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Technology integration and the digital divide: Understanding factors that impact on educators' ability to integrate technology in South African classrooms

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfillment of the requirement for the degree of Master of Business Administration.

7 November 2016

ABSTRACT

Information and Communications Technology (ICT) investment in education is growing steadily in many countries, yet ICT adoption and integration in teaching is still in its infancy. In particular, in South Africa, only 26% of educators have basic ICT skills. This alarming statistic means that educators are ill positioned to impart digital skills to their learners. Consequently, failure to address these challenges may result in the widening of the digital divide in South Africa, with an inability to work in the knowledge economy.

Thus, the purpose of this research was to explore the nature and extent of technology integration in South African classrooms, from the perspective of educators. In particular, the study examined five factors. These were educators' attitudes towards ICT; their digital capabilities (knowledge and skills); the extent to which they had been formally trained in ICT, what digital resources they had at their disposal, as well as what type of institution type they worked in, in order to determine if institution impacts on ICT adoption. Using a combination of explanatory and causal research design, data was collected from 66 educators using an online survey. Due to the nature of the data collection instrument, the participant profile was that of well-resourced educators (in terms of digital resources) working mostly in private high schools. Thus, findings are confined to this group.

It was established that the participants had positive attitudes towards technology, and its use in the classroom. In particular, positive educator attitudes and access to ICT resources promoted the adoption of ICT in the classroom. However, limitations in terms of the range of respondents meant that no statistically significant relationship could be found between institution type and ICT adoption, although the descriptive statistics indicated that this could well be so. However, training and professional development were severely lacking and so this is the greatest barrier to the integration of technology into the classroom. In particular, most educators were self-taught in terms of ICT and, thus, displayed only a surface level of competence, with basic skills in place but advanced skills absent. These findings illuminated the need to intensify efforts to provide training to develop digital skills for educators. Active engagement of educators is at the epicentre of addressing the demands of the digital native learner.

Keywords: Digital divide; Digital natives; Educators; Information and Communication Technology (ICT)**;** Teacher training; Technology Integration

ABBREVIATIONS

BI	Behavioural Intention
DBE	Department of Basic Education
DC	Digital Competence
DLM	Digital Learning Materials
DT	Digital Training
GDE	Gauteng Department of Education
HEI	Higher Education Institution
ICT	Information and Communication Technology
MBP	Integrated Model of Behaviour Prediction
NDP	National Development Plan
NEPAD	New Partnership for African Development
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SDT	Self Determination Theory
TAM	Technology Acceptance Model
TPACK	Technological Pedagogical and Content Knowledge

DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Thubelihlelenkululeko Zonke Mashile

07 November 2016

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CHAPTER 1: INTRODUCTION TO RESEARCH PROBLEM

"The impact of digital technologies is now felt not only in the IT department, but across the entire organization, creating a huge demand for digital skills."

Capgemini Consulting, The Digital Talent Gap

1.1 INTRODUCTION – RESEARCH BACKGROUND

Even with Information and Communications Technology (ICT) investment in education consuming a growing share of most nations' investments, ICT adoption and integration in teaching still lags behind desirable levels, (Buabeng-Andoh, 2012). Schools' underperformance in this regard has resulted in an amplified call to understand the factors that influence effective ICT integration in schools. Most specifically, it is important to review the experiences of educators, and the role that they play in the digital skills ecosystem. Rapid changes in technology have fuelled shifts in teaching and learning. These shifts have mostly been aimed at improving educators' efficacy, and educational outcomes for learners, (Gomleksiz, 2004). With this changing context, educators have an enormous role to play in equipping leaners with ICT literacy that enables them to compete in the knowledge economy and meet the evolving challenges and demands posed by the 21st century, (Mahmud & Ismail, 2010).

The shifts in teaching practices, from chalkboard and chalk to digital tools, have vast implications for the pedagogical habits of educators. Due to the rapid pace of development in ICT, most learners no longer rely on educators as their primary source of knowledge and information. For learners with access to digital tools, information is abundantly available at all times, (Mahmud & Ismail, 2010). ICT tools have introduced a new paradigm of modern learning, (Raboca & Cãrbunãrean, 2014). Considering the wealth of possibilities offered by the use of ICT in education, technology is quickly cementing itself as a critical and integral part of school curriculum, (Tezci, 2011).

Due to this changing landscape, the role of educators has become plenary, with multiple facets ranging from facilitation to managing and coordinating of learning resources and outcomes, (Mahmud & Ismail, 2010). However, even though the availability of computers in schools has increased, the use of ICT and its integration for learning purposes remains worryingly low, with most educators questioning the value of ICT in their classrooms, (Drent & den, 2008). Against this backdrop, a question that is repeatedly asked by

scholars is whether educators have the prerequisite skillset to drive technology integration in their classrooms. By extension, do optimal conditions exist in schools that aim to enhance student learning, while simultaneously squeezing the digital divide?

The technological age has undoubtedly unleashed a myriad of challenges and opportunities. There is an increasing suite of technology solutions that aim to deliver unparalleled access to information. These fundamental shifts have placed demands on countries looking to remain competitive on a global stage. Key national assets that can be leveraged in driving economic competitiveness are the education systems and institutions. Education systems and institutions play a critical role in ensuring that technology integration is achieved in schools led by educators, positioning millions of learners to be equal and active participants in knowledge economies.

Wolhuter (2014) shed some light on the evolution of economies, positing that in the current era of the neoliberal globalised world economic order, availability of natural resources has been relegated as one of the key factors of national stature and competitiveness, with national education systems becoming increasingly important as an element of national power. By inference, human resources and skills have become an important aspect of economic competitiveness in this new and evolving international context, (Wolhuter, 2014). The global economy is now characterised by rampant technological developments, highlighting the need for society to keep abreast with these developments. To maintain competitiveness in this digital context, nations are obliged to iteratively review the quality and relevance of their education systems.

For that reason, numerous national governments invest significant resources to advance their global competitiveness, and South Africa is no different. In the National Development Plan (NDP), South Africa has set itself impressive and very bold targets for 2030, spanning across economic, infrastructural, environmental, educational, and health sectors, (National Planning Commission, 2011). However, with respect to attaining education goals, South Africa faces a number of challenges, including poor quality educators, and unequal distribution of physical resources such as libraries, laboratories, and computers.

This study seeks to advance understanding of the factors that hinder or advance South African educators' efforts in integrating technology in their classrooms.

1.2 RESEARCH RATIONALE FOR THE STUDY

The purpose of this research study is to explore and understand factors that impact on educators' ability to integrate technology to bridge the digital divide in South African classrooms. To aid this objective, the study will define enablers and barriers to effective integration of technology in the classroom, and outline the state of technology integration in South African schools.

Educators play a pivotal role in nation building. They are at the epicentre of most educational activities in most nations. For that reason, their societal and economic value-add cannot be underestimated. Trends continue to show that educator efficacy is directly linked to how quickly educators adapt to shifts in education systems, including the introduction of digital media as learning tools. However, trends suggest that most educators battle to keep up with the technology and digital demands of their school environments. Prensky (2001), a preeminent author on the subject, shed light into one of the reasons for the slow pace of ICT integration in classrooms. The research cited the emergence of 'Digital natives as learners', which most schools haven't consciously addressed. 'Digital natives' are a generation of learners that have been raised with and have access to a myriad of 'digital toys', and modern technology tools such as computers, videogames, digital music players, video cams, and cell phones, (Prensky, 2001, p. 1). By extension, institutions that provide training to educators must ensure that educators are able to engage with these 'Digital Natives', (Kivunja, 2013). That is, they need to become 'Digital Native Educators', who are described as fervent users of technology, pioneering the adoption and integration of technology use in the classroom, (Hudgins & Anderson , 2015).

In a classroom of digital natives, information is consumed in a fundamentally different way than that of 'Digital immigrants', (Hudgins & Anderson , 2015). Prensky (2001) defines 'digital immigrants' as people who have to learn this new digital language and way of being. Another challenge is that newly graduated educators must work with peers who are digital immigrants. Finally, these newly minted educators in South Africa will also find themselves in a diverse classrooms. Some will be filled with 'high tech' equipment such as smartboards and ubiquitous WiFi, while others will have scant resources, where the 'basics' such as media and published materials (textbooks) are few and far between. Thus, educators must be able to operate in very different situations.

This background builds the case for the urgent need for educational efforts aimed at integrating technology in classrooms. There is no denying that the digital age has added

complexity to how educators function and perform at schools, (Tezci, 2011; Cervera & Cantabrana, 2015). Traditionally, the responsibility of imparting and using technology in the classroom resided with information systems instructors. This responsibility has now shifted to educators, (Hsiao, 2012). Even with increased access and training on technology, technology is still not being leveraged as a powerful teaching aid, (Ertmer & Ottenbreit-Leftwich, 2010). Arguably, educators should be the agents of change when it comes to technology integration, (Ertmer & Ottenbreit-Leftwich, 2010) but many do not have the prerequisite ICT literacy to respond to learners' needs and expectations in the classroom, (Hew & Brush, 2007). As a result they fail to prepare their learners to be participants in a knowledge society, (Uzunboylu & Tuncay, 2010).

Research further found that even with all the advances that have been made in equipping educators with technology, and the value of integrating it in the classroom, most educators still do not effectively integrate technology in their classroom practices, (Tezci, 2011). It is paramount that educators are able to prepare learners for the knowledge society in which the skill to effectively use ICT to attract and interrogate information is of utmost importance, (Drent & Meelissen, 2008). With the dawn of the knowledge age, educators are expected to integrate technology in their classroom, with the aim of enriching the learning environment, (Gomleksiz, 2004).

These developments signal a significant shift in learning preferences, which, necessitates an evolution in learner-educator, and educator-educator engagement practices. Existing literature does not present a uniform view of digital natives, particularly in the area of teacher preparation programmes. Understanding technological trends and their related applications in the classroom warrants a relook in education sectors, (Hudgins & Anderson, 2015). The concept of digital natives as educators is not well researched. Most of the literature looks at digital natives as learners, but little attention has been given to digital natives as educators, (World Economic Forum, 2014). Krumsvik (2014, p. 269) suggests that digitisation of teacher education' is still in its infancy, representing a new pedagogical terrain for academia, particularly in the South African context.

The South African government, through the *Operation Pakisa* initiative, has recognised the urgency of addressing the digital divide in South African schools, (Enca, 2015). The *Operation Pakisa* initiative aims to roll out broadband internet connectivity to all schools by the year 2020, removing internet connectivity as a barrier to information access. Given that only 28% of South African schools had access to a computer in 2014, there is little

doubt that this is a very bold ambition, (Enca, 2015). The magnitude of this challenge is exacerbated by poor levels of digital competence amongst educators. According to the Department of Basic Education (DBE), only 26% of South African educators have basic ICT skills, with only 7% of educators an intermediate competency level, (Alfreds, 2016). These are poor statistics by anyone's standards, especially for a country that has been vocal about ensuring that digital education is a national priority to support the rollout of 'paperless' classrooms, (Alfreds, 2016).

To drive governments' ambition of digital or smart or classrooms of the future as they are commonly called, in 2014 the Gauteng Department of Education (GDE) announced a R17 billion five year investment in paperless classrooms, with pilot phases well underway, (South African Government, 2015). Together with the recent launch of online school registration by the same department, (TMG, 2016), there are clear indications that South Africa has woken up to the need to address the digital divide in schools. These developments present fertile ground for this study. The above government programmes will see the launch of eLearning in all township and rural schools by end of 2018. Similar initiatives are emerging across several provinces in the country. The New Partnership for Africa's Development (NEPAD) has joined the urgent call to address the digital divide in education through the development of support structures, and regulatory frameworks positioned to accelerate internet access at schools, thereby infusing ICT as part of normal school activities, (Mayaki, 2010). The wave of initiatives by NEPAD are an acknowledgment of the efficacy of ICT in accelerating economic growth and development, (Mayaki, 2010).

It is, therefore, evident that for learners to thrive in the new educational environments, educators must assist their learners to become conversant with eLearning and eWorking technologies, (Kivunja, 2013). It could be argued that to optimise the return on investment in smartboards and tablets by the South African government, understanding of the factors and conditions that lead to optimal technology integration in classrooms, coupled with the upskilling of the current and future base of educators is critical. Upskilling enables the educators to engage effectively with technology.

However, research on the state of technology integration in South African classrooms, as well the factors that impact the educators' ability to integrate technology remains limited. This study is, therefore, timely, as it will contribute towards these existing gaps in research by elaborating on educators' perceptions of technology integration in their

schools. These educator perceptions will be grounded in factors, which either hinder or advance technology integration efforts, identified from reviewed literature in Chapter 2.

