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Teachers' use of iPads in the classroom in a South African public school

Research Report

*In partial fulfillment for the requirements of the Master in
Commerce (Information Systems)*

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DECLARATION

I declare that this research report is my own unaided work. It is submitted for the degree of Masters of Commerce at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination to any other university.



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ABSTRACT

This study examined the use of iPads by teachers in a public school in South Africa. The school is a public school located in a township East of Johannesburg. The majority of the learners are from the surrounding townships. The school was part of the 'Paperless Classroom' project of the Gauteng Department of Education which equipped schools with smartboards in classrooms, iPads for the learners and teachers and additionally laptops for the teachers. The paperless classroom, is an initiative provides devices to learners and teachers, access to online educational content and classrooms are equipped with smart boards and Internet connectivity. The education department of Gauteng's objectives is to encourage ICT adoption, skills development and improving the quality of education in townships. The project was rolled out in 2015 and schools were selected based on academic performance. The school was included in the project as they had achieved a one hundred percent pass rate of its matric class for three consecutive years.

The study sought to explore how the teachers use iPads in the classroom in a township school context. The Affordance framework was applied in exploring how teachers use iPads in the classroom and the associated benefits and challenges. Qualitative data was collected through interviews with the teachers and at a single school. Seven teachers were interviewed including the principal. The findings of the study indicated that overall the effect of iPad use by the teachers has been positive. The use of iPads resulted in the teachers having access to quality multi-media and educational apps to teach their subjects which resulted in learners' increased class involvement and independent learning. The study revealed that effective use of iPads requires teachers that are adequately trained to use the iPad technically and also on subject specific training. Additionally the study showed that a reliable wireless connection and reliable technical support and mitigation of learners' distractions increased the effectiveness of using iPads in the classroom.

Key words: iPad, public school, teachers, use, affordances

Chapter 1: Introduction

1.1 Background

Technology and Gauteng Schools

The provision of superior and appropriate education to learners, especially from previously disadvantaged communities, has the potential to improve a wide range of the social challenges that beset South Africa. A lethargic economy, high youth unemployment, high crime rates and an inequality in society have motivated the post-apartheid government in South Africa to channel a significant portion of its budget to education (National Development Plan, 2011). The Gauteng Education department Member of the Executive Council (MEC), Panyaza Lesufi committed to the provision and use of technology in Gauteng public schools in the Gauteng State of the Province in 2015. He stated “*We refer to classrooms with facilities that will transform the conditions and raise the standards of our education even higher. We are working toward creating a classroom that will provide technological support to all our learners and educators.*” (Gauteng State of the Province, 2015). Credence was given to this statement by the budget allocation to the “Paperless Classroom” project of 17 billion by the end of the 2017/18 financial year (Gauteng Budget Speech, 2016).

The “Paperless Classroom” is a steady progression from the Gauteng Online Schools project (GOSP) implemented in 2002. The intentions of the GOSP were two-fold: a) provision of information technology literacy to learners and b) building a network of all schools in the province and support the provision of a good learning experience at all public schools in Gauteng (Isaacs, 2007). However even though there was a project to increase computer literacy a study conducted by the Pan African Research Agenda on the ICT Pedagogical Integration (2009-2012) found that the use of the technology in township schools was low. Moreover schools that had access to information technology (in this case computers) were found to focus on learning about “the computer and the acquiring of skills to use them as opposed to applying the information technology knowledge in the classroom in the learning of subjects (Nkula and Krauss, 2014; Gedik and Beydas, 2013; Ertmer, 1999).

The Gauteng Online Schools project was discontinued in 2013 and MEC Panyaza Lesufi states the following issue with the project "Every school was connected with GOSP, but they were used as laboratories where people could check e-mails or send e-mails. I wanted this connectivity to go to the classrooms, so we just tweaked that program, and moved it from being a lab to access the Internet, to connecting the classrooms." This statement supports the objective of the paperless classroom to provide cutting edge technology to learners who may not have access to it, support the delivery of quality education by loading textbooks on tablet devices and the improvement of the learning experience by learners (IT Web, 2015).

The Paperless Classroom

The Paperless Classroom aimed to provide each classroom with a smartboard that also performs the function of a projector and enables internet browsing. The teacher can write on the smartboard digitally or the learners can write on it from their desks using their iPads. Each learner was allocated an iPad which they 'owned' until the end of the school year. The focus of the study was to examine the following: The perceptions that teachers have on the iPad and its affordances, how the teachers use iPads in their classroom and the classroom effect of the iPads. The Paperless Classroom initiative is a very substantial investment and with the struggling South African economy it is vital that the implementation of the project is effective and yields the intended outcomes of delivering quality and relevant education to Gauteng learners. Thus a framework is needed to provide teachers and policy makers' guidance on what iPads can do and how they can be used in classrooms. Learners who are exposed to technology and it is incorporated in their classroom learning may have a bigger chance at acquiring the tertiary skills they need to contribute to the economy (DOE White Paper, 2004)

1.2 Problem Statement

Through the years, the Gauteng education department has implemented various projects that give learners access to technology. These projects were external to the classroom as teachers and learners alike had to go to the computer laboratories to engage with the technology. Thus previous studies conducted on technology driven projects in education, found that in most Gauteng schools computer technology is

present but there is little evidence of effective use in the classroom (Hlatshwayo, 2006). Teachers are left to use their own discretion on how to effectively use the device in their teaching. Thus, there is a need to conduct research on teachers' use of the iPads in the South African context in order to generate empirical evidence that identifies what affordances of the iPad teachers use to support teaching and learning in the classroom and any challenges and benefits teachers encounter in classrooms. The proposed study will take place in one public high school based in a township in the east of Johannesburg. The average teacher/learner ratio is 1:41. Infrastructure at township public schools is often inadequate. Facilities like laboratories and libraries may be available but may not be adequately equipped, which makes it difficult for the teachers to impart their subject to the learners.

There is a wide variety of research that is available on technology use in schools where it mostly focuses on how the learners improve their general ICT skills. There is a dearth of research that explores how teachers interact with technology and its use in their teaching. This is especially apparent in a South African context. Teachers are critical to the integration of technology in classrooms therefore understanding what influences them in using technology is important in the roll out of technology in classrooms. The other dominant theme is the implementation of personal computers as opposed to newer technological devices that have developed on the market. Research is required to understand a) how teachers perceive the iPad affordances as a teaching tool, b) the teachers' application of the iPad in the classroom and c) the effect of the application in the classroom.

1.3 Purpose of the study

This research explores the affordances teachers perceive iPad devices to have with the purpose of addressing the following main question:

What iPad affordances influence teachers' use of iPad devices in their teaching?

1.3.1 Research Sub-questions

The following research sub-questions have been identified:

1. What affordances do teachers perceive the iPad to have?

2. How do the teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?
3. What are the benefits and restrictions teachers perceive of using iPads in a classroom?

1.4 Intended contribution of the study

This study explores the iPad affordances that influence teachers use of iPad devices in their teaching. It will provide insight into how teachers use iPads in classrooms from the teachers' perspective as well as the benefits and challenges arising from iPad use. The teachers interviewed will be provided with the opportunity to discuss the device and its application in the classroom and highlight possible areas of improving the use of the iPad in teaching.

It is important to understand how the iPads contribute in this context to the teachers effectively imparting their knowledge to the learners. The integration of the iPad in the classroom places technology right in the hands of teachers and learners, yet there is a paucity of published research to endorse the iPads value in the classroom (Shuler, 2012), especially in the South African context. Current published research has placed teachers as central figures to integration in the computer technology context and this has not been investigated in the new world of iPads (Mbatha, 2015; Segaoale, 2002). There is also a lack of empirical research on how to implement iPads in the classroom (Pegrum, Howitt & Striepe, 2013). Therefore, this study aims to examine the use of the iPad as an educational tool through the lived experience of teachers.

Existing literature by Churchill, Fox and King (2012) has identified the affordances of iPads, which will be outlined in the literature review. The contribution to exploring the applicability of affordance theory in this context. This research will contribute knowledge about the extent to which these affordances influence teachers' use of iPad devices in the classroom. This contributes to the literature within the South African context specifically regarding iPad use in the classroom by teachers.

1.5 Delimitations of the study

The aim of the study is not to show to what extent the South African education system will be improved using iPads in classrooms. The findings of this study are regarded as unique to South Africa and within the context of this particular case study. The study will explore the views of teachers in Johannesburg and their perceptions of the iPad device and its affordances.

2. Literature Review

This chapter seeks to complete a critical review of the current literature in order to identify the gaps in the existing research. The following focus areas will be ; The, progress of technology use in schools in South Africa , The concept of Affordance, The iPad device and its affordances , The evolution of iPads in schools, iPad integration models, , educational challenges of iPad use and knowledge required to use the iPad meaningfully.

2.1 The progress of technology use in South African schools

In the past twenty-two years, the South African government has tried to improve the quality of education. The White paper on e-Education (2004) identified three main challenging areas:

- Involvement in the information society
- Effect of information technology on the access, costs and quality of education; and lastly
- Use of information technology in the teaching and learning process

The primary goal derived from the identified challenges stated in the White Paper on e-Education (2003) was that every learner in primary education and students in tertiary education must be ICT capable by 2013 meaning that they can “use ICTs confidently and creatively to help develop the skills and knowledge they need to achieve personal goals and to be full participants in the global community” (DoE, 2003, p.17). This goal was not achieved hence the move first to the Gauteng Online Schools Project then the Paperless Classroom. Involvement in the information technology sector is enabled by the successful implementation of e-education which encompasses learner based teaching, inquiry-based learning, collaboration and developing deeper thinking skills (Wilson-Strydom and Thomson, 2005). Inquiry-based learning is a method of teaching where questions and problems are presented to learners rather than presenting known facts. The purpose is to encourage learners to create their own knowledge (Kahn and O’Rourke, 2005). This goal also assists in eliminating the digital divide that exists in South Africa, which is regarded as an educational barrier. In the U.S. 87% of Americans, use the internet in contrast with only 49% of South Africans who use the internet (World Bank, 2014).

Indeed, there is still a digital divide particularly in the public school sector but projects such as Gauteng Online, Khanya and Connectivity were implemented by different provinces to provide teachers and learners with ICT infrastructure and equipment such as the provision of computers, laptops and projectors. Nationally the Intel® Teach to the Future and School Net SA organisations provided development programs for teachers. A study by Wilson-Strydom and Thomson (2005) explored the degree to which teachers' integrated technology into their teaching upon completing the Intel® Teach to the Future training. The study revealed that 33% had never used technology in their class lessons (Wilson-Strydom and Thomson, 2005). This finding suggests that the mere access to technology does not automatically result in technology- integrated lessons by teachers (Bonfadelli, 2002; Toyama, 2015). Technology can only be valuable if the teachers are confident in using it in everyday classroom teaching and can see some benefit from use (Meschac, 2015).

