will either you as an individual or your school be mentioned by name or indeed be allowed to be identified by any manner or means whatsoever in the dissertation.

Thanking you in anticipation.

Ms.K. Pringle
Student Researcher
University of Pretoria
u13117174@tuks.co.za
074 998 0928

Dr. M. Mihal
Supervisor
University of Pretoria
maryke.mihal@up.ac.za
082 430 2928

LETTER of CONSENT

SCHOOL PARTICAPATION
VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED

The acceptance of interactive whiteboards in educator's teaching practice

I, _____ (Full name) the principal of _

_____

Please tick the appropriate block

Give consent ☐

Do not give consent ☐

to allow my school to participate in the above-mentioned study introduced and explained to me by Ms. Kirsten Pringle, currently a student enrolled for a Master's degree at the University of Pretoria.

I further declare that I understand, as explained to me by the researcher, the aim, scope, and purpose of collecting information proposed by the researcher, as well as how the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

_____ _____

Full name Signature

_____

Date

Appendix C: Consent letter to educator participants

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Education

Dear Sir/Madam,

REQUEST FOR YOUR SCHOOL TO PARTICIPATE IN AN INTERVIEW AND OBSERVATION IN A RESEARCH PROJECT:

Title: The acceptance of interactive whiteboards in educator's teaching practice.

My name is Kirsten Pringle and I am currently enrolled for a Masters' degree at the University of Pretoria under the supervision of Dr. Maryke Mihal. The title of my approved research study is: *"The acceptance of interactive whiteboards in educator's teaching practice."*

The aim of the study is to investigate what contributes to educator's acceptance of interactive whiteboards in their teaching practice. Part of the data collection for this study will require interviews with educators, lesson plans and a brief demonstration on how educators use interactive white boards in everyday teaching.

The interview with you will take approximately 50 minutes outside of dedicated teaching time. The classroom observation will take place during this time as well. I would like you to give me a demonstration on how you would normally use the interactive white board on a daily basis. I have included here for your information a schedule of interview questions.

I hereby request your permission to:

1. Participate in the interview;
2. Be part of the classroom observation.

All participation is voluntary. No harm or injury will come to you during the interview and classroom observation. Please note that the decision for you to participate is completely voluntary and this will not affect your livelihood. None of the results obtained during the interview will be used for assessment purposes. You may request to leave the interview or observation session at any time without any explanation or consequences.

As part of the data collection I will be using an audio recorder to capture the interviews for research purposes. The purpose of the audio recorder is to capture and transcribe the data accurately. All information obtained during the research study will be treated confidentially. My supervisor and I will have access to the data. The names of educators, principal or school will not be mentioned during the findings phase of the study. Furthermore, pseudonyms will be used to avoid identification of the educator and school.

At the end of the study, I provide the school with a copy of the dissertation containing both the findings of the study and recommendations. In addition, I would like to request your permission to use all data, confidentially and anonymously, for further research purposes, as the data sets will become intellectual property of the University of Pretoria. Further research may include secondary data analysis and use of the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

All the information obtained during the research study will be treated confidentially, with not even the University of Pretoria or the Department of Education having access to the raw data obtained from the interviews. At no time will either you as an individual or the school will be mentioned by name or be allowed to be identified by any manner or means whatsoever in the dissertation.

Thanking you in anticipation.

Ms.K. Pringle
Student Researcher
University of Pretoria
u13117174@tuks.co.za
074 998 0928

Dr. M. Mihai
Supervisor
University of Pretoria
maryke.mihai@up.ac.za
082 430 2928

LETTER of CONSENT

INDIVIDUAL CONSENT

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED

The acceptance of interactive whiteboards in educator's teaching practice

I, _____, (Full name)

Please tick the appropriate block

Give consent ☐

Do not give consent ☐

To participate as an individual in the above-mentioned study introduced and explained to me by Ms. Kirsten Pringle, currently a student enrolled for a Master's degree at the University of Pretoria.

I further declare that I understand, as explained to me by the researcher, the aim, scope, and purpose of collecting information proposed by the researcher, as well as how the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

_____ _____

Full name Signature

_____

Date School stamp

Appendix D: Interview questions for the participant

INTERVIEW QUESTIONS

1. Background

1.1 Age

1.2 How long have you been in the profession?

1.3 Which grades do you currently teach?

1.4 For how long have you been using the IWB?

1.5 Do you use other technology in the class? If so, what technology?

2. What are the biggest challenges that you experience when using the IWB?

3. What benefits do you experience when using an IWB?

4. How easy or difficult is it for you to use your IWB? Explain why.

5. How useful do you find the IWB? Explain why.

6. What are your attitudes towards using an IWB?

7. How do the learners feel about using the IWB? Their attitudes?

8. Which factors will influence you to use / not use the IWB?

9. How has your lesson planning changed since the use of the IWB?

10. How do you use the IWB in your class? For which activities?

11. What do you allow the learners to do on the IWB? How may they use the IWB?

12. Have you received training in using the IWB? What training? Was the training adequate or not?

13. What support do you receive from the school management regarding the use of the IWB?

Appendix E: Field note schedule

Context		
Activities		
Interaction		
Lesson Delivery		