1.3 BUSINESS RATIONALE FOR THE STUDY

ICT has a significant role to play in fostering human development, however, the human development benefits associated with ICT can only accrue to those privileged enough to have access, (Kozma, McGhee, Quellmalz, & Zalles, 2004). The human development benefits brought about by ICT and technology innovation in general are twofold. Firstly, at a micro level, technology innovation can enhance human capabilities by allowing individuals to be active participants in all aspects of their lives, such as social, educational, economic and political life. Secondly, at a macro level, technology innovation and integration can be levered to support and even advance economic growth and the development of a highly skilled workforce, (Kozma et al., 2004). A combination of these two factors creates a perpetual circle that can drive down poverty and enhance human conditions in the long term, (Kozma et al., 2004). At the turn of the 21st century, several countries intensified their efforts on the utilisation of ICT for acceleration of economic growth, (Mahmud & Ismail, 2010)

These two reasons, particularly the second one, affirms the need for business to pay attention to the advances in technology as these developments may directly impact the supply and quality of the labour force. Schools are known to be key suppliers of labour and, as a result, play a critical role in this value chain. Ideally, initiatives aimed at driving a technology culture need to commence at grass root levels, namely, in schools.

These views are supported by the World Economic Forum (2014), which posits that skills are a critical asset for individuals, businesses, and societies. Further, the report argues that even though building these basic skills early on is paramount, what is most crucial is the alignment of skills nurtured at school to the demands of the world of work. This sentiment is shared by Capgemini Consulting (2012), who highlight the alarming and unprecedented shortage of digital skills in the marketplace. Additionally, innovations targeted at education technology are starting to yield benefits in enhancing learning outcomes and helping to address the skills gap by developing skills required in the 21st century world of work, such as communication, collaboration and creativity, (WEF, 2015).

Therefore, the value of developing skills aligned with the business requirements is of utmost importance. The lack of this alignment results in a skills gaps/mismatch. A persistently high skills mismatch is costly for all labour stakeholders and society at large,

(World Economic Forum, 2014). It is often argued that this mismatch is a material contributor to rampant unemployment in South Africa, particularly amongst the youth. Aligning educators' technological competence to learner and labour demands will narrow the skills gap. The ability to navigate the digital world is a skill that has become a prerequisite for entering the labour market. The absence of this skill has led to what is now known as the digital/knowledge gap among educators.

1.4 RESEARCH SCOPE

The objective of the study is to explore and to deepen understanding of the nature and extent of technology integration, aimed at bridging the digital divide, in South African classrooms. The scope of the research study will focus on the perceptions of educators on the state of technology integration in their classrooms and will aim to articulate some of the factors that influence ICT integration in their environments. To aid this objective, the study will define enablers and barriers to effective integration of technology in the classroom, and outline the state of technology integration in South African schools.

In the context of this study, educators are defined as preservice teachers and inservice teachers between kindergarten and Grade 12 (Matric), as well as lecturers at institutions of higher learning. Unlike most theories on ICT, this study will focus on ICT as a medium for teaching and learning, rather than as an object of study. Further, the study will aim to provide insights into how the digital skills divide is being bridged in school learning.

1.5 RESEARCH MOTIVATION

South Africa is now ranked 49th out of 140 countries in the recent global competitiveness rankings, although the country continues to face material challenges (World Economic Forum, 2015). In spite of high rankings in the areas of innovation (38th), effective financial markets (12th), solid goods market (38th), vibrant domestic competition (28th) and strong institutions (38th), the nation still struggles with corruption (76th), the burden of government regulation (117th), security (102nd), inefficient electricity supply (116th), and an inflexible labour market (107th), (World Economic Forum, 2015). Of concern for this study is the quality of education (120th), an indication that our education system is not geared to produce the skills required to compete globally, (World Economic Forum, 2015). It is against this background that the focus on education, specifically educators' efficacy, is heightened.

Further, the evolution of learners in the digital era lends credence to the need for this study. Learners now source and consume information and acquire knowledge from digital platforms. In addition, access to massive amounts of information or data is possible in an instant, meaning that it can infiltrate a classroom at rampant speeds. Thus, educators confront a multitude of challenges when they teach a “connected or digital” classroom or teach the “wireless” generation. There is less knowledge or information sharing and more knowledge or information management. Educators need far more knowledge in their discipline than ever before. Along with digital hardware, digital competency is necessary to ensure that technology is used to supplement high-quality instructional methods. In 2011, the International Education Advisory Board went as far as claiming that effective educators using digital technology would be the most prolific educators in the 21st century, (International Education Advisory Board , 2011).

This research paper is organised into seven chapters. The preceding chapter introduced the subject of the study by outlining the research and business rationale for the study. Further, Chapter 1 presented the scope and motivation for the study. Chapter 2 will review pertinent literature on the theme, while Chapter 3 will advance research questions and hypotheses that emanate from the literature discussed in the second chapter. The fourth Chapter will discuss the research methodology adopted to achieve the research objectives of the study by answering research questions and hypotheses tabled in Chapter 3. A summarised view of the results obtained from the sample will be presented in Chapter 5, followed by a critical discussion of these findings in Chapter 6. Finally, the last chapter, Chapter 7, will conclude by reiterating the principal findings of the study in light of the limitations. In addition, the final Chapter, will put forward recommendations grounded in the key findings of the study to critical stakeholder groups. Based on identified limitations and findings, suggestions for future studies will be tabled.

CHAPTER 2: LITERATURE REVIEW

The focus of this literature review was on understanding technology integration in schools, using educators' perceptions and experiences as the point of departure. To facilitate the understanding of educators' views on technology integration, a study of factors that influence technology or digital integration in the classroom was necessary. These factors, grounded in literature, collectively but not exhaustively, account for the educators' experiences in the classroom. Nuances and insights that emerge from the review of literature provided a view of whether or not educators' current experiences are geared towards bridging the digital divide in the classroom as hypothesised in this study.

Following from the introductory chapter, the literature review was grouped into four key themes. The first section presents the theoretical framework underpinning this study. The second section introduces and elaborates on the concept of the digital divide in the context of technology integration in teaching. The third section broadly delves into the state of technology integration in classrooms. Finally, the theory on factors, often referred to as barriers and enablers, of technology integration is unpacked.

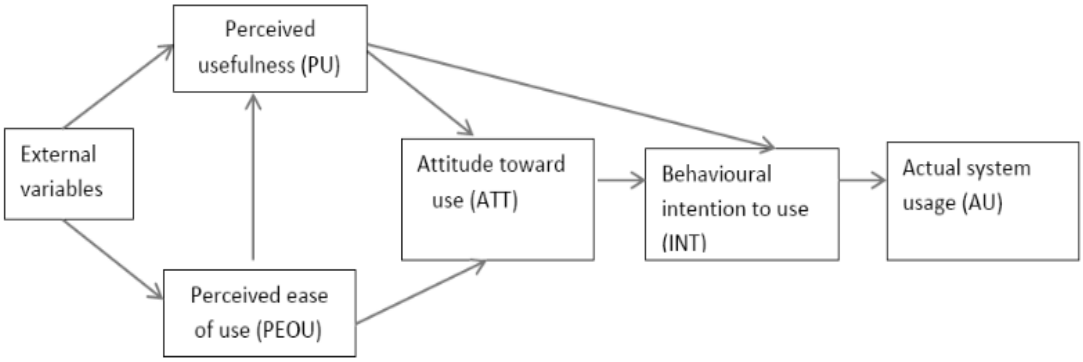
2.1 TECHNOLOGY ACCEPTANCE MODEL

The Technology Acceptance Model (TAM), developed by Davis (1986) first explored the idea of technology adoption and sought to expound why people choose to adopt or not adopt a technology when executing a task. As one of the preeminent authors on technology adoption, Davis' (1986) body of work built a foundation for subsequent literature on technology and its subsequent integration in multiple contexts. TAM evolved from the Theory of Reasoned Action proposed by Ajzen & Fishbein in 1975, proclaiming that both attitudes, and subjective norms effect behavioural intention, which, subsequently, influence a person's actual behaviour when engaging technology, (Cheung & Vogel, 2013). According to Wallace and Sheetz (2014), TAM has been extended and adapted by a number of researchers and has been applied in many different sectors and contexts. Earlier studies on the adoption of TAM mainly explored personal behaviour to use new technology in corporate settings, (Park, Nam & Cha, 2012). In the educational sector, TAM is also utilised as an instrument to establish how learners perceived the usefulness and ease of use of technology, and how these perceptions affect their e-learning acceptance in the classroom, (Cheung & Vogel, 2013). The TAM advances the notion that a person's behaviour can be predicted from several known variables, (Edmunds, Thorpe & Conole, 2012).

TAM consists of two variables that impact on technology adoption: perceived usefulness, and perceived ease of use, (Wallace & Sheetz, 2014). Perceived usefulness (PU) is defined as the level to which a person trusts that using certain technology would improve his or her job performance. On the other hand, perceived ease of use (PEOU) is defined as the level to which a person believes that using certain technology would be free of both physical and mental energy, (Wallace & Sheetz, 2014).TAM suggests that if a technology or innovation improves an individual's output, without a resultant material increase in the work required to perform a task, it is construed as useful and easy to use, and the individual will be highly likely to embrace the technology or behaviour, (Wallace & Sheetz, 2014). The TAM model as proposed by Davis (1986) is illustrated below in Figure 2-1.

Figure 2-1

Initial model of TAM



Source: Davis (1986)

TAM advances an attitude-belief–intention–behaviour paradigm for clarifying and predicting technology acceptance among possible users, (Kim, Lee, Mun & Johnson, 2016). Wallace and Sheetz (2014) posit that traits that drive the perceived usefulness of technology include the following:

- Utilising technology improves people's productivity;
- Utilising technology increases people's job performance;
- Utilising technology improves the quality of work;
- The benefits of using the technology offset the disadvantages;
- Utilising technology makes it easy for people to do their job; and
- People find technology to be useful in their job.

TAM has been extensively used to investigate the acceptance of e-learning technologies in the classroom, (Cheung & Vogel, 2013). Studies that use TAM have investigated perceived usefulness, attitude, behavioural intention, ease of use and system usage as the key factors that predict the adoption of a new technology, (Cheung & Vogel, 2013). Regardless of the increasing evidence on the sturdiness and validity of the TAM in the literature, studies have shed little light on how that attitude influences the adoption of technology. Interestingly, attitude was not incorporated in Davis' (1986) work, (Kim, et al., 2016). As a result of the unremitting development of internet inventions and technologies, leveraging technology for educational purposes has fast become widespread within education institutions, (Al- Adwan, Al- Adwan & Smedley, 2013).

The growing use of ICT in education has been studied largely in relation to learner and student experiences on course work and university environments, (Edmunds, et al., 2012). More recently, a study by Ratna (2015) exploring the acceptance of e-learning using TAM across 112 students in India, observed significant relationships between all five factors described in Davis (1986) initial model, that is perceived ease of use, perceived usefulness, attitude, behavioural intention to use and actual use. Further, Svendsen, Johnsen, Almås-Sørensen and Vitters (2013) in a Norwegean study of 1004 educators suggested that personality, which may drive attitudes, influenced behavioural intention (BI) directly, as well as served to mediate through the TAM beliefs. The addition of personality added to earlier work on TAM. Similar studies aimed at establishing the relevance of TAM in different contexts have been carried throughout the world. Have remain clear is that TAM's primary focus is on relationship between PEOU and PU, arguing that PEOU drivees PU.

Whilst the TAM places emphasis on the perceived ease of use and usefulness as the key factors in the adoption of new technology by users, its sheds very little light other factors that influence technology adoption and so that reason, can be limited in its application. Further, TAM is mainly used as a framework used to gauge the efficacy of a specific technology and not multiple technology aimed at addressing macro issue, such as technology integration at schools.

On the back of the limitations of TAM, this study expands the framework's perspective to include educators' attitudes, educators' digital capabilities (knowledge and skills), educators' digital training, educators' digital resources, educators' personal digital barriers, and institutional digital barriers to technology integration in the classroom. The

above review indicates that the TAM could serve as a valuable theoretical grounding for the present study.

2.2 WHAT IS THE DIGITAL DIVIDE?

Though the concept of the digital divide is not explicitly addressed in the study, it does provide a vital context and literature framework for the study. The challenge of technology integration in the classroom is fundamentally a response to the consequences posed by the digital divide. For that reason, understanding this phenomena is fundamental in the understanding of themes that emerge from this study. Against the background provided above, this discussion will introduce and define the concept of the digital divide, and place it within the context of this research study by elaborating on its relevance and link to the study.

Ghobadi & Ghobadi (2013), in their analysis of how access gaps shape the digital divide, found that vast inequalities still exist in access to, and the utilisation of ICT amongst individuals, mainly developing countries. These access gaps have increasingly become a major topic of interest in recent decades, necessitating the need to understand the contributing factors that drive these inequalities. It is these gaps that are commonly referred to as the Digital Divide, (Ghobadi & Ghobadi, 2013), essentially an increasing gap between computer users, often called ‘have’s’ ,and non-users also referred to as ‘have not’s’, (Becker, 2000).

The OECD (2001; p. ?) provided a different, but congruent definition, by defining the digital divide as “… the gap between individuals, households, business, and geographic areas at different socioeconomic levels with regard to both their opportunities to access ICT, and the use of Internet for a wide variety of purposes”. The distribution of hardware (e.g., computers), and soft aspects (e.g., skill and competence) remains a challenge. These disparities are pronounced between developed and developing countries, (Kozma et al., 2004). South Africa, in spite of being one the most digitally connected countries in the African continent, is still plagued with major access challenges, (Kozma et al., 2004).