Research conducted in the Western Cape to identify critical success factors for ICT adoption in one Western Cape school (Miller, Naidoo, Van Belle & Chigona, 2006) found that ICT was used to build ICT skills as opposed to integrating ICT for teaching and learning activities. The schools that had computers, had specific computer rooms that had to be reserved by the teachers should they want to use them. Priority was also given to specific subjects (in this case English and Mathematics) which could further distance teachers of other subjects from using the computers for teaching purposes.

The implementation of various ICT initiatives in these South African schools did not significantly change the teaching practices. The main constraints identified were that the ICT was usually outside the classroom and access was prioritised for certain subjects and secondly the teacher's abilities and attitudes in using technology in their teaching (Wade, 2008) which influences the success or failure of the technology project. Hew and Brush (2007) identified that teacher development is one of the greatest barriers to integration. Wade (2008) further asserts that giving teachers' technology without developing the teacher's skills to use the technology will not empower them to reap the benefits of the technology.

2.2 The concept of Affordance

The concept of affordance was devised by psychologist James Gibson (1977) to explain what the environment affords the animals living in it and was defined as ‘The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill’ (p. 127). According to Gibson, an affordance is a resource that is available to an animal that is able to perceive and use the resource.

Gibson’s idea of affordances has been applied in different fields and that resulted in different definitions and interpretations based on the field where it is applied. Norman (1988) introduced the concept of affordances in the information systems field and adapted the definition as follows: “the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used.” Norman (1988, p9) further explains in his book “Affordances provide strong clues to the operations of things. Plates are for pushing. Knobs are for turning. Slots are for inserting things into them. Balls are for throwing or bouncing. When affordances are taken advantage of, the user knows what to do just by looking: no picture, label, or instruction needed.” The term “affordance” increased in popularity in the information systems field but as Torenvliet (2003) found there was confusion and lack of understanding of the term. Norman accepted the blame for the lack of understanding and clarified that “the concept (of affordance) has caught on but not always with complete understanding. My fault: I was really talking about perceived affordances, which are not at all the same as real ones. The designer cares more about what actions the user perceives to be possible than what is true.” (Norman, 1999).

For the purpose of the study, it is vital to note the difference between Gibson and Norman’s definitions according to McGrenere and Ho (2000), who posit that Gibson’s affordance points to “an action possibility available in the environment to an individual, independent of the individual’s ability to perceive this possibility.” However for Norman an affordance is the possibility of the action and how the action possibility is made available to the actor (Norman, 1988). In the case of Norman this means that an affordance must be perceived before it can be of any use to the user.

In an Information Systems (IS) context, Conole and Dyke (2004) proposed the following as IS affordances: accessibility, speed of change, diversity, communication and collaboration, reflection, multi-model and non-linear, risk, fragility and uncertainty,

immediacy, monopolization and surveillance. They argue that firstly classifying the affordances assists in creating a deeper understanding of the affordances should help practitioners in their use of a specific technology in order to achieve their goals. Secondly, it can also assist in identifying potential limitations of the technology.

In the context of the study the teachers' ability to understand what functions the iPad can afford their teaching, how to use the functions positively in their teaching and the functions to avoid in the iPad it will encourage effective use of the iPad in the classroom. An example of this would be a teacher who understands that the iPad can be used as collaboration tool they are able to adjust their lessons to incorporate iPad for them and their students. The teacher will also be aware that the iPad can be a distraction to the students and would monitor the students closely to mitigate for distractions.

In this study unperceived affordances of the iPad will restrict the teachers' use of the iPad when they are teaching; for the teacher to fully utilise the iPad affordances, they must be able to perceive them.

2.3 The iPad device and its affordances

The iPad is an Apple Corporation product that was first released in April 2010. The height and width of the iPad is similar to the size of a children's book (Yeow and Henderson, 2012). It is thin which makes it easy to carry and hold. The screen is a large multi-touch display which rotates depending on the angle. The screen also has a wide-viewing angle display enabling users to share and view content together. iPad users interact with the device by touching the screen. The device comes in Wi-Fi and 3G models enabling wireless connectivity to the internet at any location where Wi-Fi or 3G are supported. The blend of the iPad's size, light weight, no attachments and connectivity makes it an easy device for children to handle (Yeow and Henderson, 2012). The device also has thousands of educational applications available, which users can download from the App store for free or at a fee.

An affordance is a useful lens that can be used to explore how teachers use iPads in their classrooms). Affordances can emerge from how they are used by the teachers in the classroom (Churchill and Wang, 2014). Liaw et al (2010) suggested five

affordances for technology in education a) “educational content and knowledge delivery b) adaptive learning applications c) interactive applications d) individual applications e) collaboration applications”. Identifying the affordances of the iPad enables teachers to facilitate the use of the device appropriately. In their study to identify how higher education teachers use iPads in their teaching, Churchill, Fox and King (2014) further classified iPad affordances into; productivity tools, teaching tools, notes tools, communication tools, blogging tools, content accessing tools.

Productivity tools include word processing, document marking and creating multimedia content. Teaching tools enable teaching - examples are presentation tools. Notes tools enable note taking in conjunction with audio recording, drawing and typing. Communication tools enable social networking and other communication. Blogging tools allow easy blogging. Content accessing tools enable accessing apps and the internet for content. (Churchill et al, 2014).

2.4 The evolution of iPads in schools

iPads were not designed for use in classrooms for teaching but with the world firmly captured by this technology they have been now adapted and used in classrooms (Gasparini, 2011). Conventionally the application of technology in education has been external the classroom where the computers were in computer labs (Henderson and Yeow, 2012; Sackstein, 2013). Now with the introduction of mobile technology in the classroom new ways of accessing and relaying information by teachers and learners have been enabled. Li and Pow (2011) assert that iPads can enable learners to collaborate and communicate with each other which enhances active learning. This further encourages a shift in teaching from teacher-centred to learner-centred teaching which provides learners with comprehensive and broader information sources than only having a teacher in the classroom can provide. Traxler (2010) argues that desktop computers restrict learners from interacting beyond the computer lab during their lesson. This is contrary to the iPad which allows learners to interact with their classmates anytime or anywhere outside of school hours.

The implementation of iPads has been found to encourage teachers to offer a variety of learning activities (examples: teachers can use an app to explore the galaxy of stars with the learners) and promote independent learning (Heinrich, 2012; Montrieux, 2014). In a study by Clark and Luckin (2013) found that the ease of use of the iPads

also encouraged teachers' to perform administrative tasks such as lesson preparation and assessment marking, in this instance, teachers had the ICT skills and could see the value of the device. According to Burden et al (2012) applying iPads in their classroom encouraged teachers to discover alternative classroom activities, for example looking at the Galaxy of stars using a iPad app, which may not have been possible before the iPads.

The popularity of the iPad has also been spearheaded by the plethora of applications at low cost or in many cases free from third parties some of which are for educational purposes (Benton, 2012). These include the iBooks app for all reading levels. The application helps users with the pronunciation of difficult words, to enlarge the font and to interact with animated pictures. These types of applications would be beneficial to South African learners who are learning a second language which is not their mother tongue.

2.5 iPad integration models

There is no universal technology integration definition. The effectiveness of the using the iPads may be measured by the goals of the school or the teacher (Benton, 2012). Johnson states that "it should prepare staff and students for a 21st century world of work and education" (2009, page 67). Other schools implement a one-to-one model where learners each have their own devices (Bobel, 2010). This model encourages that the learners has a device which is available to them anytime to promote ubiquitous learning (Benton, 2012). In other schools a full classroom set or small classroom set is implemented where the device does not belong to one learner but they are distributed to learners for class group work (Benton, 2012). In the multiple-user model the learner cannot customise the iPad with their preferences as with the one-to-one model.

2.6 Educational challenges of iPad use

Existing literature has identified some challenges to using iPads in education such as technical support, app selection (Yeow and Henderson, 2012), teacher training (Hatten, 2012), distracted learners (Yeow and Henderson, 2012; Chou, Block and Jesness, 2012) and lack of curriculum aligned applications (Chou, Block and Jesness, 2012).

In their study Henderson and Yeow (2012) found that finding a suitable application for their grade and subject at the right level for teaching was on a trial and error basis, this is further asserted by Harmon (2012). Teachers found this task daunting as there are many apps available and it was not easy to find apps that suited the content or curriculum fully (Harmon, 2012).

Hatten (2012) argues that teachers usually only get one form of training and this is not adequate preparation for them to use the iPad in their teaching. Teachers should receive various forms of training which include workshops, mentoring and coaching, online and face to face groups and videos (Hatten, 2012). The duration of the training must also be considered in order to ensure that the teachers get the value out of the training.

Another challenge that was identified with the iPad is how it distracts learners during class time where they browse the internet or play with applications they are not supposed to be on (Henderson and Yeow, 2012; Chou, Block and Jesness, 2012). In their study, Henderson and Yeow (2012) explain how the teachers would lay the ground rules for iPad use and if a learner was found to contravene them, the learner would lose their iPad privileges for a period. In terms of control purposes teachers were able to see quickly when a learner was off task due to the iPad being so visual (Henderson and Yeow, 2012).

2.7 Knowledge required to use the iPad meaningfully

In South African public schools a substantial number of teachers have not been exposed to teaching incorporating technology. It is therefore important to ensure that the teachers have the right knowledge to fully enhance classroom learning for their learners.

Koehler, Mishra and Cain (2013) argue that 'teaching is a complicated practice that requires an interweaving of many kinds of specialised knowledge' (p. 13). Teachers then need to have the required knowledge of using the technology effectively with the subjects they teach. Teaching with newer technologies such as the iPad complicates the nature of teaching even further. Older teaching technologies (i.e. microscopes, chalkboards) are characterised by specificity meaning they have a specified use, stability which relates to the technology not changing much over time and transparency of function where how it is built and works are highly related to its function (Koehler, Mishra and Cain, 2013). In contrast new teaching technologies (iPads, computers and handheld devices) are usable in different ways, they are always changing; and how they are built not to a specific function (Koehler, Mishra and Cain, 2013).

In their study, Sang et al (2010) explain that using technology successfully is related with the teachers' teaching objectives as opposed to the technology skills they may have. They further emphasise the understanding of the teaching practices of the teachers and challenging those objectives in training sessions. Insufficient training results in teachers who may have a lack of confidence in integrating technology in the classroom (Hew and Brush, 2007).

Teachers may resist the integration of technology if they do not understand the value of using it and how to use the technology in their teaching (Niess, 2013). The British Educational Communications and Technology Agency agrees that teachers are more likely to resist integrating technology if they do not see why they should and if they have not been trained properly (BECTA, 2004). In their study, Churchill, Fox and King (2012) explain the teachers must understand the affordances of the iPad in order for them to integrate technology in order to realise the value in their teaching.

2.8 Conceptual Framework

The emerging notion from the literature is that iPads have the potential to influence teaching and learning. The literature highlighted that teachers must understand what iPads are useful for in their teaching, so that the device can be fully utilized. Identifying the existing affordances of the iPad and how teachers perceive them assists in understanding how teachers can use them effectively in this study. The Affordance framework has informed the conceptual framework for the proposed study.

The conceptual framework derived from the literature review and theoretical lens has five co-dependent concepts namely; affordance existence, teacher affordance perception, classroom effect, implementation models and integration issues.

The main proposal of the framework is that affordance actualisation is determined by the perception of affordances and the effort required in the actualization and contextual issues that are present for actualization to happen (Bernard and Recker, 2013).

Affordance perception is a result of the user interaction with the object and the emergence of affordances as a result. In this case the teacher would be required to interact with the iPad to form perceptions of its affordances (Volkoff and Strong, 2013).

Implementation approaches refers to whether it will be a one-to-one model, multi-user model or small group model. The model used may depend on the availability of the resources for the school and the teacher's intention with the lesson.

The classroom effect will be determined by how the teacher uses the iPad in their classroom.

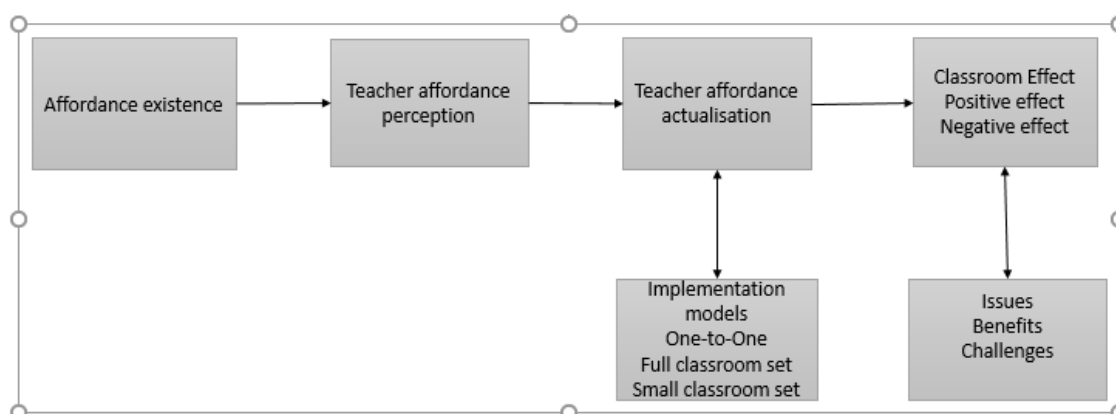


Figure 1: Conceptual Framework

3. Research Design and Methodology

The study aimed to explore the perceived iPad affordances that influence teachers' use of iPad devices through the lived experience of teachers at a school located in a Johannesburg township. The study identify the affordances teachers perceive the iPad to have which result in the teachers using the devices in their classrooms to support their teaching and the learning of their students. The study also aimed at determining the benefits and restrictions the device afforded to the teachers.

The main research question that I am attempting to answer is:

How do teachers' use iPads in the classroom in the public school setting?

The following research questions have been identified:

- What affordances do teachers perceive the iPad to have?
- How do teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?
- What are the benefits and restrictions teachers perceive of using iPads in a classroom?

In order to answer the questions mentioned above the study applied a qualitative research design. Data was collected through interviews with the teachers. This chapter describes the research methodology that was applied to complete the study. This section also explains the research design and approach, the research methods, as well as data collection instruments. The chapter finally describes how issues of validity and reliability were addressed in the study.

3.1 Research Design and Approach

A research paradigm is the structure of how the research is going to be conducted (Collis and Hussey, 2009). There are two prominent social research approaches to studying information systems as identified by Orlikowski and Baroudi, (1991). These philosophies are interpretive and positivist. Positivist research aims at studied phenomenon through an objective lens without consideration of the researcher's perspective and views (Levin, 1988). Positivists believe that reality is constant and can be observed objectively (Leedy, 2005). They assert that phenomena should be isolated and observations should be repeatable. Quantitative research methods are therefore more suitable for the positivist approach.

As the objective of my study is not quantifying how well teachers used iPads in their classrooms but to understand their view of the devices, a positivist approach would not have been suitable for the study and it needed to be rich in nuance and detail.

In this study the interpretive paradigm has been applied. The interpretivist approach arose due to the criticisms of the positivist approach (Collis and Hussey, 2009).

Interpretivist research asserts that people are different and are unpredictable and the same issue may lead to different outcomes (Saunders et al, 2009). The interpretivist paradigm asserts that understanding the social context requires that one understands how practices and meanings are formed by the “language and unspoken rules shared by humans working towards some common goal” (Orlikowski and Baroudi, 1991). The study aimed to understand ‘how’ teachers use iPad devices, ‘what’ affordances enable them to use the devices and ‘why’ they do it.

3.2 Qualitative Research Design

Qualitative research methods have been applied where there is a requirement to describe and explain the topic of the study (Creswell, 2007). Creswell (2007) defines qualitative research as a way of discovering and understanding the meaning people associate with social issues or human problems. It enables the researcher to explore the phenomenon in its natural setting. The data collected is mostly text and data analysis must be done using non-statistical methods (McMillan and Schumacher, 2010).

Qualitative research methods differ from quantitative methods. Quantitative methods seeks to discover the facts about social phenomena (Bhattacharjee, 2012). Data is collected through measuring the facts through questionnaires and/or empirical examination (Bhattacharjee, 2012). This method was not employed in this study as the aim of the study is to explore how the teachers use the iPads in the classroom and why they do it.

A qualitative research design is the most relevant and appropriate approach to use in exploring how teachers are using iPads in their classrooms. In South Africa there is a dearth of empirical evidence on what and how iPads contribute to teaching and learning (Pegrum, Oakley, & Faulkner, 2013). It was therefore important to explore

and understand this phenomenon from the lived experiences of teachers who are applying the iPad in their classrooms daily.

The study looked at the lived experiences of the participating teachers and it is largely a phenomenological study. Phenomenography examines the qualitative ways which people may experience phenomena or their thoughts on the phenomena. Phenomenology is a qualitative research methodology. In a phenomenological study the data is collected through discussion, dialogue and open-ended questions, where afterwards the researcher will describe and interpret the data collected to extract what the experience meant to the participants who have it (Cristensen, Johnson & Tuner, 2010). For the study the teachers from a less affluent school expressed their daily experience of using iPads as teaching tools. The school was selected because it was in a less affluent area in Johannesburg and was part of the Paperless classroom project by the GDE.

3.3 Case Study

Case studies are defined in many ways and a firm standard does not exist. A definition that was compiled from Lehaney & Vinten (1994) describes it as follows,

“A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups or organizations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used.” (Lehaney & Vinten, 1994)

According to Yin (1991) a case study is an “empirical enquiry that investigates a contemporary phenomenon within its real life context, especially when boundaries between the phenomenon and context are not clearly evident.” Yin (1991) further asserts that case studies are suitable to answering the how and why type questions. In the literature review we have established that teachers are central figures in using iPad technology in the classroom. This study aims to do is to uncover the methods, challenges of teachers in using iPads in the classroom.

A case study was employed in this study in order to describe the lived experience of how teachers use the iPad and what motivates them to use in their teaching. A single case study was conducted to establish which of the affordances of the iPad that have

been identified in previous literature are used by teachers in their classrooms. Only teachers were interviewed and no learners were interviewed.

3.4 Population and Sampling

Qualitative research requires only a small sample of a population to be selected for a given study. The three common methods for sampling in qualitative research are discussed below:

3.4.1 Purposive Sampling

“Purposive sampling, one of the most common sampling strategies, groups participants according to preselected criteria relevant to a particular research question. Sample sizes, which may or may not be fixed prior to data collection, depend on the resources and time available, as well as the study’s objectives. Purposive sample sizes are often determined on the basis of theoretical saturation (the point in data collection when new data no longer bring additional insights to the research questions). Purposive sampling is therefore most successful when data review and analysis are done in conjunction with data collection.” (Lehaney & Vinten, 1994)

Purposive sampling was used in this study due to the willingness of the school Principal to have the study conducted at the school. The school principal was approached by the researcher after she was introduced to him by his daughter who is a colleague of the researcher. The school also fulfilled the criteria required of a) they were a township school b) the school was part of the Paperless classroom project.

3.4.2 Snowball Sampling

“This method is also known as chain referral sampling, and is also considered a type of purposive sampling. In this method, participants or informants with who contact has already been made use their social networks to refer the researcher to other people who could potentially participate in or contribute in to the study. Snowball sampling is often used to find and recruit ‘hidden populations’, that is, groups not easily accessible to researchers through other sampling techniques.”(Lehaney & Vinten, 1994). Snowball sampling was not applied in the study as the researcher needed all the teachers to be at a single school.

3.4.3 Convenience Sampling (availability sampling)

“Convenience sampling is a type of sampling where the first available primary data source will be used for the research without additional requirements. In other words, this sampling method involves getting participants wherever you can find them and typically wherever is convenient.” (Saunders et al, 2012)

Convenience sampling was applied in the study as the principal asked all the teachers who would like to participate in the study to make time with me while I was at the school. Seven teachers excluding the principal made themselves available for the study. In mitigating selection bias, the principal requested all the teachers to voluntarily participate in the study (Saunders et al, 2012).

The kind of sampling used in a phenomenological study is called purposeful sampling (Miles and Huberman, 1994). Purposeful sampling is well-suited for this kind of research because “qualitative researchers usually work with small samples of people, nested in their context and studied in-depth” (Miles and Huberman, 1994, p.27). Creswell (2007, p.125) also states that purposeful sampling serves to “*inform an understanding of the research problem and central phenomenon of study*”.

In the study purposive sampling was also applied as the school qualified for the two criterion for the study which were: a) the school was in an underprivileged area of Johannesburg b) the school was part of the ‘Paperless Classroom’ project rolled out by the GDE and lastly c) the principal was willing for me to conduct my research study there. The teachers were invited to voluntarily participate in the study and could retract their participation at any time.

3.5 Data Collection Methods

The data was collected using interviews. Qualitative research requires the use of varied sources information to ensure credibility and reliability (Marshall and Rossman, 2011).

3.5.1 Interviews

Cresswell (2007) identified that the primary data collection method for a phenomenological study is in-depth interviews. Interviews are “one of the most powerful ways in which we try to understand our fellow being” (Fontana and Frey,

2000, p. 645). An interview is where the interviewer asks a set of questions, listens and records the responses from the interviewees. The interviews were only conducted with only the teachers. A total of 7 teacher interviews and 1 principal interview were completed over a 2 day period at the school. The teachers were invited to voluntarily participate in the study by the principal and 7 out of the 32 teachers participated in the study.