The relevance of the concept of the digital divide to this study is two-pronged. Firstly, it can be argued that educators have a professional obligation to equip their learners with tools and knowledge that will enable them to navigate the knowledge economy brought about by the digital evolution. The development of ICT literacy, among both educators and learners, is vital to ensure that learners are well equipped for the challenges and demands of the 21st century global economies and societies. Schools, and educators in

particular, have a significant role to play in bridging the digital divide. Educators are active agents of change in closing the digital gap in the classroom through exposing their learners to technology and digital media as part of their daily teaching activities. However, literature found pronounced diversity in the educators' digital worlds, (Uzunboylu & Tuncay, 2010). This diversity in the educator demographic poses challenges to the optimal integration of technology in the classroom as teachers themselves often experience challenges when engaging with technology. (Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008) argued that there must be focus on developing digital competencies (DC) of educators.

Secondly, but perhaps less perceptible, is the challenge of the digital divide that exists among the teacher demographic. Literature confirms that exacerbating the perceived slow pace of digital integration in classrooms is the digital divide that exists among teachers based on the age, digital knowledge and experience, ease of access to technology both in hardware, software and internet access, of educators, (Uzunboylu & Tuncay, 2010). For these two reasons, major steps need to be taken to address the digital divide for both learners, as beneficiaries of the knowledge economy, and educators as active agents and administrators of this change.

The succeeding section of the literature review seeks to highlight the importance of responding to the challenges of the digital divide, through technology integration in the classroom.

2.3 TECHNOLOGY INTEGRATION IN CLASSROOMS

Technology use in educational institutions has many promises. It is premised to offer educators the means to engage in student-centred teaching, (Ottenbreit-Leftwich, Ertmer & Tondeur, 2013). Unfortunately, many studies have revealed that most educators are not using technology in student-cantered ways, positing that they may be ill-prepared to use technology to influence meaningful learning in their classrooms, (Ottenbreit-Leftwich, et al., 2013). With the prominence of ICT in education, technology integration has been an emerging theme in teacher preparation, training and development. Yet, criticism continues to be levelled against educator training institutions, citing that educators have not been equipped with training and support that goes further than learning specific technological skills, (Kim, Kim, Lee, Spector & DeMeester, 2013).

Literature further confirmed that to optimise educators' efficacy in the digital age, educators need to accelerate the integration of technology in daily instruction, (Wei-Ying, 2012). Merely addressing resource concerns was found to be inadequate. Literature proved that resources such as high quality technology in schools will not necessarily result in high technology integration by educators, (Mahmud & Ismail, 2010).

Wei-Ying (2012) isolated issues such as inadequate professional development, and the quality of training as contributing factors in educators' technology use in the classroom. Research also suggested that the gaps in technology knowledge and skills, less than optimal technology infrastructure to enable knowledge creation skills, and an overall lack of skills in technology-driven classroom management and measurement are significant barriers to successful integration in classrooms, (Hew & Brush, 2007). This findings was confirmed by educators as the main reason for not integrating technology in their classrooms, (Hew & Brush, 2007).

Following from Hew & Brush's (2007) assertion on the inadequacy of educators' ICT literacy, Hohlfeld, et al (2008) offered the following definitions for ICT literacy:

- "Using digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information";
- "Using technology as a tool to research, organise, evaluate and communicate information, and the possession of a fundamental understanding of the ethical/legal issues surrounding the access and use of information".

Hohlfeld, et al. (2008) built on Hew & Brush's (2007) study by expanding on the importance of ICT literacy and its role in the integration of technology in the classroom. ICT and technology integration in the classroom extends to more than just fluency in the use of ICT or digital tools. It encompasses the ability to critically manage, integrate, create and evaluate information. This level of engagement starts to move away from superficial activities to meaningful, value-adding activities that seek to convert information into knowledge. Ertmer (2005) termed those value add activities as higher level tasks. Etmers' (2005) view was shared by Okojie & Olinzock's (2013) research, which found that educators' expertise in using technologies needs to extend to the integration of technology in the instructional setting in order to cultivate meaningful learning, (Okojie & Olinzock, 2013). These views were corroborated by Drent & Meelissen (2008), confirming that ICT cannot be viewed as a replacement of existing proven instructional methods, but rather as a supplementary medium aimed at supporting newer ways of teaching and learning, developing learners' cooperation,

problem solving, and communication skills in line with global and learner evolution, (Tezci, 2011).

However, research also cited that even with the rapid emergence of instructional technologies, a vast number of schools still fail to avail the technologies to their educators. In cases where technology is made available, inadequate effort is made by the schools to measure the ICT skills and proficiency of the educators who will ultimately be championing technology integration into the classroom environment, (Okojie & Olinzock, 2013).

Primarily, the objective of integrating digital technology in the classroom is to enhance learning and outcomes, (Ertmer, 2005), while enabling learners to acquire the tools necessary to compete in a knowledge economy. Research further highlighted that for educators to be able to drive the objectives of technology integration in the classroom, educators must integrate technology in their daily lives in order to remain relevant and competitive in the digital age, (Hsiao, 2012).

Even with the best of intentions, a myriad of challenges still plague the dream of effective educators-led technology integration in schools. Some of the key challenges highlighted are that educators' technology skills are inadequate in responding to learners' needs and expectations.

The next section of the literature review will discuss the key factors that impact educators' ability to effectively integrate technology in classrooms.

2.4 FACTORS THAT IMPACT TECHNOLOGY INTEGRATION IN CLASSROOMS

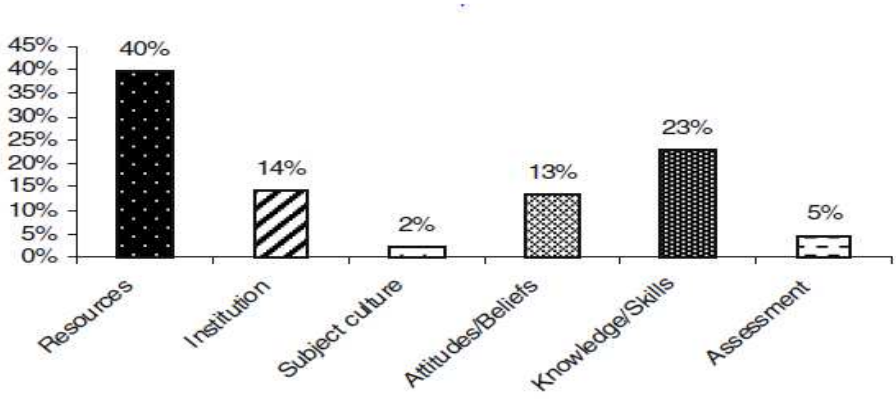
This section of the review of literature focuses on unpacking and understanding factors that either stimulate or limit educators innovative or constructivist use of technology in the classroom, (Drent & Meelissen, 2008). There is general consensus among scholars that technology integration in the classroom environment can enhance student learning, and improve learning outcomes (Drent & Meelissen, 2008; Hsiao, 2012; Kivunja, 2013). However, there is recognition that such technology integration is often marred by critical barriers. These barriers can be personal or institutional in nature, (Hew & Brush, 2007). As depicted in 2-1, Hew & Brush (2007) cited six main categories of factors, namely:

a) Educator attitude, beliefs and motivations;
b) Knowledge and skills (Capabilities),
c) Institution;
d) Resources;
e) Subject culture; and
f) Assessment

Resources, and knowledge and skills were noted as the most prominent factors, collectively accounting for 63% of all notable barriers as depicted in Figure 2-2.

Figure 2-2

Relative Frequency in which the Barriers were Mentioned in Previous Studies



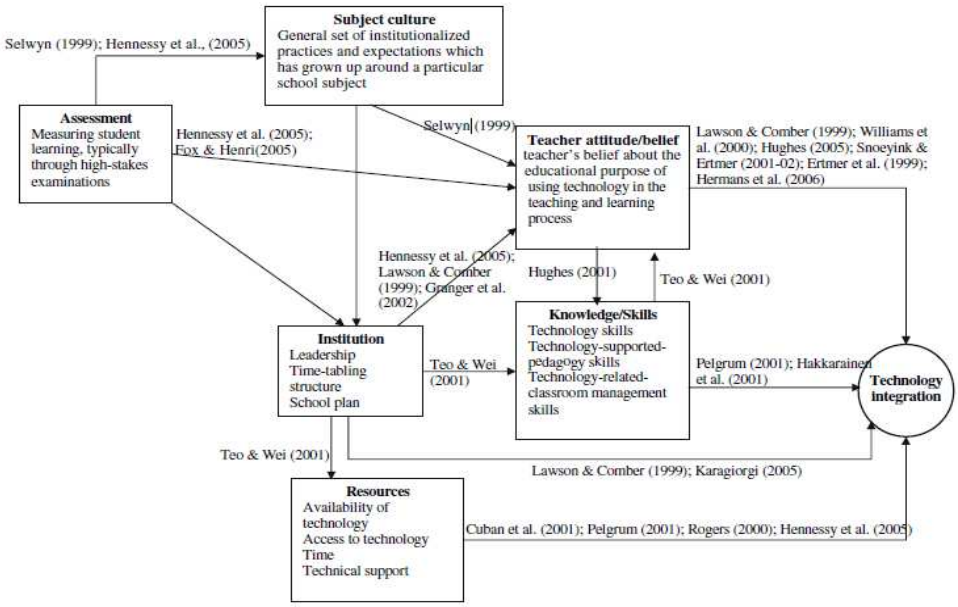
Source: Hew & Brush (2007) p. 226

Furthermore, Figure 2-2 below illustrates the interrelationship between the barrier categories. Educator attitudes, as an example, is impacted by subject culture, assessment, and institution. Similarly, Tezci (2011) also found that internal factors, such as attitudes towards technology, knowledge, and confidence in using computers, were related to external factors, such as support. However, the author showed that of the six barriers/factors identified, the following four factors were found to have a direct influence on technology integration:

a) The educator's attitudes and beliefs towards computers and the use of technology,
b) The educator's knowledge and skills,
c) The institution, and
d) Resources

Figure 2-3

Model Showing the Relationships among the Various Barriers



Source: Hew & Brush (2007) p. 231

In other words, research found that the institutions' ability to effectively integrate technology in the classroom is impacted by the resources committed to the integration of technology, the skills and knowledge of the educators, and their attitude towards technology, (Hew & Brush, 2007).

Most literature confirmed findings by Hew & Brush (2007). However, other barriers to technology integration were highlighted in the study of barriers to computer use by elementary teachers by Franklin (2005), including lack of leadership, lack of time, and lack of availability and access to computers. Peeraer & Petegem (2016), further made a distinction between non-manipulative or exogenous factors, and manipulative or endogenous factors. Non-manipulative factors are factors that cannot be influenced by the schools, such as an educator's age, teaching experience, digital literacy, government policy and external support for schools, (Franklin, 2005). Conversely, manipulative factors are defined as those factors that are within the schools' sphere of influence, such as educators' attitudes towards ICT and teaching, technology knowledge and skills, availability of resources, and commitment of the school towards implementation of technology integration programmes, (Drent & Meelissen, 2008). Other

literature confirmed these additional factors such as commitment, gender, age, ICT support, access to facilities, poor training that lacked focus on pedagogical skills, and educators' objections to adapting teaching practices, (Mahmud & Ismail, 2010).

In the following sub-sections, the discussion will further outline the four factors that directly influence technology integration in the classroom.

2.4.1 Educator attitudes

Among other factors, educators' beliefs and attitudes were found to be a fundamental factor in the integration of technology in the classroom, (Anthony, 2012). Research has shown that if educators possess healthy attitudes towards technology, they are more prone to drive active ICT use in their classrooms, (Buabeng-Andoh, 2012). This notion was shared by Hew & Brush, 2007. The alignment of educators'' personal attitude and beliefs with constructivist pedagogy, which is a way of teaching based on learning and making sense. Constructivist pedagogy leads to a new understanding informed by the interception between what is already known and believed by the educator, and new knowledge or ideas that educators come into contact with, (Richardson, 2003). It is a second order barrier that is intrinsic to educators' views on technology integration, necessitating fundamental mental shifts, (Ertmer, 2005).

However, other studies found that positive attitudes were not sufficient predictors of technology integration in the classroom, although technology experience, attitudes, and self-confidence are highly correlated, (Tezci, 2011). Successful integration of technology in the classroom requires a reconciliation between educators and technological tools such as computers. This implies that the issue extends to more than just resources, a first order barrier, to educators' core values that must be understood and possibly challenged, (Ertmer, 2005).

Further, the educators' decision on how and whether to integrate technology in the classroom is fundamentally grounded in the beliefs that they hold about technology and, by extension, their attitudes towards the use of technology. These beliefs and attitudes extend to how educators perceive the relevance of technology, and how enthusiastic they are with the opportunities that technology may present. Franklin (2007) corroborates Ertmer & Ottenbreit-Leftwich's (2010) sentiments that constructivist beliefs are an essential element to technology use. Hew & Brush (2007) also found that capabilities in the field of technology tended to drive beliefs and attitudes of educators, and the inverse relationship was found to be true, as confirmed by Gomleksiz (2004).