In order to ensure that interviews are fruitful Walsham (1993) suggested a few techniques that I employed in the study. These were: I created a rapport with the interviewee as the interviewer to ensure that there is an element of trust, asked the participants of their own experience of the iPad, be open with the responses you may receive, semi structure the interview in order to not prejudice the responses and record the data as soon as possible to mitigate against distortion. The average duration for a teacher interview was 20 minutes.

The teacher interview schedule consisted of 20 semi-structured questions. The questions were designed to elicit information on the use of the iPad to teach their subject, the impact this technology has on the teaching and learning of their subject, and the challenges they face.

Interviews were used in this study to collect information on teacher perceptions of the use of iPads for teaching and learning of their subject. Each interview was audio recorded and transcribed verbatim to facilitate the data analysis.

3.6 Data Analysis Methods

One of the characteristics of a thorough qualitative study is a rigorous analysis of the data and using multiple levels of abstraction (Creswell, 2007). It is imperative for the researcher to develop an organised framework in order to identify patterns and themes emerging from the data (Benton, 2012).

Teacher 1: I normally create **powerpoint** slides on my laptop then project on the smart board.
The iPad is helpful when I want the learners to do their own **research**.

Teacher 1: When **were** learning about plants, we would go outside and they can take pictures say of a dichotomous plant for them to see practically what I just taught them. I could give them assignments to make sure they understand what I have taught them.

Vuyo: What new learning **opportunities** does the iPad afford the learners?

Teacher 1: You see in the past and most my teaching career we have to draw on the board with chalk. This is not effective as the learners do not have a true picture of what you are talking about in 3D. Now they can **download** videos which makes your subject come alive and for them to understand the real life scenarios.

Lupondwana, Vuyo
Theme – Information sharing -encouraging learners to gather information
Theme – Sharing teaching content

Lupondwana, Vuyo
Theme – high quality multi media
Theme – Access to other information for learners.

Rectangular Strip

Fig 2: Brief excerpt of a coded passage

Qualitative researchers often use information that comes from direct sources by using data collection strategies such as observation and interviews. Prior to the empirical investigation, the researcher conducted a literature study on the use of technology in education with the aim of getting deeper insights on technology use by teachers and the relation to affordance theory. The literature study also enabled the researcher to uncover themes that can be applied to the study. The literature study was followed by semi-structured interviews for collecting data. Research data was analysed through coding, categorisation advised by MacMillan and Schumacher (2010). Literature studies was used for triangulation purposes. To ensure that the research findings are credible and trustworthy so that they can be beneficial to other researchers and interested parties, trustworthiness was ensured through piloting of the interview questions to provide an opportunity to clarify and modify difficult questions and triangulation.

Themes that have emerged from the literature are that teachers must be invested in the process of using of technology in the classroom as if they are not invested, it may lead to negative attitudes to the technology (Niess, 2013). The steady growth of iPad use in classroom is a trend that seems likely to be around for a long while. The affordances of the iPad must be explained to teachers in order for them to gain the knowledge to use the iPad appropriately and consistently in the classroom (Churchhill et al, 2012).

All interviews were recorded using the Samsung application called Smart Recorder. This application allowed secure and comfortable audio recording. Transcripts were typed using Microsoft Office Word. The Review command in the Microsoft Word allowed coding of data into broad themes. Themes were later categorised to correspond with the research questions.

3.7 Trustworthiness

The value of research depends on the willingness and capability of the participants to provide information. In this study, the techniques used for ensuring rigour and trustworthiness included creating rapport with the teachers that were participating in the study in order to establish a relationship of trust. This was followed by piloting the interview schedule using reiterative questioning and triangulation in order to confirm the findings with information from literature studies.

3.8 Ethical Considerations

Permission was sought from the school principal of the school and he approved conducting the study at the school. The University of the Witwatersrand ethics clearance was sought to ensure that the proposed study does not infringe on any human rights and to ensure the study complies with the University's ethical code of conduct. Wits Ethics clearance was approved and the protocol number – CINFO/1135 and is attached in the addendum.

All participants were informed that participation is voluntary and they can withdraw at any time without any prejudice. All information gathered during the period of research was kept private and confidential. Anonymity of the participants was ensured at all times by not identifying the school or the teachers. Anonymity was ensured by not associating any of the findings to their name or position. All interviews will be confidential. The participating teachers were not identified by name or their specific position in the research report (Walsham, 2006).

3.9 Limitations of the Study

The rationale for the study emanated from the researcher's interest in how iPads are used in the classroom with a specific focus on township schools and the strategies teachers use to teach with them. This interest was sparked by the Gauteng Department of Education (GDE) project that distributed iPads to public schools.

Although the findings may give useful insights into teachers' use of iPads in classrooms, the small sample size and limited period for this study may limit the transferability of the study as the findings are unique to that school.

4. Findings on the Use of iPads by teachers in a public school

In this chapter, the focus is on the presentation of data from the school. Findings were obtained from seven teacher interviews and one principal interview.

These findings are grouped into seven broad themes:

- The context of using iPads in the school
- Continuous Improvement with Technology Use
- The school and Gauteng Department of Education collaboration
- Parent and learner involvement
- The teachers' exposure to other technologies
- The teachers' use of the iPad in the classroom
- The teachers' professional goals and development
- The teachers' perceptions of the iPad effect in the classroom
- The teachers' perceptions of the benefits of using the iPad in the classroom
- The teachers' perceptions of the challenges of using the iPad in the classroom

4.1 The context of using iPads in the school

This School is a public school that is located in a township¹ in the East of Johannesburg in the Gauteng province. The school has approximately 1000 learners, with the majority from the township and surrounding townships. The average teacher – learner ratio is 1:41. The school is a no-fee school and is affected by the socio-economic factors that plague most townships in Johannesburg such as high unemployment, high crime, HIV and substance abuse. The school has achieved a 100% matric pass rate for the last 5 years and was part of the Gauteng Education project 'Paperless Classrooms' which initially gave well performing high schools smartboards and WIFI connectivity. Secondly, the Grade 11 and 12 teachers and learners were given iPads to use in teaching and learning. All teachers were also given laptop computers. The distribution of these technology devices and connectivity was to improve technology use in teaching in government schools where most learners did

¹ Township – In South Africa the term township and location refers to the underdeveloped segregated urban areas that were reserved for non-whites, namely Indians, Africans and Coloureds during Apartheid.

not have parents who could afford to assist the school in driving technology use. In this school only the Grade 11 and 12 classrooms are equipped with the smartboards.

Textbooks are pre-loaded on the learner and teacher iPads. The majority of the teachers who teach Grade 11 and 12 use a combination of the smartboard and iPad when they are conducting lessons. Teachers and learners use the iPads to communicate and share information with each other.

The school does have a computer lab equipped with approximately 30 computers. The lab was mostly used to teach learners basic computer skills and not necessarily used in teaching other subjects. Thus the introduction of the iPads has moved technology from outside the classroom to inside the classroom.

4.2 Continuous Improvement with Technology Use

The Gauteng Department's 'Paperless Classroom' project came at a time where the school had been struggling to find the resources to move into using iPads in teaching. The school principal explained that the school had established an Information and Communication Technology (ICT) committee which was made up of the principal, a few teachers and members of the School Governing Body (SGB). The computer labs were then established with the help of funds from various educational non-profit organisations (NPOs).

The computer labs were equipped with about thirty desktop computers which had the basic Microsoft software loaded on them. There were only five computers that were connected to the internet. A teacher was assigned to be the custodian of the computer labs and give the learners basic lessons in computer use. However as the School Principal explains, due to the limited number of computers, the learners at the school were not able to fully experience the computer labs. Secondly the School Principal also conceded that most teachers did not fully utilize the computer labs and thus the learners' interest in the computer labs tapered down. The School Principal also noted that the learners' interest was lowered because some of them had a smart phone and they could access the internet from there and did not need to wait for availability in the school labs.

“When the school received these computers we were all very excited for our learners to learn how to use computers and the teachers would facilitate with the help of Mr A [Computer Lab custodian]. We did not fully understand how to make these computers work for our school and we just focused on the standard practice where they (learners) were taught the Microsoft package (word, excel etc). But there were just too many of the learners for the computer labs to cope. Most of the teachers did not prioritise using the labs and the learners just got bored. Plus learners now have smartphones so why stress about word when there is Facebook?” (School Principal)

The School Principal also admitted that the ICT committee at the school did not collaborate effectively with the teachers in order to gain the support from them.

“We just thought it would be a very good idea and that they [teachers] would also believe so. But they didn’t really understand what we [ICT committee] were trying to do. Maybe we also did communicate well enough on this matter.” (School Principal).

The ICT committee had also attempted to source funding to purchase some iPads for the school but were unsuccessful. Thus the education department’s paperless classroom project gave the school good technical resources that would align with the school’s goals of improving technology use in teaching.

4.3 The school and Gauteng Department of Education collaboration

As the roll-out of iPads was initiated by the Gauteng Department of Education (GDE), the school ICT committee did not have any input in how the project would be implemented at the school. The GDE was rolling out the project in a phased approach and starting with Grade 11 and 12 classrooms and learners. The GDE would allocate each learner in those grades an iPad device to use for the year. Teachers received an iPad and laptop computer to use in their teaching. Lastly, each classroom would receive a smartboard and the school would be enabled with WIFI connectivity. The school principal explains that one of the issues with the project was the lack of appropriate communication from the department that led to disseminating incorrect training information to the teachers at the school.

“I really didn’t know what exactly was going to happen. We were just told that we will be part of the second phase and the technology we were receiving, as to when it starts and what must happen was not fully explained to me.” (School Principal)

4.4 Parent and learner involvement

Parental and learner engagement was key to rolling out the project successfully. As a no-fee school, access to iPads was very limited to most of the learners due to the socio-economic circumstances. It was important then for the parents to understand the responsibility that their children would need to have in taking care of the devices in order for them to monitor them at home. Through meetings with the school ICT committee and representatives from the GDE the parents and learners were convinced that the use of iPads would improve the quality of education and expose them to technology.

“The parents were very happy as most of them could have never been able to afford these devices, and also felt it would motivate their children to do well in school. (Teacher 1).”

The project was supported by the parents and learners.

4.5 Teachers exposure to other technology

In this section, we discuss the findings of what other technology the teachers were exposed to prior using the iPads in their classrooms. The section starts with presenting data on the profile of teachers that were interviewed in the study.