ICT use in education highlighted that in general, educators are reluctant to use ICT in their instructional practices, and the same is true for digital learning materials (DLM's), (Kreijns, Vermeulen, Van Ackerc & van Buurenc, 2014). Additionally, research also highlighted that the availability and accessibility of well-resourced ICT infrastructure in schools, coupled with the educator's ability to drive learning though digitally enabled pedagogy in classes, still does not guarantee use of ICT, (Kreijns et.al., 2014). This finding illustrates the need to understand the factors that drive DLM adoption by educators. Consistently, attitude is a critical factor in DLM adoption. Educators must be motivated to develop positive attitudes towards the use of DLM's. Research using a combination of self-determination theory (SDT), and the theory of planned behaviour/integrated model of behaviour prediction (IMBP) affirmed this point (Kreijns et.al., 2014). Research further drew a distinction between global level psychological needs of educators; contextual level needs; as well as situational level motivational constructs, (Kreijns et.al., 2014).

Yeung, Tay, Hui, Chenri, & Low (2014) share the belief that personal use of digital technology (DT) is likely to be influenced by different motivational factors. One factor identified was that learning outcomes have to go beyond the evaluation of performance in a traditional sense (i.e. test results). Educator assessment must extend to theoretical comprehension, and psychosocial results such as having positive affect on learning. Secondly, educators are more likely to apply DT in classrooms if they acknowledge and value DT, and have the expertise to apply it effectively, (Yeung et al., 2012). For this reason, an educational goal is essential. If an educator has a solid educational goal, he or she will be more inclined to take risks and experiment with the application of DT.

Similarly, studies have suggested that in order to cultivate students' learning goal orientation, the first step to encourage positive inspirations toward DT is that educators must develop higher learning orientations, and serve as role models (Yeung et al., 2012). Generally, most research found a positive relationship between educator attitudes towards ICT use, and technology integration in classrooms, (Tezci, 2011).

2.4.2 Digital knowledge and skills (Capabilities)

Without the prerequisite skills and knowledge on technology integration as a medium of instruction, educators are ill-equipped to drive the knowledge economy. The pervasive lack of knowledge and skills in this area of pedagogy is a function of several factors. To

aid understanding of this issue, this section is broken down into a few themes that collectively shed light on the challenge of lack of technology knowledge and skills among educators, exacerbating the slow traction of technology integration in schools.

2.4.2.1 Impact of digital background of educators on technology knowledge and skills

In spite of the infancy of digital platforms as a means of knowledge accumulation, international research has found that a sizeable number of educators displayed great comfort and positive beliefs about technology, (Lei, 2009) even though most of them were Digital Natives (Lei, 2009). They viewed technology as a powerful and invaluable enabler in their daily lives. This generation of educators buys into the potential of technology as a key lever in teaching and learning. However, even these educators fundamentally lack the knowledge, skills, and experience to integrate technology into classrooms. Similar positive attitudes by Digital Native educators were not as prominent in underdeveloped and developing countries.

Lei (2009) further warned of the potential pitfalls of assuming that the new generation of educators would naturally integrate technology into classroom instruction. According to this author, even though this generation of educators has been raised in the digital era, their experience has been isolated to exploring technology as a medium of learning, not teaching. These educators still require exposure and skills to effectively use new technology and digital media for teaching. Digital Native teachers have had limited exposure to ways of teaching in this format due to the slow adoption of technology pedagogy in classrooms in the last twenty years, (Lei, 2009).

It may be argued that it is the responsibility of teacher preparation programmes to help them make the transition from digital-native students to digital-native educators, (Lei, 2009). To this end, Lei (2009) highlighted the importance of the following activities in preparing educators to effectively leverage technology in the classrooms:

a) Exposing new educators to a variety of technologies that can be used to anchor teaching and learning activities;
b) Emphasizing subject-specific technology, not just general technology;
c) Incorporation of assistive technology as an important component of teacher training;

d) Assisting newer educators with understanding and navigating technology use and adoption; and lastly
e) Continuously assisting educators make meaningful connections between technology, subject content, and the appropriate and effective instructional methods.

2.4.2.2 Educators' digital competence (DC)

In addition to understanding the digital background of educators, the extent of digital competence among educators is an equally critical discussion. Research confirmed that developing digital competencies through empowering educators is a critical ingredient in cultivating digital competence among learners, (Aslan & Zhu, 2015). Digital competence is defined as the advancement of skills in the day to day application of digital technologies, (Krumsvik, 2014). Cervera & Cantabrana (2015) suggest that digital competence or literacy is more than technical competence on digital tools, but extends to a mix of technical, procedural, socioeconomic, and cognitive skills necessary for thriving in a digital knowledge society.

Elevating educators' digital competence will enable the appropriate use of technology as a pedagogical tool, allowing for a seamless adaptation to learners' needs, (Aslan & Zhu , 2015). In essence, learners are more likely to procure digital competence if their educators are digitally competent. In addition to positioning students to meet future global economy demands, Cervera & Cantabrana (2015) posit that investing in the digital technology competence of educators improves the stature of schools as institutions.

An educator's technology competence has the most significant impact on the extent to which learners learn from their digital experiences, (Hsiao, 2012). For that reason, integrating technology into the classroom requires more than just familiarity with technology, but rather competence and skill in the use of technology for learning purposes. This view was shared by Ertmer & Ottenbreit-Leftwich (2010), who showed that ultimately, the decision of whether and how to engage with technology in the classroom hinges on the educator's level of skill and competence. To date, educators' technology use remains on low order tasks such a word processing, and browsing the internet, rather than higher order, more meaningful uses, (Ertmer, 2005).

Studies have also shown that educators' self-confidence in the use of ICT assists in technology deployment and skills in classroom scenarios, (Tezci, 2011). Etmer (2005) confirmed that it takes approximately six years for educators to migrate into higher order

tasks. This period often coincides with the amount of time it takes to acquire sufficient confidence in their technological skills, (Etmer, 2005). In his study of factors that influence elementary teachers' use of computers in the United States, Franklin (2005) highlighted that most educators primarily utilise ICT tools for administrative and preparatory functions, rather than instructional purposes, as envisioned in constructivists' pedagogy. Computers are also not used as often or as effectively as they could be in instruction, (Etmer, 2005).

2.4.2.3 The role of teacher training and development programmes

There is a consistent view among the literature reviewed that in order to optimise educator efficacy in the digital age, educators must accelerate the integration of technology in daily instruction, (Wei-Ying, 2012). However, similar to most authors, Wei-Ying (2012) cited the amount of professional development and training, as well as the quality of training as a key contributor to educators' technology use in the classroom. Cervera and Cantabrana (2015) found that given the dynamic and agile nature of technology, professional development for educators on ICT is a critical factor to enhance the institutional standing of schools. Additionally, research suggested that the gaps in technology knowledge and skills, exacerbated by poor pedagogical digital training, is a significant barrier to successful integration in classrooms, (Hew & Brush, 2007).

Furthermore, educators acknowledge and agree with this sentiment, citing these gaps as the main reason for not integrating technology into their classrooms, (Hew & Brush, 2007). Harris, Mishra, & Koehler (2009) supported the common view in the literature that effective technology integration practices are a product of a myriad of factors, including teaching expertise, knowledge about technology, and pedagogical competence as discussed earlier. For example, a study of Swedish educators' use of ICT in the classroom revealed that even though most educators used ICT as a teaching tool, most wished they had greater knowledge and skills to enhance their efficacy, and improve their application, (Andersson, 2006). It is therefore paramount that educators appreciate that technology is an enabler, and does not replace the need to develop knowledge grounded in educational intentions and pedagogy, (Kirkwood & Price, 2005). For this reason, teacher training programmes and institutions must develop teachers' technology competencies, especially in light of the highlighted importance of technology application and competence in class,.(Groth, Dunlap, & Kidd, 2007).

However, the modification of the teacher training system to accommodate changing learning preferences and the competence of preservice Digital Native educators to inform how learners engage with technology in the classroom still needs further review. Hudgins & Anderson (2015) presented a promising view, arguing that course geared at educating educators on technology have been successful in narrowing the gap in skills and the use of technology among Digital Natives in the western United States. This is in spite of clear evidence that confidence in a technology skill was not found to necessarily correlate nor predict the use of digital platforms as a tool for instruction in the classroom, (Hudgins & Anderson, 2015). Proficiency and confidence, through effective training in technology use removes just one barrier to the optimal integration of ICT in classroom practices, (Hudgins & Anderson, 2015).

Self confidence in using computers is also a material consideration. As alluded in earlier sections, educators' attitudes and experience toward technology were factors associated with technology integration in instruction. These assertions brought into focus the need for teacher training to orientate and continuously upskill pre and in service educators in digital media. This effort will likely improve educators' adoption of technology tools for classroom instruction.

A review of relevant literature showed that effective professional development on ICT integration incorporated the following aspects:

a) Focus on content (e.g. technology knowledge and skills; technology-supported pedagogy knowledge and skills; and technology-related classroom management knowledge and skills);
b) Provided educators with opportunities for ''hands-on'' work; and
c) Was highly consistent with educators' learning needs. Initially, focusing on technology capabilities is evidently important because ICT integration is hindered if the educator lacks the knowledge or skills to operate digital media, (Kivunja, 2013).

However, aligning all these aspects is a complex task, as incorporating ICT in pedagogy is an intricate process that includes reviewing and re-establishing classroom relationships, reinterpreting curriculum, and expanding the notion beyond written texts (Hudgins & Anderson, 2015). Research further posits that in order for educators to engage with digital technology in the classroom, they need to participate in feasible transitional or change management practices that allow them to embrace the digital

world, (Kalman & Guerrero, 2013). There is evidently a need to accelerate digital training for educators; training that will increase their exposure and application of technology tools to enhance content knowledge, understanding, and skill (Hudgins & Anderson, 2015).

Research further found that that even though training on how to use a computer for one's personal use offered a useful foundation to the development of electronic pedagogical content knowledge and skills, effective training programmes must extend beyond these superficial aims, (Franklin, 2005). Some countries, such as Turkey, are still in the infancy of technology integration in education systems, reporting only using basic technology and ICT applications for learning purposes, (Tezci, 2011). Ultimately, educators do not only need to be comfortable with technology, but they must know exactly how to integrate it in the classroom, (Mahmud & Ismail, 2010).

One of the evident gaps is that most educators and administrators assume that electronic pedagogical content knowledge and skill automatically follow from knowledge of how to use a computer. Research found that hypothesis to be a fallacy, (Franklin, 2005). Instead, research shows that focus on teacher preparation and development programmes need to encompass the development of digital pedagogical content knowledge and skill that prepares future educators to weave curriculum and technology. This shift necessitates the integration of technology into teacher preparation, (Franklin, 2005). Franklin's findings were confirmed by Potter & Rockinson-Szapkiw (2012), who asserted that professional development opportunities for educators must consider educators prior knowledge and experience; take a fluid approach to design; use framework-based practices and projects that allow for genuine application; and include knowledge sharing opportunities. Other authors also highlighted that effective ICT literacy interventions for educators were an important element in narrowing the gap in the learner outcomes and educator competence, (Uzunboylu & Tuncay, 2010).

Literature demonstrated that countries such as Malaysia have implemented interventions to address training gaps, (Uzunboylu & Tuncay, 2010), including:

a) Introducing of ICT related courses as core courses in preservice teacher training programmes ;
b) Upskilling programmes for educators that are already in service;
c) Numerous tailor-made programmes that respond to the unique needs of each school (Mahmud & Ismail, 2010).

2.4.2.4 Embedding digital pedagogy in teacher training initiatives

Pedagogy, is an art that requires great effort to master. The same is true for pedagogy in the technological or digital context. Howell (2012) defined digital pedagogy as the art of teaching, which embeds computer driven digital technologies to enrich learning, teaching, assessment, and the whole curriculum. It is essentially the study of how to teach using digital technologies. As such, teacher training institutions and programmes must embed digital pedagogy in their training of educators, (Howell, 2012). The Technological Pedagogical and Content Knowledge framework (TPACK) is a model that was developed by Mishra and Koehler (2006), which attempted to advance understanding on how educators can be effective in a digital classroom. At the heart of the TPACK is the need for integration of technology, pedagogy, and subject to enable the optimum use of technology in teaching a subject matter, (Mishra & Koehler, 2006)

To develop educators for the information age, teacher training programmes must enable educators' understanding of the evolution of the learner in their classroom. Learners of the 21st century, are Digital Natives, digitally fluent, rather than having skills developed with traditional methods such as chalk and board; paper, pencil and pen, (Kivunja, 2013). Research found that with most of the tenured educators belonging to the pre-digital generation, it is increasingly crucial for higher education institutions to prepare educators for the new classrooms in which they will invariably operate, (Kivunja, 2013). Therefore, embedding digital pedagogy in the skilling of these educators should be prioritised to help them appreciate the role of technology in teaching, content knowledge, and narrowing of the digital gap, (Kivunja, 2013).