4.5.1 Teacher Profiles

Teacher Name	Age	Teaching experience (in years)	Subjects Taught	Technological facilities in the Classroom
Teacher 1	57	32	<i>Maths and Physical Science</i>	<i>Teacher’s laptop, teacher’s iPad, smart board, learners’ iPads</i>
Teacher 2	54	28	<i>Maths and Computer studies</i>	<i>Teacher’s laptop, teacher’s iPad, smart board, learners’ iPads</i>
Teacher 3	34	8	<i>Economics</i>	<i>Teacher’s laptop, teacher’s iPad, smart board, learners’ iPads</i>
Teacher 4	41	10	<i>Life Sciences</i>	<i>Teacher’s laptop, teacher’s iPad, smart board, learners’ iPads</i>

Teacher 5	29	3	English History	Teacher's laptop, teacher's iPad, smart board, learners' iPads
Teacher 6	35	7	Life Sciences	Teacher's laptop, teacher's iPad, smart board, learners' iPads
Teacher 7	45	20	IsiZulu	Teacher's laptop, smart board, learners' iPads

4.6 Teachers' personal use of technology

All the teachers interviewed had a smartphone for their personal use. Only one of the teachers had their own iPhone prior to being given one as part of the GDE project. One teacher observed that having used a smartphone for accessing the internet and the various apps available, made it easier to use the iPad in their teaching. The teacher says:

"I have an iPhone 5 and I have used it to access the internet and also have downloaded a lot of apps that I use so when I got the iPad it was not too difficult to use it when I teach the learners. It was like using a big phone." (Teacher 6)

It was clear from the comments of the teachers that even though they had access to their own smartphone they did not use their smartphones as a tool for teaching. There no strong evidence that indicated that the teachers were better able to use the iPads based on their own experience of having smartphones.

4.7 Teachers use of the iPads in the classroom

The teacher interviews revealed that iPads are used by the implementation of a one-to-one model. The iPads are used almost daily during lessons for research, use of iPads for reading, use of iPads to access social media platforms, use of iPads for visual learning, use for iPads to increase learning time. The above-mentioned uses will be expanded on in the subsequent sections.

4.7.1 One-to-One model of integration

The school uses a one-to-one model of integration. Each grade 11 and 12 learner was given a device that was pre-loaded with educational apps and textbooks. It is compulsory for all the learners to bring their devices from home to use in the

classroom. This is beneficial for the learners as they can customise it to their preference and use it at home for learning. Teacher 5 observes; *“The departments project has really been beneficial for us at the school because our learners would have never been able to experience these devices.”* This created uniformity in the classroom as all the devices have the same specifications, apps and textbooks.

The majority of the textbooks are pre-loaded but there are some subjects where learners still use physical textbooks. Teacher 3 says *“There are textbooks on their iPads but some of them are not appropriate so we still use the physical textbooks that has the content we need.”* This creates an impediment to using the iPads devices constantly in the classroom by the teachers.

The one-to-one model has been convenient for teaching as noted by Teacher 5 who teaches English and says: *“Each learner has their own device and it is very helpful when we are reading something because most of them will highlight the parts that are key for them in the text. They also are able to go back and read again and record themselves reading so I can correct pronunciation.”* Teacher 7 feels that *“if they were sharing devices they would just talk and not concentrate on what needs to be done in class.”*

4.7.2 Use of iPads for reading

The language teachers used the iPad mostly for reading. Learners have most of the textbooks and prescribed reading material on the iPads. This assisted the learners when they have to move around to another class as they don't have to carry many heavy books.

The teachers also used the recording apps to record the learners while they read text.

“The iPads made reading work easier as all the reading material is in one place and they [learners] don't forget their books at home now because they are all in there.”
(Teacher 7)

“The recording idea came from them [learners] and it works well for me. They record themselves when they read and then we play the recording and listen to it and I can correct their pronunciation” (Teacher 5)

4.7.3 Use of iPads for Internet Research

The iPads are also used for in-class and homework assignment research and learners use the iPads to access the internet. The internet gives them access to video tutorials, eBooks, 3D images, interactive educational websites and science experiments. The teachers agree that the availability of the internet makes teaching their subjects more interesting and fun for the learners. Teacher 4 affirms: *“Yes you will plan the lesson, a learner can ask a question and to give more understanding to them I would download a video on the iPad and we all watch it together to give them more insights and this also leads to more questions which makes the lesson fun for them.”* Teacher 3 also adds that: *“In my Economics class I give them a new topic to research prior to me starting with it in class. I have found that it gives them better context especially for those learners who prefer visuals rather than just me teaching them. So when I speak of monopolies in economics then they can always remember the story of Coca-cola on YouTube.”*

The internet provides the learners with educational support that they need when they are at home. Teacher 1 said that the learners struggled with doing assignments and homework after school hours. This is due to not having internet access at home and most parents could not help because they are not educated enough or due to parents being absent due to long working hours. Teacher 1 says: *“learners make sure that they download material from the internet so that they can use it to do homework or assignments before they go home from school.”*

4.7.4 Use of iPads to highlight important information

Teachers present the lessons on the smartboard but learners can access the presentation on their iPads. The teacher would share the presentation with them via a sharing app and they will receive it on their iPads. Teacher 3 says: *“When I present I will tell them the important sections and they can highlight those for them to focus for tests or exams.”*

This helps the learners to be able to know what to focus on for tests or exams.

4.7.5 Use of iPads for accessing social media

The use of iPads in the classroom has introduced social media to the teachers in interacting with the learners. Learners at the school have downloaded WhatsApp and

Facebook on their smartphones and used these social media platforms to communicate with each other. At the school this permeated into the classroom. Teachers found that because learners were used to communicating via these platforms so they downloaded these on iPads. The teachers were invited to be part of class groups and Facebook groups. This has had a positive impact as they can ask questions on the class WhatsApp group while at home and even if the teacher does not respond one of the learners can answer the question. The iPads have been useful as some of the learners do not have smartphones and can now also participate in the social media class groups. Facebook also has found teachers collaborations with other schools. Teacher 3 explains: *“I run a group with teachers from other schools and it has really helped our learners to collaborate. The teachers are from suburban schools and have more resources. They help our learners with questions as well. It has been very helpful.”*

4.7.6 Use of iPads for visual learning

A strong theme was the use of the iPad as a visual learning tool to learning. The teachers agree that in-class lessons have become more interactive and fun as the learners are able to interact with the content as opposed to the old way of the chalkboard.

In Life Sciences, Teacher 6 described using the Interactive Anatomy 3D to provide the learners with visual and interactive content. The app provides 3D images of the body. The learners can use the touch screen to select an organ on the body displayed on the app. The selected organ is displayed with its name and other information describing it. The learners can then zoom in and out of the image, rotate the organ, turn it upside down and change the view back and forth.

The educational app enables the learners to view the organs in the body and gives them better insight of the size of the organ and location in the body. The app also provides activities for the learners to do which assist in understanding the subject.

In the History lessons, Teacher 5 describes using YouTube in teaching Apartheid in the 1940s – 1960s. The video was a short documentary of the laws that were passed by the government against black people. Teacher 5 describes the video:

“The video explained the laws that created the townships where most black live in and laws that governed the daily life of black people. This created a very deep discussion in the class and led to many more questions. It also made them want to talk to their grandparents and parents about what was it like living during the apartheid times. It was a very fruitful class.”

This demonstrates how the learners were interested to learn in a simulated learning environment.

4.7.7 Use of iPads for increasing learning time

The teachers observed that most learners are encouraged to spend their free time on school activities. The learners come in before school starts or stay after school to work on their homework and assignments. The learners can still access the WIFI even if the classrooms are close.

“Even after school you will find that the children are still at school working on assignments.” (Teacher 1)

4.8 The teachers professional development

The teachers agreed that training was necessary for them to start using the iPads meaningfully in the classrooms.

“Mntanami [my child] I’m from the old days of the chalkboard so I needed to be taught how use these gadgets.” (Teacher 1)

“I needed training especially on the smartboard and the iPad because I had never used them at all in teaching.” (Teacher 3)

The training was a combination of the technical aspects of the iPad and also the educational apps that were preloaded on the learners’ iPads in order to use it effectively.

“It was important to know what the learners’ iPads would have and also what was on Cyber Schools (This is an e-learning platform that is pre-loaded on the iPads for the learners and teachers) so that I could understand what was there.” (Teacher 3)

It did emerge that even though the teachers were trained they did not feel it was adequate and that the facilitators were also not experts in the topic. Also the period to training was not sufficient enough.

“You know the people training us also did not know everything. They had to call other people to clarify the questions that we asked. And it was too short” (Teacher 4)

“The time we had to go for training was inconvenient because it was during holidays and we were not given enough notice. I didn’t like that.” (Teacher 2)

4.9 The teachers perception of the effect of the iPad in the classroom

The teachers who participated in the study agree that the overall effect of the iPad in the class has been positive. The changes they have observed in their learners was positive, as they were more engaged and interactive in the classroom. The notable effects experienced in the classroom is the availability of the internet and educational apps to enhance the teaching experience. The internet enables the teachers to find multi-media resources like YouTube that assist learners to visualize what they are learning. The educational apps. This resulted in the students becoming more engaged in class. The teachers’ also felt that they had enhanced their teaching by using the iPad. Even though the effects of the devices were not always positive as the learners would get distracted

“The iPads has given us a way to reach students better. Before it would seem like you are talking to yourself sometimes because they just looked blank.” (Teacher 5)

“The kids really enjoy them.” (Teacher 4)

4.10 The teachers perception of the benefits of using the iPad in the classroom

The teachers viewed the iPad as an important education tool to enhancing teaching and learning in the classroom. The iPads provide access to the internet, quality multimedia, educational apps and e-textbooks.

4.10.1 Access to multi-media resources

The teachers viewed the iPad as an important education tool to enhancing teaching and learning in the classroom. The iPads provide access to the internet, quality multimedia, educational apps and e-textbooks.

All the teachers responded enthusiastically to the iPad's ability to access quality multimedia resources like YouTube and educational apps. Prior to the introduction of iPads the teachers relied on board charts to try and help the learners visualise the content. These board charts were inadequate in most subjects for the learners as the quality was not good.

"I am not very creative so my board charts were quite boring for the learners so I would not use them after some time and they just hang and fade on the wall. And even the teaching aids did not helpful." (Teacher 6)

Teacher 6 emphasised how now in Life Sciences she can access high quality images on the apps and the internet. She also highlighted that the visual aspect assists learners who are visual learners.

"Interactive Anatomy has been such a good tool for me. Even the internet is helpful because I can find nicer pictures and I can share it with the learners" (Teacher 6)

It is apparent from the teachers' comments that the iPads have encouraged visual learning which is helpful for the learners who prefer visual learning than a teacher talking in front of the class.

4.10.2 Teachers not the only source of information

Before the iPads were introduced to the school, the learners relied on the teachers in providing the information for learning. The learners would ask questions that the teachers did not know the answers to. Teacher 2 admits that this generation was a

challenge as they have more information sources and expects immediate answers. Now that they have the iPads and access to internet, he can direct to google and that provides new learning opportunities for other learners. Teacher 2 felt that the iPad has reduced the pressure for him to know everything and he now involves the learners in answering the questions that they have on a subject.

4.10.3 Increase in learner involvement

The teachers have all remarked that using iPads in the classroom has increased the learners' interest and involvement in class. Prior to the introduction of iPads, the learners relied entirely on the teacher to provide all the information in class. Teacher 3 comments, *"Prior to the iPads, I did most of the talking in class. Now they feel more confident to add to what I'm saying with information that they have found on Cyber Schools or the internet."* In addition, the teachers noted that the learners were also asking more questions, which demonstrated interest in their subjects.

4.10.4 Independent learning and thinking

Teacher 5 noted that using the iPads in her English class has enabled her to stretch the learners thinking. Learners have dictionary apps on their iPads, access to English books for reading and YouTube channels dedicated to English grammar.

"Now when we do orals they can practice their speeches and ask their friends to record them. Also where they do not understand a word or grammar they have the resources to find the meaning of the word. Sometimes they even correct me." Teacher 5

The independent thinking in the learners is also enhanced by the study groups formed at school and online groups on Facebook and Whatsapp. These groups assist learners to exchange ideas. This results in the learners not just accepting the information the teacher shares with them but can compare with the information they have on their iPads. This is also related to the learners increased independence in thinking where they are able to find information for themselves.

4.11 The teachers perceptions of the challenges of using iPads in the classroom

Insight from the teachers' responses relating to the challenges of using iPads in class sheds light on the technological knowledge constraints, WIFI connection, lack of care for devices, learners coming to school without their iPads, distracted learners and theft.

4.11.1 Technical knowledge

Teacher 1 and 2 indicated that it has been difficult to know how to incorporate the iPad with their subject in class. They explained that they did receive training on how to use the iPad but because they had limited technical experience it was difficult to know what features of the iPad to use and when to use for their specific subjects. Teacher 1 and Teacher 2 have 32 and 28 years' experience teaching and for the majority of their careers technology did not feature in the classroom.

"We did go through the training. But you know at the training you do everything right then you get to your own class and you are just confused. " (Teacher 1)

"Remember I am from the time where we used chalkboards and the chalkboards were all removed from the Grade 11 and 12 classes, so I had to learn how to use these things." (Teacher 2)

The two comments above illustrate that the teachers needed technical knowledge in order to use the iPads effectively. The teachers were both assisted by learners when they were not sure what to do with the iPad and the smartboard.

Teacher 2 conceded that it was better for the old chalkboard to be removed as it forced him to learn to use the device.

"At first I thought it was very unfair of the old board to be removed. I was not happy. But it is actually good now otherwise I would have just used it and not these iPads." (Teacher 2)

Teacher 4 also explained that using the iPads required getting out of the comfort zone. They also shared that the technical knowledge strengthened as they started matching the technological affordances with specific learning outcomes they wanted to achieve in class. In Teacher 4's case when they start on the topic of excretion in Life Sciences

the Anatomy app would enable the class to see how the organs interact in the excretion process. This was where the technical affordance of the iPad were used effectively in the classroom.

4.11.2 WIFI connection

The WIFI in the school plays a major role in using the iPads. The teachers shared that often the WIFI would be offline and this disrupted the flow of the teaching schedule. Without WIFI the learners cannot connect to Cyber Schools or some educational apps.

The company supporting the WIFI would take time to resolve the issue and at times a whole week will pass without WIFI.

Teacher 5 shares: *“a whole day can be wasted and one time a week without WIFI.”*

In order to mitigate this issue the teachers requested to the ICT committee that they be given allowance to print learning material for the learners for the lessons to continue.

4.11.3 Learners leave iPads at home

It was also mentioned that some learners leave their iPads at home. This creates a problem in class, as now other learners have to share their iPads with the ones who did not bring them from home. Teacher 3 stated that *“This is like coming to school without a uniform.”* Teachers emphasised that the learners need to be more prepared and responsible because it delays the teaching if they come to school without their iPads. They also recommended that there be safes at school where the learners can leave their devices.

4.11.4 Learners lack of care for devices

The teachers all noted that the learners did not take very good care of their devices which made the devices vulnerable to issues. They noted that the learners dropped the devices and then the screen would crack. Some learners may over charge the iPad which results in overheating and they would use them for other things and not just school work. Teacher 6 narrates: *“One learner would lend his parents his iPad to take to church and eventually the iPad was lost and never recovered.”* In some cases, learners do not charge the battery while at home and the battery was depleted during class. The teachers recommended the school get a charging station for the learners to charge before and after school.

4.11.5 Distracted learners

The teachers also noted that a major issue was that learners would do other things on the iPad and not the tasks assigned for class. The learners will browse the internet, play games or use other apps that are not related to the class.

“Learners move away from what you are teaching/doing in class and they do their own thing on the iPad. Which now means I must be more vigilant in class to monitor who is doing what.” (Teacher 1)

It is evident that the teachers must be vigilant and monitor the activities of the learners on the iPad when they are in class.

4.11.6 Theft

Theft of the devices is becoming an issue at the school. The theft is community based as the community knows that the grade 11 and 12 learners have iPads. This puts the learners at the risk of muggings and other serious crimes such as rape. Teacher 1 explains: *“In our community we also have these boys on nyaope [drugs] so they will take anything that can give them money for the nyaope.”*

The teachers also noted that the theft was also happening at the school where the learners steal each other's devices. Teacher 3 notes: *“What happens is that one learner loses an iPad and they know it will not be replaced, then they steal someone else's. Now we are stuck with a problem of not knowing who is lying.”*

5. Discussion of the findings

This study explored the iPad affordances that influence the use of iPads in their teaching through the lived experience of teachers in one public school situated in a Gauteng township. The research sought to identify what affordances teachers perceived the iPad to have, to explore how the teachers use the perceived affordances of the iPads to support their teaching and to identify the benefits and challenges teachers experience in using iPads in the classroom.

The previous chapter presented the findings from the study at the school in an effort to explain the phenomenon as experienced by the participating teachers. In this chapter the findings reported in the previous chapter are analysed and distilled into conclusions. The discussion takes into account the context in which the school operates.

The school is a public in a Johannesburg township where the iPads are sponsored by the Gauteng Department of Education. In this regard the discussion of these findings will not seek to generalize the findings to a broader context as they might be unique to the school in the study. However, will be used to reflect on the applicability of the theory and make practical recommendations.

The following research sub-questions have been identified:

1. What affordances do teachers perceive the iPad to have?
2. How do the teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?
3. What are the benefits and restrictions teachers perceive of using iPads in a classroom?

5.1 Affordances teachers perceived the iPad to have

What affordances do teachers perceive the iPad to have?

The findings of this study are in line with keeping with the findings of previous studies that are conducted in affordance theory. The study found that teachers must identify for themselves the affordances the iPad has in order to use it in the classroom effectively. Toyama in his book asserts that “While PC’s can supplement good instruction, they don’t substitute for time with real teachers.” (2015, page 5) Liaw et al (2010) identified five affordances for mobile technology in education namely: “a)

educational content and knowledge delivery b) adaptive learning applications c) interactive applications d) individual applications e) collaboration applications.” Alyahya and Gall (2012) also reported six iPad affordances: accessing internet resources, access to written materials, organising the subject materials, presentation, note taking, and as a tool preparing assignments.

These affordances align to the study’s findings as the teachers used the iPads to access the internet, facilitating collaborations; learners use the iPad for reading, using it for presentations and learners used it to highlight important information.

This study found that the teachers perceived that the iPad could assist them with demonstrations, presentations, internet research, reading, highlighting important information, accessing educational apps and facilitating collaborations with other teachers and/or schools. This corresponds with the affordances found in existing literature as depicted in the table below:

Alyahya and Gall (2012) Affordances	Findings at the school
Accessing internet resources	Internet Research Facilitating collaborations with other teachers and/or schools
Organising subject materials	Reading Accessing educational apps
Presentation	Demonstrations and presentations
Note taking	Highlighting important information
Assignment preparation tool	Not found

Table 2: iPad Affordances used at the school

5.2 Teachers used of iPads in the classroom in teaching their subjects to their learners

How do the teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?

At the school the teachers use the iPads in accordance with the aspects that were stipulated in the White Paper on e-Education (DoE, 2004). Every day the devices are used to connect the teachers to the learners and to the internet for information. They allow teachers to share learning content with the learners, access educational apps for class demonstrations and communications. Teachers felt that the resources

afforded by the iPad assisted in teaching their curriculum and offered better information than some prescribed textbooks.

Most learners at the school come from homes where the parents are not able to help with homework due to the parents' lack of education, absence due to long working hours or substance abuse. The availability of internet access at school paired with the iPad partly overcame this challenge for the learners. This is in contrast with previous studies where most of the parents were actively involved with the learners' schoolwork and were able to purchase the devices for their children. In the studies by Yeow and Henderson (2012), Churchill, Fox and King (2014), Deaton, Inankovic and Norris (2013) and Alyahya and Gall (2012) the iPads were that were used by the learners and students were all purchased by the parents and the schools had Bring Your Own Technology models. It must also be noted that these studies were conducted in developed countries. The learners at the school now regardless of their background can access the internet for school activities.

The iPads were used at the school to advance the ICT strategy of the school of integrating technology in classroom. The school did have computer labs but this discouraged technology integration, as the labs were external to the classroom. Wade (2008) asserted that when technology is outside the classroom it was difficult for teachers to effectively use technology in their teaching in classrooms.

The educational apps installed on the iPads are enabling the teachers to provide the learners with opportunities for independent learning. If learners need additional information on a topic, they can search for the information on the internet that is powered by the school WIFI. The learners also use the school WIFI to download multimedia resources on their iPads to use when they are offline. This supports them when they are at home and need to complete assignments and homework. This contrasts with previous studies which were conducted in affluent school where the learners has access to the internet at home (Sackstein, 2013; Yeow and Henderson, 2012). Traxler (2010) further asserted that iPads are extending the learners time for learning. Learning is not only restricted in the classroom but can happen at break time or even after school hours.

At the school, iPads were used in conjunction with the smartboards. The teacher presented the lesson using the smartboard and their laptop; the learners could access

the teacher's presentation using the iPads. The learners could highlight the important points of the teacher's presentation and personalise it to benefit their learning needs. This endorses one of the affordances identified by Churchill (2012) of the iPad as annotating documents.

As stipulated in the White Paper on e-Education, technology diversifies the learning opportunities available and enables access to resources that would not be traditionally available at the school. This study supported the affordances identified in previous studies of iPad. This study identified four underlying factors that influence how teachers were using the iPads at the school: mode of integration, access to internet resources, and the way the iPads were introduced at the school, teacher technical training and teacher's subject objectives.