2.4.3 Barriers that impact on educators' uses of technology

As an extension of Ertmer's (1999) identified barriers to technological integration, Tsai and Chai (2012) argued that the lack of design and critical thinking skills can be described as the third-order barrier for technology integration in education. Based on their investigation of 48 empirical studies, mostly from the American Educational Research Journal, Hew and Brush (2007) outlined the three most commonly cited barriers impacting technology integration: i) resources; ii) educators' knowledge and skills, and; iii) educators' attitudes and beliefs. This confirms findings of earlier studies, which cite a range of barriers in technology development, including economic, technological, regulatory and social barriers, (Kanie Suzuki & Iguchi, 2013)

Ertmer, Ottenbreit-Leftwich, Sadik, Emine Sendurur and Sendurur (2012) noted that the above barriers prohibit educators from using technology in a manner that is better aligned with their beliefs, even though many of these barriers, such as access to resources and support, have since been eradicated in the majority of schools in developed countries. Some literature on factors that influence the extent of technology integration in education cited that organisational support plays a critical role in ICT integration, (Tezci, 2011). The lack of such support is a fundamental institutional barrier that has a direct impact on the integration of technology in education, (Hew & Brush, 2007). Ertmer, et al. (2012) classified key external barriers that affect educators' integration efforts as hardware and internet access; software and tool access; training and support (administrative, technological, professional and colleagues).

Similarly, Luthra, Kumar, Kharb, Ansari and Shimmi (2012) listed the most pertinent barriers in the adaptation of technologies as large amounts of investment and insufficient financial resources; market uncertainty; lack of regulatory framework; low awareness and engagement; lack of innovativeness in the sector; lack of infrastructure, technology immaturity; lack of essential technical skills and knowledge; unclear standards and guidelines; and security and data privacy. Even though these findings mainly related to the business context, they appear to corroborate findings in studies focused on education and for that reason, can be accepted as relevant in the education sector as well. Perceivably, challenges such as the lack of investment, limited financial resources, and regulatory oversight can hinder technology integration in schools.

Further, research has shown that the state of leadership at schools can hinder educators ICT integration efforts. Fox and Henri (2005) found that the majority of educators in Hong Kong felt that their principals did not understand technology. Consequently, the impact of technology on the educators' practices in the classroom was restricted due to perceived poor leadership and sponsorship. Another critical factor that was isolated as contributing to institutional (school) barriers in technology integration in education was the lack of school planning by administrators with regard to technology use, (Franklin, 2005). Bitner and Bitner (2002) developed 8 key factors in the successful integration of technology in the classroom and curriculum. These are:

1) Fear of change
2) Personal use
3) Training in basics
4) Teaching models

5) Learning based
6) Motivation
7) Climate
8) Support

All of these are evidently intrinsic factors. However, some research remains unconvinced on whether or not educator beliefs and attitudes are significant predictors of use technology in the classroom. Some studies has shown that educator attitudes and beliefs *do* shape behaviour, (Blackwell, Lauricella, Wartella, Wartella & Schomburg (2013). Blackwell, et al. (2013) pronounced that personal barriers might play a more significant role in determining whether and how much educators integrate technology into their classroom. Thus, barriers that impact educators' uses of technology in the classroom must be critically considered when driving technology integration efforts in schools. The research reviewed indicates that when ignored, they can be major hindrances to the process.

2.4.4 Resources

Advances in technology have significantly enhanced educators' ability to create a functional reality for learners by growing ubiquitous access to learning resources, (Davies, Dean & Ball, 2013). Kim, Kim, Lee, Spector, & DeMeester (2013) found that the value derived from technology use for student learning is significant due to the appeal it has on learners, as a result of its interactive nature. Hew and Brush (2007) identified resources as a direct driver of technology integration in education. A profound understanding of resources as an enabler or barrier to impactful technology integration in schools is essential, (Hew & Brush, 2007). Research by Carrasco and Torrecilla (2012) revealed that access to technology or digital tools, such as computers, and subsequent use of those tools, has a positive influence on technology integration and learner performance. Diversity in technological resources rests on the level of the perceived organisational environment uncertainties (technological and market), (Kim, Shin & Min, 2016). A study corroborating of new technologies in Cambodia, Dotong, De Castro, Dolot and Prenda (2016), also found that language barriers, hardware incompatibility, internet access, complexity, computers, the lack of electricity, limited experience among trainees; and trainees' poor understanding of the benefits of these technologies to be some of the key barriers to technology integration.

Access to information, organisational structure, and the ease of sharing and circulating technology are associated with technological resources, (Carrasco & Torrecilla, 2012). According to Carrasco and Torrecilla (2012), there are also no contrasting views on the significance of learners having educational facilities that provide them with access to ICT tools at their fingertips, and tools that are integrated into their learning practices. However, merely equipping schools with technological resources may not necessarily lead to superior learning or have an effect on the level of learners' performance, (Carrasco & Torrecilla, 2012). The availability of resources must be coupled with a change in educators' attitudes, and a change in the dynamics of the classroom ecosystem, (Doering, Koseoglu, Scharber, Henrickson & Lanegran, 2014).

To illustrate this point, Sugar and van Tryon (2014) show that instead of spending significant time preparing for class lessons, educators spend a significant portion of time on being familiar with the technological resources, and learning how to use them. In addition, educators stressed the importance of being able to share technology resources, such as instructional materials, lessons, digital teaching tools with their colleagues. Tondeur, Roblin, van Braaka, Voogt and Prestridge (2015) argued that educators who were more experienced had more time and resources to discover the educational value of technology. They are better able to effectively relate it to their already established pedagogical and curriculum practices and habits.

On the other hand, limited access to educational equipment was the most frequently mentioned resource challenge by educators, (Doering, et al., 2014). Facing budget austerity measures, and restrictions in funding, many educational institutions need cost effective open access to educational resources, (Davies & West, 2010). In some cases, reliance on limited school resources prevents educators from introducing new ideas and methods into the classroom, especially technology-driven methods, (Doering, et al., 2014). The lack of technical support at schools remains another major challenge related to access, (Lai, Trewen, & Pratt, 2002; Rogers, 2000). Doering, et al. (2014) highlight that resources enable educators to engage with technology integration whilst strengthening their skills.

2.5 CONCLUSION TO LITERATUE REVIEW

The body of literature reviewed in this chapter is pertinent because it offers a comprehensive understanding of the dynamic factors at play in the pursuit of technology integration efforts in schools. The theory builds a business case for the importance of tackling the digital divide and positions the role of educators within that context. As a start, preeminent literature on the TAM (Davis, 1986) offers a useful foundation on the subject by isolating a few factors, such as PU and PEU, factors that are critical drivers of technology adoption. Though TAM offers a useful base to build on, it had a few shortcomings in the context of this study and for that reason was not an optimal fit for this research project. One of the shortcomings is that studies on TAM have mainly centred on learner perceptions and not educator perceptions, the object on analysis in this project. This gap highlights the need to build more literature on educator perceptions of technology integration. The fill the identified gap, subsequent evolution of the TAM, followed by comprehensive literature which isolated additional factors that impact, not only adoption but integration of technology, in schools was unpacked in this Chapter. This literature included findings of Hew & Bush (2007) on barriers to technology integration in K-12 schools in the United States.

The review of prior literature in this Chapter covered what is the digital divide and the relevance to the subject of technology integration. Further, literature on technology integration in the classroom, the focus of this study was explored and an understanding of factors that impact of the educators ability to integrate technology in their classroom, such as, teacher's attitudes, digital knowledge and skills, barriers that impact on educators uses of technology and resources, was obtained.

However, most of the research conducted in this context does not provide tangible solutions to successful technology integration implementation. There have been some attempts by scholars to uncover this framework but discussions have been limited to isolating the factors and not extending those discussions to prioritising the challenges and coming up with concrete implementation plans. Further, to date, literature on technology integration has mainly been focused on developed economies. Very few studies have extensively explored this topic in the African context, a continent marred by developing and underdeveloped economies. This observation highlights the need to 'localise' findings from prior studies and build a body of knowledge on varying contexts. In the context of South African, more can be done to broaden understanding on the

extent of technology integration in South Africa, in light of factors that impact it. This understanding will lead to the design of appropriate response strategies. The literature reviewed in the preceding Chapter created value in these discussions.

CHAPTER 3: RESEARCH QUESTIONS AND HYPOTHESES

3.1 RESEARCH QUESTIONS

The purpose of this research study is to explore the factors that impact on the educators' ability to integrate technology in South African classrooms. The study explores enablers and barriers to the effective integration of ICT in schools, and examines the extent to which educators and lecturers are trained on integrating digital technology in their classroom. This study sought to answer the following research questions:

3.1.1 RESEARCH QUESTION 1: WHAT ARE THE ATTITUDES OF EDUCATORS & LECTURERS TOWARDS TECHNOLOGY?

The research question seeks to determine what the educators' and lecturers' attitudes towards technology are.

3.1.2 RESEARCH QUESTION 2: WHAT ARE THE DIGITAL CAPABILITIES OF EDUCATORS & LECTURERS?

The research question seeks to describe the digital skills and competences of educators and lecturers.

3.1.3 RESEARCH QUESTION 3: WHAT DIGITAL TRAINING IS PROVIDED TO EDUCATORS & LECTURERS ON TECHNOLOGY INTEGRATION IN THE CLASSROOM?

The research question seeks to describe digital training that is offered to educators and to determine if the training is adequate, specifically on digital pedagogy, for educators and lecturers.

3.1.4 RESEARCH QUESTION 4: WHAT DIGITAL RESOURCES ARE USED BY EDUCATORS & LECTURERS FOR TECHNOLOGY INTEGRATION IN THE CLASSROOM?

This research question seeks to clarify what digital resources educators and lecturers use in classroom.

3.1.5 RESEARCH QUESTION 5: WHAT IS THE DISTRIBUTION OF EDUCATORS AND LECTURERS BY INSTITUTION TYPE?

This research question seeks to determine the distribution on educators based on the type of institution (private vs. public).

3.1.6 RESEARCH QUESTION 6: WHAT ARE PERSONAL BARRIERS TO INTEGRATION OF DIGITAL TECHNOLOGY (ICT) IN THE CLASSROOM THAT EDUCATORS & LECTURERS HAVE?

This research question aims to clarify what educators view as personal barriers to ICT integration in the classroom.

3.1.7 RESEARCH QUESTION 7: WHAT ARE THE INSTITUTIONAL DIGITAL BARRIERS FACED BY EDUCATORS & LECTURERS IN THE INTEGRATION OF DIGITAL TECHNOLOGY (ICT) IN THE CLASSROOM?

This research question aims to ascertain what educators view as institutional barriers to ICT integration in the classroom.

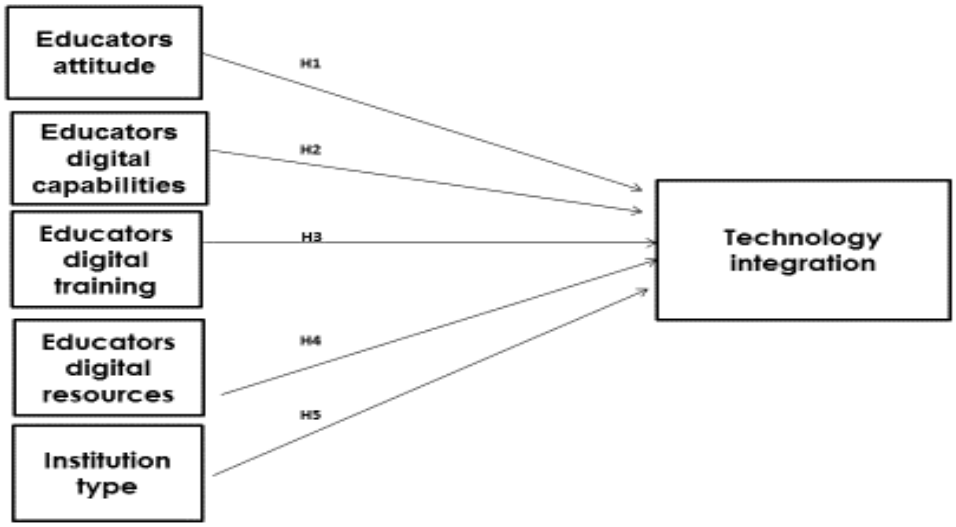
3.2 RESEARCH HYPOTHESES

The proposed hypotheses extend on the research questions articulated above. The hypotheses seek to determine whether the five factors described in research questions one to five, have an impact on technology integration.

As depicted in Figure 3.1, the study aims to establish whether educator attitudes, digital capabilities, digital training, digital resources and type of institution, all independent variables, have an impact on technology integration, the dependant variable.

Figure 3-1

Research Hypotheses Conceptual Model



H1: The hypothesis is that educator attitudes have impact on technology integration in the classroom.

H2: The hypotheses is that educator digital capabilities (knowledge and skills) have an impact on technology integration in the classroom.

H3: The hypothesis is that educator training of digital technology has an impact on technology integration in the classroom.

H4: The hypothesis is that educators' access to digital resources have an impact on technology integration in the classroom.

H5: The hypothesis is that the type of Institution that the educator is a part of has an impact on technology integration in the classroom.

CHAPTER 4: RESEARCH METHODOLOGY AND DESIGN

4.1 INTRODUCTION

Saunders & Lewis (2012) describe research methodology as the collecting of data which requires interpreting and inferring of information to create an outcome with a distinct aim. A methodology plots out techniques for gathering data that will be used to answer research questions and solve problems, (Malhotra, Birks, Palmer & Koenig-Lewis , 2007). This chapter presents the structure and procedure of the research methodology. It proceeds with a discussion of the research design and research strategy. In addition, the population, unit of analysis, sampling method and size are outlined. Furthermore, measurement instrument and data collection process is discussed. Finally, data analysis approach and research limitation are presented.

4.2 RESEARCH METHOD

Creswell (2009) differentiates between the three main types of research methods as follows: qualitative, quantitative, and mixed methods (triangulation). A quantitative research method was used in this study. A quantitative research method uses an organised process, along with procedures, to collect information under precise conditions, and highlights impartiality through statistical analysis. Further, a quantitative research method allows for an objective investigation and analysis of objective theoretical concepts by statistically exploring relationships between variables (Bryman, 2004). The motivation in selecting a quantitative method was to enhance the accuracy of findings through meticulous statistical analysis.

4.3 RESEARCH DESIGN

Research design is defined as a plan of gathering research subjects and collecting information from them, (Kruger & Welman, 2001). Research design articulates the plans and techniques for research that describe procedures of data collection and analysis, (Creswell, 2009). Other authors defined research design as an approach to answering defined research questions, (Saunders & Lewis, 2012). Creswell (2009) acknowledges that there are three main elements that influence the choice of research design, which is world view, strategy, and methods. The main types of research design are:

- **Descriptive research**, which provides an accurate account or description of the facts and events surrounding an identified situation. This research type only provides a description on the phenomena, but falls short in explaining the cause(s) of the phenomena, (Saunders & Lewis, 2012).
- **Explanatory research**, which entails studying occurrences or problems with the aim of explaining relationships between variables, (Saunders & Lewis, 2012).
- **Causal research** studies of one occurrence influences another, (Saunders & Lewis, 2012).

A combination of explanatory research, through descriptive statistics and causal research, through correlation statistics, was used in this study to describe the occurrences and relationships between each of the factors identified, namely educators' attitudes; educators' digital capabilities (knowledge and skills); educators' digital training; educators' digital resources; educators' institution type, educators' personal digital barriers; and institutional digital barriers on technology integration in the classroom

4.4 RESEARCH STRATEGY

The research strategy and data collection method used for the study was a comprehensive online survey, which entailed the collection of data from a targeted sample using a structured process, (Saunders & Lewis, 2012). The method was a cross sectional survey, a widely accepted tool used to collect data from a sizeable sample, (Saunders & Lewis, 2012). The survey method was particularly appropriate for this study because there is a solid theoretical base that could be used to study real life situations with subjects immersed in the targeted situations, (Tharenou, Donohue, & Cooper, 2007). The rationale for the chosen data collection method was that surveys can be managed quickly and without effort, and they enable simple collection of data in remote locations, (Bryman, 2004). The literature base gave insights into the constructs that influence technology integration by educators in classrooms, supporting the survey choice. Restricted access to the target sample also facilitated the decision to use an online survey. In addition, ease of distribution, time and cost effectiveness supported this choice. To accommodate participants with no access to digital tools or digital literacy, a paper based version of the form was available.

4.5 POPULATION

Saunders & Lewis (2012) define the population as the complete set of group members. In this study, the population was all qualified educators, consisting of school educators, and post-secondary lectures in South African schools and institutions of higher learning. In 2013, there were approximately 425,023 educators in South African schools, 391,829 in public schools and 33,194 in private or independent schools, (Department of Basic Education, 2013). Data on the number of lecturers was not readily available but the ratio of educators to lecturers was assumed to be significantly weighted towards educators.

4.6 UNIT OF ANALYSIS

The unit of analysis for this study was qualified educators (school teachers and lecturers).

4.7 SAMPLING METHOD AND SIZE

Sampling refers to the technique used in the selection of unit of analysis from the base representing the research population or universe, in the absence of access to the entire population, (Saunders & Lewis, 2012). The results obtained from the units of analysis selected can be used to generalise or extrapolate to the population, (Tharenou, Donohue, & Cooper, 2007)

4.7.1 Sampling technique

Due to resource and time constraints, the study utilised non-probability sampling techniques. These are techniques used when the researcher does not have a complete list of the population, rendering it impossible to select the sample at random as there is no knowledge of the chance that each member of the population has in being chosen, (Saunders & Lewis, 2012). Convenience sampling was chosen as the primary sampling technique due to ease of access to the target participants. To mitigate the risk of poor response rates from the convenience sampling technique, a snowball technique was adopted to supplement responses from convenience technique. This applied in cases where the response rate from convenience sampling fell outside of unacceptable parameters. Respondents were encouraged to circulate the online survey to persons that they deemed suitable to the study. Any educator- a school teacher or lecturer- was deemed suitable for the study.

However, because of the sampling technique chosen, one primary group of respondents was initially targeted, namely an online community of Geography educators (educators and lecturers) across different institutions in South Africa. Targeting Geography educators was deemed a convenient target due to the spread, coordination and maturity of their online presence, as outlined in Table 3-1.

Table 3-1

Target Online Communities

Online public community	Contact details
1. SAGTA FB group	https://www.facebook.com/SAGTAdmin/
2. Southern African Geography Teachers' Association (SAGTA)	http://sagta.yolasite.com/ southagta@gmail.com
3. SA Geography Teachers Google Group	https://groups.google.com/forum/#!members/sageographyteachers sageographyteachers@googlegroups.com
4. Society of South African Geographers (SSAG)	SSAG Sandra Brits: britss@ufs.ac.za
5. SchoolNet FB group	https://www.facebook.com/SchoolNetSA/ info@schoolnet.org.za http://schoolnetsa.blogspot.co.za/

4.7.2 Sampling size

Research offers some guidelines on optimal sample size. Generally, large sample sizes are required for quantitative analyses that studies relationships between constructs, (Tharenou, Donohue, & Cooper, 2007). However, for the results to be valid and for the principles of normal distribution to apply in data analyses, sample sizes must be no less than 30, (Tharenou, Donohue, & Cooper, 2007).

In light of the context above and to comply with the minimum sample size requirement whilst ensuring data validity, the final sample size for this study was 66, , representing a 50% completion rate on those respondents who attempted the survey (132).. The poor survey completion rate may potentially have been due to the survey being perceived as too long. Due to the survey distribution method, it was impossible to determine how many educators were approached to complete the survey. Even though the number of respondents, at 66, was significantly lower than the initially targeted number of 100, the number of respondents still met the minimum conditions for statistical analysis.

4.8 MEASUREMENT INSTRUMENT AND DATA COLLECTION PROCESS

As detailed above, a detailed online survey was utilised as the main measurement instrument for the study. However to aid inclusivity, a print version of the survey was generated for participants who were willing to participate in the study but did not have access to online or digital facilities. None of the targeted respondents took up the print version option.

4.8.1 Survey design

Development of the online survey, adapted from Hudgins and Anderson (2015) and Lei (2009), was based on the themes that emerged from the literature review. The detailed questionnaire is attached in Appendix A for reference. To facilitate logical flow of completion of the survey, related questions were grouped together based on four key themes emerging from the literature review. The format and structure of the survey was primarily designed to answer the research questions and hypotheses. Prior to receiving the survey, participants were given an informed consent form, which briefly outlined the purpose of the study, and research objectives. Additionally, the informed consent form clarified the voluntary nature of participation, and potential respondents were notified that they could elect to opt out of the research process at any point. Details of the supervisor and researcher were also provided, in case respondents wished to query aspects of the study.

The format and structure of the survey was primarily designed to answer the research questions. The first section on the survey (Questions 1 – 5) was aimed at gaining an understanding of the types of digital devices that the respondents personally owned or had access to. Using a Likert scale scoring system, indicating agreement or disagreement with the said statement, the second section was asked questions related to the attitudes and beliefs of educators towards technology, and its value in the

classroom. Similarly, using the Likert scale, the third section of the survey was aimed at understanding the skill, competence, and tools educators use, and their confidence levels in the use of technology tools. The fourth section of the survey was aimed at understanding whether the educators had received training on digital pedagogy, and the extent of any training received. At the end of the survey was a list of classification and demographic questions aimed at categorising the data for specific statistical tests. With the exception of two open-ended questions on institutional and personal barriers to technology integration in the classroom, all question choices were either Likert scale, or Yes/No or Multiple Choice (demographical data) questions.

4.8.2 Survey pre-testing

Upon design completion, the survey was pre-tested prior to circulation. Five individuals were approached for the pre-test. Selection was based on convenience, and participants were not required to be part of the target sample of unit of analysis. Of the five individuals chosen, only one fell in the target population. The scope of pre-testing included clarity and simplicity of questions, ease of understanding the Likert scale, duplication and syntax, grammar and spelling. From this pre-test, it was found that the Likert scale was not compliant with best practice as ‘Strongly Agree’ was the first option, instead of the last in most studies. This issue was expected to result in confusion and possibly influence the validity of the data. To mitigate those risks, the Likert scale was revised. The pre-testing also highlighted one duplicated question, which was removed from the survey. The survey was updated will all identified issues prior to circulation.

4.8.3 Data collection

As indicated, data was collected by using an online survey, with a print version of the survey as back-up. None of the respondents opted for the print version of the survey. The data gathering phase was initiated by email to targeted online participants, as listed in Table 3 above. Only two of the targeted groups consented to participating in the study by circulating the survey link to their members. The data gathering phase lasted for four weeks and potential respondents were reminded on a weekly basis via email to complete the online survey.

4.9 DATA ANALYSIS APPROACH

Data analysis entails making sense of the data that has been collected, with the primary goal of gaining an understanding that will eventually lead to the knowledge that was

pursued from the onset, (Fox and Bayat 2011). Data analysis is a statistical procedure in which raw data is organised and arranged so that valuable evidence can be uncovered, (Ullah, 2010). The data analysis was performed using Statistical Package for Social Sciences (SPSS) software version 24. To understand characteristics of each measurement item, descriptive statistics analysis was utilized. A regression analysis was conducted to run the tests on the seven hypotheses as mentioned above. Commonly, if the p-value is above 0.05 (5%), the hypothesis is rejected and the inference drawn is a presence of a significant difference between variables, (Wilckens, 2010). All statistical tests were performed at a 95% confidence level.

4.9.1 Reliability and validity

Reliability and validity both relay the reasoning and precision of a test, (Wilckens, 2010).

4.9.1.1 Reliability

The main goal of measuring reliability is to ascertain the internal consistency of the research measurement instrument pertaining to each variable, (Teo, 2011). Zikmund and Babin (2006) state that reliability examines the consistency of the measurement instrument, where diverse efforts to assess a variable meet at the same result. The study used Cronbach's coefficient alpha (α), which is the most commonly used measure of internal consistency.

4.9.1.2 Validity

Validity in research probes whether the measurement instrument assesses what they are meant to assess, (Bryman & Bell, 2011). Welman, Kruger and Mitchell (2005) posit that construct validity tries to establish the degree to which the measurement items precisely captures the variables that are being measured. Discriminant validity was measured using Pearson Correlation Matrix. According to Malhotra et al. (2007), discriminant validity is defined as the extent to which a measurement item is not connected to other items that should not measure the same essential variable.

4.10 RESEARCH LIMITATIONS

By design, the research process has inherent limitations. The following limitations, that might influence the validity and reliability of the study, were noted on the research methodology and design:

- Non-probability sampling method (Convenience and snowballing) means that the results are not statistically representative of the population.
- The use of targeted online groups representing segments, in this instance Geography educators, means that the results are not statistically representative of the population.
- The choice of targeted online communities was driven by convenience, potentially resulting in a demographically unrepresentative view of the current state of digital integration in South African schools, for example, 'unconnected-not online' teacher communities may not have had a 'voice' in the study.
- The snowballing sampling technique may result in a homogenous sample, lacking diversity of thought, leading to a premature saturation point.
- The length of the online survey, at 89 questions, may have discouraged participation and may have only attract participation from participants with similar views, leading to non-response bias. The length of the survey was designed to comprehensively cover all seven research questions and the related five hypotheses.
- The final sample was relatively small, and as indicated, may consist of respondents with similar demographic backgrounds. Again, this may bring into the ability to extrapolate resultant finding to an entire population.

4.11 CONCLUSION OF THE CHAPTER

In this chapter the research method, design and strategy were defined, including an outline of the sampling technique and size of the targeted sample, the research survey design and data collection process was discussed. The data analysis methodology that was adopted was also described, concluding with a discussion of the study's reliability and validity. Finally, the research limitations of the study were stated. The next chapter presents the results collected from the research respondents.

CHAPTER 5: PRESENTATION OF RESULTS

This chapter presents results of the data collected from the 66 respondents of the online survey. Survey respondents comprised of a group of preservice and inservice educators, as well as lecturers at institutions of higher learning. The structure of the presentation of results is aligned to the research questions and hypotheses outlined in Chapter Three of the study and the research methodology outlined in Chapter 4.