5.3 Mode of integration

There is no universal technology integration definition (Benton, 2012). The effectiveness of the using the iPads may be measured by the goals of the school or the teacher (Benton, 2012). This model encourages that the learners had a personal device, which is available to them anytime to promote ubiquitous learning (Benton, 2012). The learners can also personalise and organise the learning material to suit them for the year and also study out of class time using the iPad. This mode of integration was facilitated by the Gauteng Department of Education otherwise the majority of parents at the school would have not been able to buy their children the devices. In contrast the multi-user model there is limited use of the devices and use is limited to class time for the learners. The teachers would also be discouraged to use the iPads regularly as they would need to plan for specific lessons in order to accommodate group work. Henderson and Yeow (2012) also found that where learners are sharing iPads they become increasingly distracted and start talking to each other.

5.4 Access to internet resources

Nye (2006) suggests that technology is a combination of functions and how they are used. According to Earle in Harris (2005), “integrating technology is not about the technology. It is primarily about content and effective instructional practices. Technology involves the tools with which we deliver the content and implement practices in better ways. Its focus must be on both curriculum and learning” (p. 117). This implies that a device such as the iPad can only be used in the classroom if it enables teachers with tools to facilitate the teaching of the subject content. An iPad without subject specific content and related apps is useless to the teacher in this context.

5.5 The way the iPads were introduced at the school

The introduction of iPads at the school was through a Gauteng Department of Education initiative. Only Grade 11 and 12 learners were given iPads to use in their final years at school. The teachers in these grades were also given the devices. The old chalkboards were removed from the classrooms to make way for smartboards.

Even though the iPads were not introduced to the whole school, it yielded positive results for the Grade 11 and 12 teachers. The teachers were compelled to use the devices at the same time. The learners were also instrumental in assisting the struggling teachers with the devices because they themselves were using the devices. Technology integration is meant to be cross-curricular in order to be effective (Alberta, 2000).

5.6 Teacher technical training

In this study, the older teachers with less technological knowledge did not use the devices as much as the younger teachers with sufficient technological knowledge. The lack of technological knowledge was attributed to poor technical training given to teachers.

“We did go through the training. But you know at the training you do everything right then you get to your own class and you are just confused. ” (Teacher 1)

“Remember I am from the time where we used chalkboards and the chalkboards were all removed from the Grade 11 and 12 classes, so I had to learn how to use these things.” (Teacher 2)

The teachers all received the same training without being assessed about the level of their technical skills. The training was generic to using the iPad and not specific to their subjects. Thus it was difficult for the teachers to apply the technical training to their subject.

It was also noted in the findings that during the rollout of the smartboards in classrooms at the school, the old chalkboards were removed from the classrooms. This further entrenched the use of the iPad by the teachers. According to Ferrini-Mundy and Breaux (2008, p.437) “in the absence of professional development on instructional technology and curriculum materials that integrate technology use into the lesson content, teachers are not particularly likely to embed technology-based or technology-rich activities into their courses.”

5.7 Teacher’s subject objectives

The teachers’ that used the iPad effectively were noted to have key objectives that they wanted to achieve in each lesson meaning that they have specific learning outcomes they want to achieve

“When I was teaching them apartheid South Africa I googled for videos so that they can see how it was back then... lezingane [these children] have no idea. Bazi ooMandela [They just know Mandela]”

These goals were then supported by the activity on the iPads of the learners. According to Koehler et al (2014) teachers who understand their subject content and the teaching approaches might be enabled to accommodate the technology in the classroom. This knowledge helps the teacher find the right educational apps for their subject and assign the learners appropriate assignments where the learners can utilise the iPad fully within a learning context. Due to this finding the framework of the study was revised to include Teacher’s subject objectives.

5.8 The effect of iPad use in the classroom

How the teachers use the perceived affordances of iPads to support the teaching and learning of their subject to learners?

The iPad has been regarded as an enabler for education, shifting teaching from teacher-centred to learner-centred as it provides access to richer learning resources than would be available in a traditional classroom (NSW, 2012). The study findings indicated that at the school there has been an increase in learner involvement in learning activity due to access to the multi-media resources available in the educational apps loaded on the iPad. The multimedia resources enable the learners to gain better insight into the subjects taught in class as now teachers can demonstrate concepts in the subject content. This is especially key in a school that does not have a well-equipped laboratory for the subjects that require experiments and demonstrations.

In learning about Apartheid in History, learners are able to watch videos pertaining to how life was during that period and further discuss what they have learnt with the family members who lived during that period. This enables the learners to be actively engaged in what they are being taught by the teacher. Lindstrom (1994) noted that learners only remember 40% of what they see and hear but will remember 75% of what also participate in.

The use of the iPads to enables the learners remember more of the subject content they are taught as they are actively participating with the content on the as interactive apps and videos used to teach the subject. This echoes the Chinese proverb that says: "Tell me, I'll forget. Show me, I will remember. Involve me, I'll understand."

The study indicated that the learners were taking ownership for their own learning due to the iPads they have been given. The learners can access information on a subject on the internet or educational apps and do not solely rely on the teacher to provide information.

The use of the iPads has sharpened the independent learning and thinking skills in the classrooms at the school. Independent learning and thinking are related to critical, logical, reflective and creative thinking (King, Goodson and Rohani, 1998). According

to Dede (1990) learners develop independent learning and thinking in an environment where:

- a) Learners create knowledge rather than submissively receiving subject information from only the teacher.
- b) Superior information-gathering tools are used to stimulate the learner to focus on testing hypotheses rather than on plotting data
- c) There is collaboration with other learners

The above factors were reported by the teachers at the school. In the English class, the teacher noted that the learners used the iPads to record themselves when reading. After school they would share the recordings of their readings amongst themselves in order to get feedback from their peers and discuss the set workbook they are exploring in class. They then find resources to help with an aspect of the work done in class and further compare and contrast what the teacher said in class and what they have found

In the Life Sciences class, the teacher gave them an assignment to research about organ donation. This enabled the learners to learn about a topic which most of them would have not thought about. The teacher was able to promote the learners independent thinking by giving them this assignment. The learners were able to form their own opinions on organ donation.

The iPad also increased collaboration between the learners through small-groups after school and online groups on Whatsapp and Facebook. The learners worked together to their knowledge. The class sizes did limit the teachers, as some classes were too big to enable group work as the learners become too noisy and become distracted.

5.9 Benefits using iPads in the classroom

What are the benefits and restrictions teachers perceive of using iPads in a classroom?

The iPad provides the teachers with high quality multimedia teaching resources to use in teaching their subject. As a result the learners become more motivated to learn (Amelito, 2010; Li and Pow, 2011).

The findings in this study confirmed what previous literature has found. The teacher participants expressed their thoughts that using the iPad has enhanced their teaching

in a positive manner. The availability of educational apps enabled the teachers to have quality teaching aids to use in teaching their subjects.

Teachers noted that learners also benefited from the iPads size and light weight. It enabled them to move around unencumbered by heavy text books. The availability of educational apps and other resources enable the learners to download what they need on their iPads and use them when they are home. This has been a big advantage in a school where most learners do not have access to internet in their homes.

5.10 Challenges of using the iPad in the classroom

What are the benefits and restrictions teachers perceive of using iPads in a classroom?

The study uncovered some challenges the teachers were experiencing in using the iPads which echoed some that have been found in literature (Becta, 2004; Harmon, 2012; Leow and Henderson, 2012). WIFI connection, technical knowledge and distracted learners were some of the most pertinent to the teachers. Other notable challenges include learners who did not charge their devices or did not take care of them properly and theft of the devices.

5.10.1 WiFi connection

An unreliable WIFI connection made using the iPads difficult for the teachers. At times the WIFI is offline and resolution takes time and there is a loss of teaching time. This disrupts the teaching schedule as teachers use the iPad daily to access educational apps and Cyber Schools (Becta, 2004).

5.10.2 Technical knowledge

The teachers were taken for training but some of them felt the duration allocated to the training was insufficient. The teachers need the technical knowledge on the iPad functionality in order to use them effectively in the classroom.

5.10.3 Distracted learners

The teachers participating in the study raised the concern of distracted learners in the classroom. Games and social networks were the distractors for the most of the learners in the classroom (Leow and Henderson, 2012).

5.10.4 Lack of care for devices from learners and not charging prior to class

The teachers noted with concern that the learners were often negligent of their devices which made the devices vulnerable to screens cracking and battery problems. The learners at times allowed unauthorised people to use their devices when they are home which led to further neglect. The teachers felt that the learners used the devices during the night and this resulted in the iPad to not be charged sufficiently in time for class. The result would be that the battery would die during class and then they have to share with another learner.

5.10.5 Theft

The theft of devices was on the rise in the school and outside school. In school the learners steal each other devices. Outside school, the community knew that some learners had iPads and these were stolen to be resold to get money. This made the learners vulnerable to other serious crimes besides theft.

5.11 Updated Conceptual Framework

The conceptual framework was revised to include one concept as it emerged from the findings of the study. The conceptual framework has six co-dependent concepts namely; affordance existence, teacher affordance perception, teacher subject objectives, classroom effect, implementation models and issues.

The main proposal of the framework is that affordance actualisation is determined by the perception of affordances and the effort required in the actualization and contextual issues that are present for actualization to happen (Bernard and Recker, 2013).

Affordance perception is a result of the user interaction with the object and the emergence of affordances as a result. In this case the teacher would be required to interact with the iPad to form perceptions of its affordances (Volkoff and Strong, 2013).

Teacher subject objectives together with the teachers' affordance perception enable actualisation to occur. The teachers' that used the iPad effectively were noted to have key objectives that they wanted to achieve in each lesson. (Koehler, 2013).

Implementation approaches refers to whether it will be a one-to-one model, multi-user model or small group model. The model used may depend on the availability of the resources for the school and the teacher's intention with the lesson.

The classroom effect will be determined by how the teacher uses the iPad in their classroom.

6. Conclusion and Future Research

The main purpose of the study was to explore the affordances that influence iPad use by teachers in the classroom and effect this has of the teaching and learning of their subjects. Based on the findings, the following are discussed in this chapter; Summary of Research Questions, reflections of the researcher, theoretical and practical contribution and future research.

6.1 Summary of Research Questions

The study aimed to explore the perceived iPad affordances that influence teachers' use of iPad devices through the lived experience of teachers at a school located in a Johannesburg township. The study identify the affordances teachers perceive the iPad to have which result in the teachers using the devices in their classrooms to support their teaching and the learning of their students. The study also aimed at determining the benefits and restrictions the device afforded to the teachers.

The main research question that I attempted to answer were:

- What affordances do teachers perceive the iPad to have?
- How do teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?
- What are the benefits and restrictions teachers perceive of using iPads in a classroom?

This study found that the teachers perceived that the iPad could assist them with demonstrations, presentations, internet research, reading, highlighting important information, accessing educational apps and facilitating collaborations with other teachers and/or schools. iPads provided the teachers and learners with quality multimedia to enhance the teaching and learning of topics, which were previously difficult to teach and learn. They provide learners with timely access to information; as a result, learners engage with content and learn any time and from anywhere. The integration of iPads promoted a shift towards learner-centred teaching approaches.