Results will be presented under the following headings:

- Sample description
- Reliability and validity measurements
- Descriptive statistics
- Research questions and hypotheses testing

5.1 SAMPLE DESCRIPTION

On expiry of the data collection period, response data from the 66 respondents was analysed using SPSS 24. As per Appendix B, all questions on the online survey were themed into nine categories. One of them was on the demographic profile of the respondents, while seven of the themes were focused on each research question, and the hypotheses. The last theme was on technology integration, the dependent variable of the study, and demographic data detailed below:

- Demographics
- Educator attitudes
- Educator capabilities
- Educator training
- Educator digital resources
- Educator institution type
- Educator personal digital barriers, and
- Educator institutional digital barriers
- Technology integration

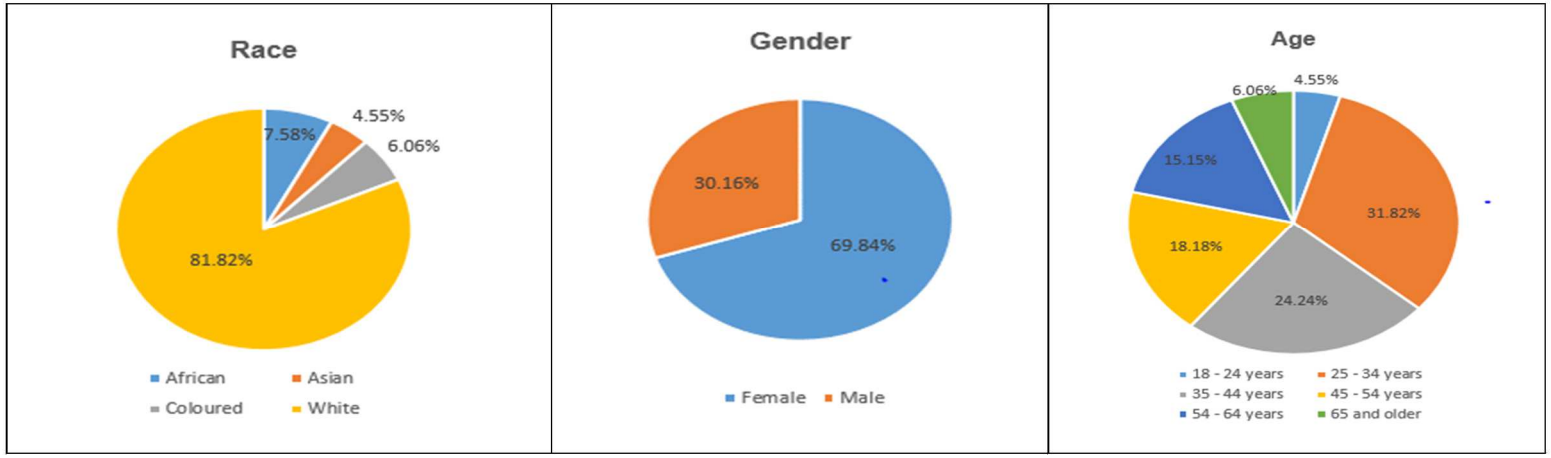
With the exception of two open-ended questions on institutional and personal barriers to technology integration in the classroom, all questions were either a 6 point Likert scale, ‘Yes or No’, or Multiple Choice (demographical data) questions. The full mapping of survey questions to research questions and themes is attached in Appendix B.

5.1.1 Demographic information

Based on the data collection method of an online survey, significant reliance was placed on the responses provided by the respondents. Responses to the online survey were used as the basis for all analysis. For that reason, understanding the demographic profile of the respondents was a critical factor in analyzing responses.

Figure 5-1

Key Demographic Results



The Figure above represents the respondents demographic by race, by gender and by age.

As set out in Figure 5-1, 81.82% of the respondents were White, followed by Africans at 7.58%; and the Coloured group only accounting for 4.55% of the sample. The significant skew towards the White demographic may be explained by the sampling method chosen. The targeted online communities, Geography educators, appeared to be demographically unrepresentative of the general South African population. In addition, majority of the educators surveyed were from Private Schools (62.12%). Private schools and former model C schools traditionally have a disproportionally higher percentage of White educators, 75% according to Govender (2015).

Females accounted for 70% of the respondents. Similarly, the higher representation of the females in the sample could be explained by the chosen sampling method. It is widely assumed that most Geography educators are female. The age distribution of the respondents was wide. 31.82% of the respondents were between the ages of 25 and 34, while almost a quarter of respondents between the ages of 35 and 44 (24.24%). Only 10.61% of the respondents were over the age of 53 (6.06% over 64 years). The researchers' perception was that a low percentage of older respondents was expected for two reasons, the survey was digital (online), effectively excluding all educators without access and/or skills to online tools and secondly, most educators in practice are younger than 53 years of age

Table 5-1

Educator Demographic Profiles

Demographic variable	Frequency (out of 66)	%
Qualification		
3 year diploma	2	3.03%
3 year undergraduate degree	1	1.52%
4 year undergraduate degree	8	12.12%
Post graduate qualification	55	83.33%
Educator type		
Preservice teacher	4	6.06%
Inservice teacher	44	66.67%
Lecturer	18	27.27%
Location of institution		
Eastern Cape	2	3.03%
Free State	3	4.55%
Gauteng	36	54.55%
KwaZulu-Natal	8	12.12%
Limpopo	1	1.52%
North West	1	1.52%
Western Cape	15	22.73%
Type of institution		
Private school	41	62.12%
Public school	6	9.09%
Private institution of higher learning	3	4.55%
Public institution of higher learning	16	24.24%
Experience		
Less than 1 year	4	6.06%
1 - 5 years	16	24.24%
6 - 10 years	6	9.09%
11 - 20 years	16	24.24%
21 - 30 years	11	16.67%
Greater than 30 years	13	19.70%

Other demographic indicators, such as qualifications, educator type, location of institution, type of institution and experience, revealed interesting patters, as shown in Table 5-1. At 83.33%, an overwhelming majority of respondents had post-graduate qualifications. Only 3.03% of respondents had 3-year diplomas. Considering that the

survey was mostly targeted at qualified educators, it is not surprising that most of the respondents had 4 year diplomas and higher. What was slightly surprising is the magnitude of respondents with post graduate qualifications. However, considering that the survey was targeted at individuals in the field of education, it is not entirely unexpected that they would be highly educated.

Two thirds (66.66%) of the respondents were inservice teachers between kindergarten and Grade 12. Lecturers at institutions of higher learning accounted for 27.27% of the respondents. Preservice teachers were marginally represented, at 6.06%. The distribution between all three educator groups was consistent with the sampling method chosen. Geography online communities mainly comprise of inservice teachers and lecturers. Teachers from private schools accounted for 62% of the sample but only 4.55% of respondents came from private institutions of higher learning. The high representation of private schools may be due to the snowballing technique applied to supplement convenience sampling. The assumption is that because of the high proportion of private school educators in the Geography online communities, the likelihood of them sharing the online survey with educators from their institutions, which were also private institutions, was high.

With the exception of the Mpumalanga province, educators from all South African provinces were represented in the sample. Gauteng province had the highest representation at 54.55%, followed by the Western Cape province at 22.73%. The North West and Limpopo provinces only had one respondent each (1.52%).

The distribution of teaching experience by sampled educators was telling. The count of respondents with experience between 1 and 5 years, and those with 11 – 20 years' experience was identical at 24.24% respectively. Over a third of respondents had teaching experience exceeding 20 years. As discussed earlier, respondents with extensive teaching experience were likely to be the same respondents with the highest age. The online community of Geography educators comprises of a very wide group of educators, from relatively new educators to very experienced educators and lecturers.

5.2 RELIABILITY AND VALIDITY MEASUREMENTS

To test the reliability and validity of measurement scales, Cronbach's alpha test and Pearson's Correlation tests were used.

5.2.1 Reliability

Reliability is concerned with whether the findings of a study are repeatable, (Bryman & Bell, 2011). This study used *Cronbach's alpha* as a measure of reliability, which is how narrowly connected a set of items are as a collective, (Bryman & Bell, 2011). It is deemed to be a measure of the internal consistency of a scale's reliability. Reliability analysis was not performed for personal barriers and institutional barriers, as they represented a single item. There needs to be two or more items to measure reliability. α *coefficients* that are less than *0.5* are not statistically significant. As shown in Table 5, the alpha scores ranged between 0.509 and 0.882. Therefore, the coefficients for this study were above the threshold of 0.5, indicating that all measurements engaged in this study revealed an acceptable internal consistency, (Bryman & Bell, 2011). The tests concluded that the research survey reflected a reliable measurement instrument.

Table 5-2

Cronbach's Alpha

Variable	Cronbach's Alpha	N of Items
Educator Attitudes	0.664	18
Digital Capabilities	0.879	10
Digital Resources	0.509	9
Digital Training	0.618	9
Technology Integration	0.882	27

5.2.2 Validity

Validity refers to whether a planned variable measures the correct concept, (Bryman & Bell, 2011). Discriminant validity was measured using Pearson Correlation Matrix, which is the measure of the linear dependence among two variables X and Y, (Malhotra et al., 2007), giving a score between +1 and −1. As seen below in Table 5-3, the scores ranged between –0.398 and 0.659. This means the study met the validity requirements of scores between +1 and −1.

Table 5-3
Pearson Correlation

	Educator Attitudes	Digital Capabilities	Digital Resources	Digital Training	Personal Barriers	Institutional Barriers	Technology Integration
Educator Attitudes	1.000						
Digital Capabilities	.569	1.000					
Digital Resources	.574	.659	1.000				
Digital Training	.173	.188	.189	1.000			
Personal Barriers	-.046	-.398	-.302	.027	1.000		
Institutional Barriers	-.065	-.264	-.160	-.147	.433	1.000	
Technology Integration	.463	.538	.620	.371	-.210	-.167	1.000

5.3 RESEARCH QUESTIONS

The next section of the results will articulate the results of the seven research questions outlined in Chapter 3 of this report. Based on the nature of the research questions, the results are descriptive in nature.

5.3.1 Educator attitudes

The online survey consisted of 17 statements measuring educators' attitudes towards digital tools, and technology integration in the classroom. A 6 point Likert scale was used to determine responses to each of the questions. Respondents could either 'Strongly Disagree, Disagree, Mildly Disagree, Mildly Agree, Agree or Strongly Agree' with the presented statement.

Table 5-4

Rank Ordered Summarised Results on Educator Attitudes

Survey Question	Strongly Disagree & Disagree	Mildy Disagree & Midly Agree	Agree & Strongly Agree
I am likely to adopt digital technologies in my teaching in the next 5 years	1.52%	18.18%	80.30%
I think new digital learning technologies will assist in my teaching	3.04%	21.21%	75.76%
Good teaching does not necessarily require teachers to use digital learning tools/techniques	7.58%	16.67%	75.76%
Computers and other digital technology tools are generally reliable	0.00%	25.76%	74.25%
I enjoy learning new technologies, new ways of doing things	3.03%	24.24%	72.73%
I find computers and related technologies interesting	6.07%	27.27%	66.66%
I believe that digital technologies promote learning	6.06%	34.85%	59.09%
I am confident in using technology to teach	4.55%	37.88%	57.57%
The socio-economic divide is replicated by the digital divide	6.07%	37.88%	56.06%
Digital technologies promote facilitation style teaching	12.12%	46.97%	40.91%
Computers and related technologies isolate learners from each other	21.22%	39.40%	39.40%
Digital technologies enable learners to become self-driven	15.16%	50.00%	34.85%
The more technology one uses, the more respect you get from your peers	13.64%	56.06%	30.31%
I have concerns that apps, YouTube videos and websites are a crutch for lazy teachers	37.88%	31.34%	30.30%
I believe that digital technologies 'dumb down' learners	46.97%	27.28%	25.76%
I feel embarrassed when my learners are more digitally competent than I am	59.09%	24.33%	16.67%
Digital technologies in teaching and learning are just another 'fad'	57.57%	28.79%	13.64%

The summarised results above were rank orders by the number of respondents who either agreed or strongly disagreed with the statements. Respondents either agreed or strongly agreed with most of the posed statements, as depicted in Table 5-4 above. Of the 17 statements posed, over half of the respondents tended to either agree or strongly agree with nine of the statement. Respondents who either agreed or strongly agreed with the statements ranged from 56.06% to 80.30%. The top 5 statements that most respondents agreed with were:

- I am likely to adopt digital technologies in my teaching in the next 5 years (80.30%)
- I think new digital learning technologies will assist in my teaching (75.76%)
- Good teaching does not necessarily require teachers to use digital learning tools/techniques (75.76%)
- Computers and other digital technology tools are generally reliable (74.25%)
- I enjoy learning new technologies, new ways of doing things (72.73%)

These results demonstrate that a large majority of the respondents accepted that digital learning technologies would assist in their teaching, and planned to use them in their teaching in the short to medium term (5 years). However, they were very clear that the use of digital technologies did not necessarily make for better educators.

On the other hand, more than half of the respondents either strongly disagreed or disagreed with the two statements listed below:

- I feel embarrassed when my learners are more digitally competent (59.09%)
- Digital technologies in teaching and learning are just another ‘fad’ (57.57%)

Interestingly, even though nearly half of the respondents (46.97%) either strongly disagreed or disagreed with the statement that “digital technologies ‘dumb down’ learners”, 25.76% of the respondents either agreed or strongly agreed with the statement. This indicates a significant variation in the responses, possibly as a result of differences in age and background. What is evident is that educators are divided on the impact of digital technologies on their learners’ ability to apply themselves in class.