At the school the availability of internet resources and educational apps have enabled the teachers to find rich content to assist them in teaching their subjects. In turn, learners can access Cyber schools and interact with the content shared by the teachers to their iPads. This results in learners spending more time on learning activities, which in turn encourages independent thinking. The interaction of teachers and learners is also facilitated by Facebook and WhatsApp groups, which further encourage interaction between teachers and learners during and after school.

6.2 Reflections of the researcher

Due to my academic and professional background in the Information Systems space, my strong belief that teachers should adopt iPad technology in the classroom in order to enhance their teaching. During the research process, I have come to appreciate the complexities of balancing teaching and incorporating technology in the classroom.

This study was limited as it was only a single school case study due to time constraints for the researcher who is a full-time employee and part-time student and for further research, a multi-school study including private schools could be conducted to explore how teachers in better resourced schools use the iPad and also apply the affordance theory in the educational context.

6.3 Theoretical and Practical Contribution

One of the notable findings to emerge from this study is that iPads have great potential to transform teaching and learning. iPads provided the teachers and learners with quality multimedia to enhance the teaching and learning of topics, which were previously difficult to teach and learn. They provide learners with timely access to information; as a result, learners engage with content and learn any time and from anywhere. The integration of iPads promoted a shift towards learner-centred teaching approaches.

Theoretically the study was able to show that affordance theory is applicable in the context of a South African public school. The teachers were able to identify the affordances that they perceive the iPad which enable them to use the iPads in their teaching. The study also uncovered that for the teachers to actualize the affordance they must know the objectives they wish to achieve in class for the subject to be taught. This illustrates that the iPad merely enhances the teachers' subject content. This resulted in the conceptual framework being amended to include the teacher subject objectives. The implementation model of one-to-one enabled the teachers and learners to personalise their iPads and this extended learning time even outside of school hours for the learners. They noted that when learners shared iPads they were generally more likely to be distracted. The effect on the classroom was generally positive supported by the benefits the teachers shared in the study.

Practically the study suggests that the technical training for the teachers should be subject-content specific in using the iPad so that they can use effectively when teaching. The textbooks and educational apps loaded on the iPads for both the teacher and learner must be relevant to subjects for the iPad to be optimally used. The school with the assistance of the GDE must address the issue of wireless connection that is erratic at time with no reliable technical support on hand at the school. The school needs high speed connectivity within the school at all times during school hours and minimise outages. The bandwidth should also be reasonable to facilitate a speedy connection. Teachers must also be trained in trouble –shooting in order to resolve minor issues quicker.

The school with the assistance of the GDE must address the issue of wireless connection that is erratic at time with no reliable technical support on hand at the school. The school needs high speed connectivity within the school at all times during school hours and minimise outages. The bandwidth should also be reasonable to facilitate a speedy connection. Teachers must also be trained in trouble –shooting in order to resolve minor issues quicker.

The school with the assistance of the GDE to provide the school with a charging station where learners can charge their devices while at school should they not be able to at home. This will increase learning time and discourage learners sharing devices due to one learner not charging their device. The school with the assistance of the GDE to provide secure lockers at the school for safe keeping of the devices to avoid misuse of the devices by unauthorised people and reduce the theft of the devices both at school and outside school.

6.4 Future Research

As this study only addressed a small sample of teachers at a single township school; it would be beneficial to explore this study in other township schools that have been allocated by the GDE.

Future studies can also include the learners to contrast their views with that of the teachers. The theme of how social media impacts teaching in the classroom should also be considered for further research.



7. Appendices

7.1 Appendix A – Teacher Interview Schedule

No	Interview question	Research question
1.	<p>Affordance Existence</p> <ol style="list-style-type: none"> 1. Describe your experience using an iPad. 2. How does it compare to other technologies you have used in your teaching? 	<p><i>What affordance do teachers perceive the iPad to have?</i></p>
2.	<p>Affordance perception</p> <ol style="list-style-type: none"> 1. What challenges do you face when using this technology? 2. Please describe your personal experience of using the iPad? 3. What challenges do you face when using this technology? 4. How does it compare to other technologies you have used in your teaching? 5. How do you go about choosing educational apps for your subject? 6. What challenges do you face when using this technology? 	<p><i>What affordance do teachers perceive the iPad to have?</i></p> <p><i>How do teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?</i></p>

<p>3.</p>	<p>Issues</p> <ol style="list-style-type: none"> 1. What challenges you are likely to encounter when implementing iPads in your teaching? 2. What hints would you give other teachers wishing to implement iPads in their teaching? 3. Anything else that you would you want me to know about use of iPads in the classroom? 4. What are the benefits do the learners experience? 	<p><i>What are the benefits and restrictions regarding teachers lived experiences of using iPads in a classroom?</i></p>
<p>4.</p>	<p>Classroom Effect</p> <ol style="list-style-type: none"> 1. What benefits or challenges have you encountered when using the iPad in your classroom? 2. What challenges do you face with the learners with using the iPad 	<p><i>How do teachers use the perceived affordances in iPads to support the teaching and learning of their subject to learners?</i></p>

7.2 Appendix C – WITS Ethics Clearance

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<small>School of Economic and Business Sciences Private Bag X3, WITS, 2050, South Africa • Telephone: +27 (0) 11 717 8004 • email: Siyabonga.Molaba@wits.ac.za</small>	
<u>CLEARANCE CERTIFICATE</u>	<u>PROTOCOL NUMBER: CINFO/1135</u>
<u>PROJECT:</u>	TEACHERS' USE OF IPADS IN THE CLASSROOM IN A SOUTH AFRICAN PUBLIC SCHOOL
<u>INVESTIGATOR:</u>	Vuyo Lupondwana
<u>STUDENT NUMBER:</u>	397117
<u>SCHOOL:</u>	SEBS
<u>DATE CONSIDERED:</u>	29 June 2017
<u>DECISION OF THE ETHICS COMMITTEE:</u>	Approved
<u>NOTE</u>	
Unless otherwise specified this ethics clearance is valid for 1 year and may be renewed upon application. Please remember to include the protocol number above to your participation letter.	
<u>DATE:</u> 14/07/2017	<u>CHAIRPERSON:</u> Jean-Marie Bancilhon
cc: Supervisor: Dr Emma Coleman	
	SCHOOL OF ECONOMIC & BUSINESS SCIENCES

7.3 Appendix D – Transcribed Interview

Interviewer: Vuyo Lupondwana

Interviewee(s): Teacher 1

Date of Interview: 25 October 2017

Start time of interview: 09:29am

End time of interview: 10:05am

Location of Interview: High school in Johannesburg (East Rand)

Interview Topic:

Vuyo: Just an introduction, mna I am Vuyo Lupondwana, I am doing my Masters research at the University of the Witwatersrand. I am under the department of Information Systems. iUndergrad yam I did at the University of Pretoria which was in Informatics. Informatics looks at how technology and people interact to form an information system.

My research looks at teachers what influences teachers (key features) use of iPads in their teaching.

So firstly how long have you been a teacher:

Teacher 1: Mntanami [My child], I have been teaching for 32 years now

Vuyo: And what subjects do you teach?

Teacher 1: Maths and Computer Studies

Vuyo: Have you had any previous experience of using iPads before being given one at school?

Teacher 1: Yes I really enjoy using technology. These are my things wena [laughs] but I did not have an iPad.

Vuyo: What affordances (affordances are like specific functions of the device in this case iPad) support you in your teaching?

Teacher 1: In my case, the ability to download videos (I teach LO), from YouTube or from any other source. Because learners can relate with what they can see. They can do what they have just seen practically. And sometimes use it with the smart board.

Teacher 1: I normally create powerpoint slides on my laptop then project on the smart board. The iPad is helpful when I want the learners to do their own research.

Teacher 1: When were learning about plants, we would go outside and they can take pictures say of a dichotomous plant for them to see practically what I just taught them. I could give them assignments to make sure they understand what I have taught them.

Vuyo: What new learning opportunities does the iPad afford the learners?

Teacher 1: You see in the past and most my teaching career we have to draw on the board with chalk. This is not effective as the learners do not have a true picture of what you are talking about in 3D. Now they can download videos which makes your subject come alive and for them to understand the real life scenarios.

Vuyo: Do you have educational apps that you use to enhance your lessons/teaching?

Teacher 1: The smartboard and iPad already have pre-installed applications. Cyber schools and EMI books are already pre-installed.

Teacher 1: At the same time, there is a challenge as they (Department) gave us the books that they want and the books that we want and use. You will find that there is a specific book that we use to teach Life Orientation and it is not there on the iPad for the learner. There is no continuity with what I'm teaching them and what is on the iPad.

Vuyo: What challenges do you experience with using the iPad?

Teacher 1: Learners move away from what you are teaching/doing in class and they do their own thing on the iPad. Which now means I must be more vigilant in class to monitor who is doing what.

Teacher 1: Fortunately it is easy to see that this learner is not with you because their behaviour shows.

Teacher 1: Also it's a problem when the learner's device doesn't work anymore. Then they can do things alone, they need to pair with another learner. Which sometimes

leads to disruption. Even with the smartboards they sometimes don't work and they take time to fix them.

Vuyo: Do you not have back up for the smartboard – say like the old chalkboards?

Teacher 1: Not at all, they removed them. So teaching stops. In one instance it was more than 3 weeks in my classroom where the smartboard was not working.

Teacher 1: As we are trying to integrate ICT into our teaching, other people who are technology shy will just continuously use the normal chalkboard/ normal lesson plans what they see that the technology is faulty. They also don't try and find ways to use the device in their teaching and you find learners lag in the use of ipads from their class mates. So there were right to remove all the chalkboards.

Teacher 1: It will be better to have mobile smartboard.

Vuyo: Are all the classes smart?

Teacher 1: Only Grade 11 and 12 classrooms.

Vuyo: Do all the learners have iPads?

Teacher 1: Only Grade 12s.

Vuyo: What benefits do you experience when using the iPad?

Teacher 1: It's easier to share content with the learners.

Teacher 1: It doesn't only stop in the classroom. They also continue working from home. We even created a Whatsapp group where we communicate after hours should they experience a problem.

You can record your lesson on the smartboard when for example

Vuyo: Do the learners take care of their devices?

Teacher 1: I can say out of 10 learners only 3 will take care of their devices. The rest of them will download movies there and all sorts of rubbish. We are aware of it and we monitor it closely?

Teacher 1: Others will come to me and say they are not working even though they have been told how to take care of them, like they cannot charge it for more than 3

hours otherwise they overheat and the battery expands. The screens crack or the touch thing doesn't work anymore. They were advised to buy pouches but they will say parents do not work blah blah.

Vuyo: What hints would you give other teachers?

Teacher 1: The benefits are many and fun. It makes life easier.

8. References

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