5.3.2 Educators digital knowledge and skills (capabilities)

The online survey consisted of 10 statements measuring the educators’ digital knowledge and skills (capabilities). Eight of the questions were on a 6 point Likert scale between ‘Strongly Disagree and Strongly Agree’; one question was a Yes/No question; and the last question one question was on a different 5 point Likert scale between ‘Poor and Exceptional’. The summarised questions and results are tabled below:

Table 5-5

Rank Ordered Results on Educators' Digital Capabilities

Survey Question	Strongly Disagree & Disagree	Mildy Disagree & Midly Agree	Agree & Strongly Agree
I create Word processing documents with ease (e.g. Ms Word)	3.03%	7.58%	89.40%
I create Presentation documents with ease	3.04%	13.64%	83.34%
I do well with digital technologies e.g. computers	1.52%	33.34%	65.15%
I feel comfortable using digital technological tools/systems/programmes	1.52%	36.36%	62.12%
I am creative when using presentation/multimedia software (e.g. PowerPoint and Google Presentation), my presentations are highly professional	7.58%	31.82%	60.61%
I use digital technologies to self-teach/self-study	6.06%	36.37%	57.57%
I solve technical problems in my classroom	19.70%	37.88%	42.43%
I seldom require IT support (technical support in the use of digital tools)	16.67%	42.42%	40.91%

As depicted in the Table 5-5 above, 89.40% of all respondents were capable of comfortably creating Word documents, with only 3.03% of the respondents unable to create Word documents with ease. Similarly, a majority of respondents (83.34%) had no challenges with preparing Powerpoint documents. Over 65% of the respondents agreed that they do well and are comfortable with digital technologies, with only one respondent admitting that they neither did well nor were they comfortable with digital technologies. What was interesting is that a sizeable number of respondents, in excess of 30%, were non-committal on their responses (mildly disagreed and mildly agreed), possibly indicating that those educators were still not certain of how they honestly fared with digital technologies.

60% of respondents agreed that they were creative when using presentation and multimedia software, and that their presentations were highly professional. Almost a third of respondents (31.82%) were relatively neutral on this statement (mildly disagreed and mildly agreed). There was almost the same number of respondents (approximately 40%) who agreed that they could solve their own technical problems and seldom required IT support in the use of digital tools, as those who appeared to be less certain, mildly disagreed, or mildly agreed. Less than 20% of respondents indicated that they were

unable to resolve technical problem and required IT support on digital tools. These results could possibly be explained by disparities in age and institutions, public versus private.

As shown in Figure 5-2 below, more than 56% of respondents rated their ability to meet the digital needs and expectations of your learners as either good or exceptional. 36.36% rated it as fair, and only 7.58% of the respondents rated their abilities as either okay or poor. This result is notably subjective, and cannot be ratified without the full understanding of the learners' needs and expectation.

Figure 5-2

Educators' Rating of their Ability to Meet the Digital Needs/Expectations of Learners

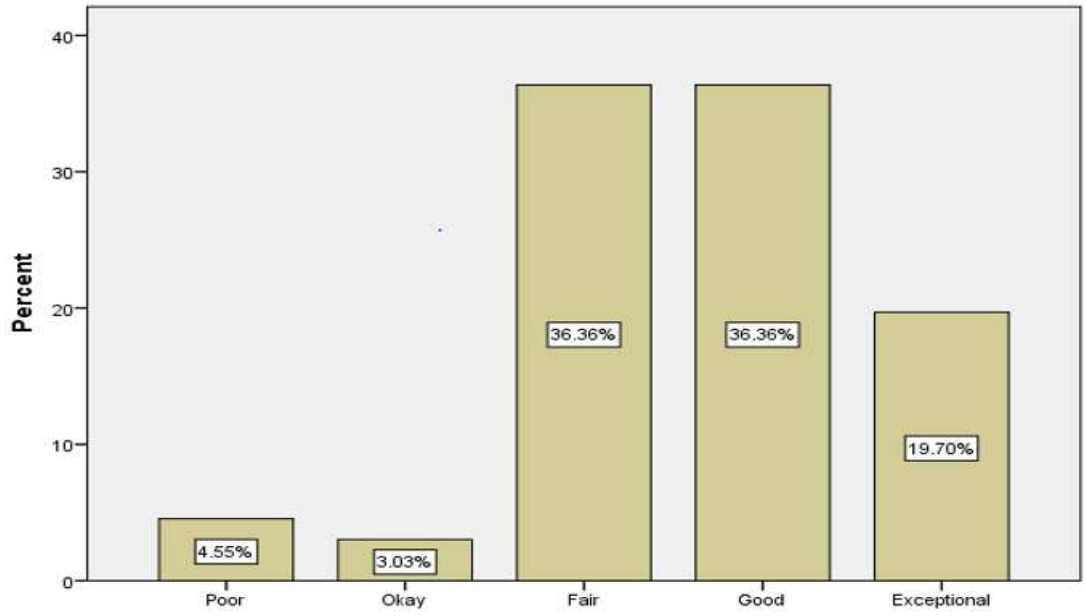
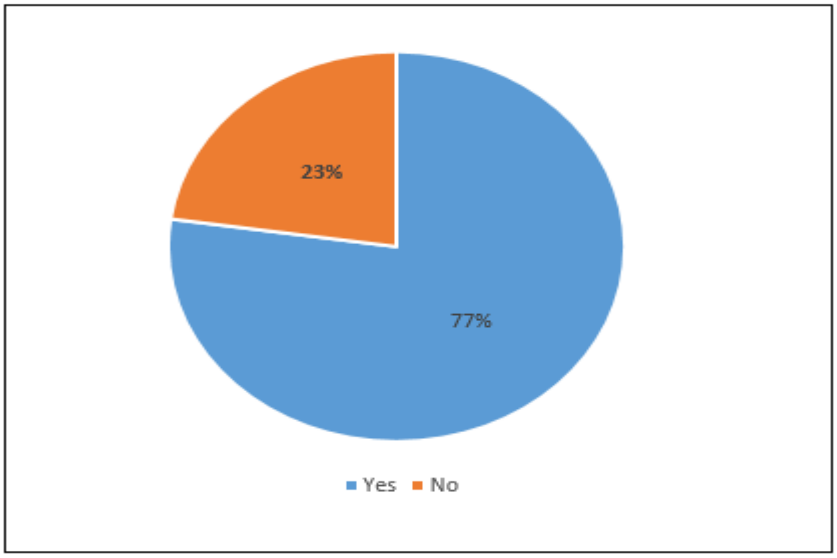


Figure 5.3 shows that 77,27% indicated that they had the skills to assist others in the use of digital tools in the classroom. This may be an indication that respondents believe that they have the technical competence and positive attitude on the use of technology, and its integration in the classrooms.

Figure 5-3

% of Respondents who Help Others in Terms of Using Digital Tools in the Classroom.



5.3.3 Educators' digital training

In keeping with the survey approach, eight of the statements/questions on the online survey were focused on measuring the nature and level of training that educators received on digital tools. Six of the eight questions, were 'Yes/No' questions as seen in Table 5.9, while the balance of the questions were on a 6 point Likert scale described in earlier sections.

Table 5-6

Rank Ordered Summary of Educators' Digital Training Results

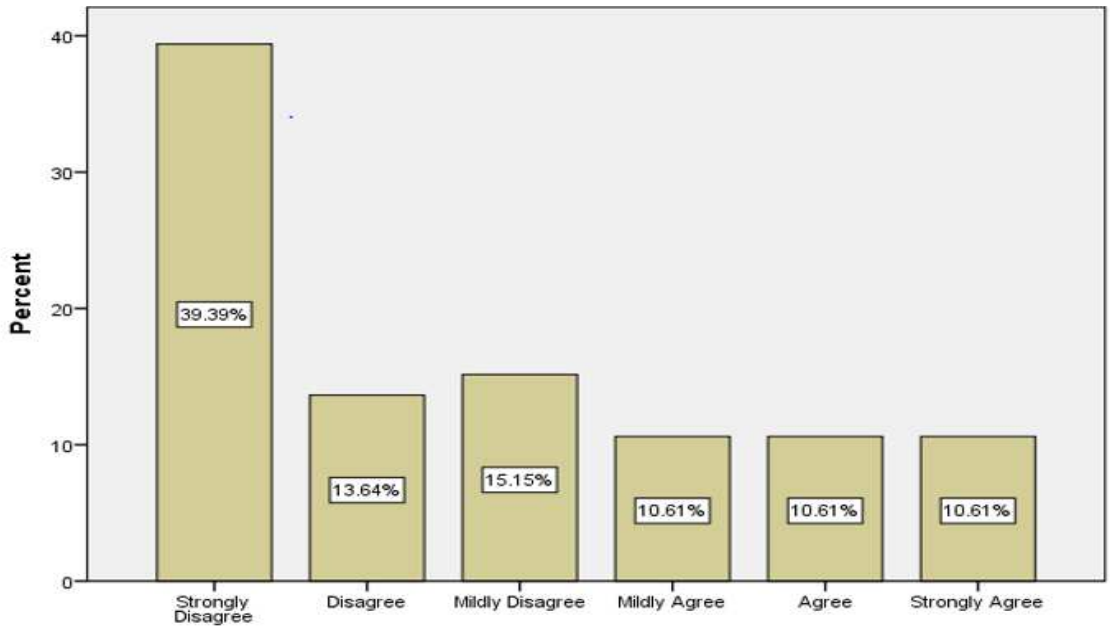
Survey Question	Yes	No
I am self-taught in terms of using Presentation e.g. Powerpoint in the classroom	92.42%	7.58%
My training has taught me how to use apps in the classroom	66.67%	33.33%
I have received training on integrating digital tools in the classroom environment	60.61%	39.39%
I have received training on lesson planning where digital tools are used in the classroom environment	34.85%	65.15%
My training has equipped me to plan strategies using technology to enhance learning	34.85%	65.15%
I have received training on creating/updating websites	13.64%	86.36%

From Table 5-6 above, it is evident that even though most respondents stated that they had either received training in the use of apps in the classroom (66.67%), and on integrating digital tools (60.61%) in the in the classroom, a vast majority of them were, however, self-taught in terms of using presentations. This indicates that their training only extended to the application or integration of digital tools, not the use of programmes within those tools.

Similarly, over 65% of respondents indicated that they had not received training on lesson planning using digital tools, and did not feel equipped to plan strategies to enhance learning using technology. Further, 69% of respondents disagreed with the statement that their training had taught them to design lesson plans that support digital technology, are developmentally appropriate and support the needs of diverse learner, as seen in Figure 5-4 below. This speaks to the use of digital tools as pedagogy media, and not just a technical skill for the educator.

Figure 5-4

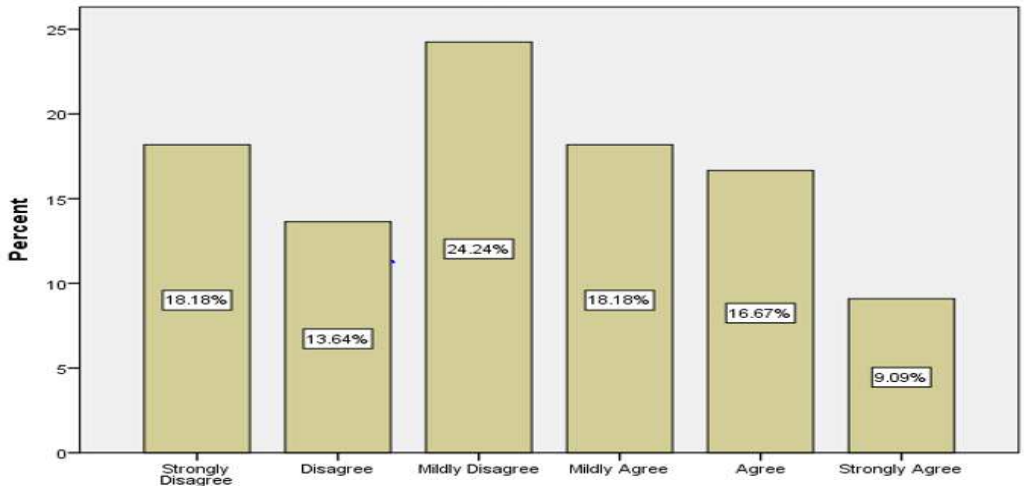
Educators Responses on whether their Training had taught them how to Design Lesson Plans that Support Digital Technology, are Developmentally Appropriate, and Support the Needs of Diverse Learners



Only 13.64% of respondents had not received training on creating and updating websites. The distribution of whether respondents had received training on how to locate educational websites for student learning was quite wide, as shown in Figure 5-5 below.

Figure 5-5

Educators' Responses on whether their Training had taught them how to Locate Educational Websites for Student Learning



5.3.4 Educators' digital resources

A total of eight questions were focused on understanding the digital resources that were at the educators' disposal. Five of the statements/questions on the online survey were 'Yes/No' questions as seen in Table 5.11, while the balance of the questions were on a 6 point Likert scale described in earlier sections.

Table 5-7

Educators Digital Resources

Do you own or have regular access to the following?	Yes	No
Personal Computer (PC) or laptop	100.00%	0.00%
Smartphone	89.39%	10.61%
Game console	25.76%	74.24%
iPod (or other mp3 player)	40.91%	59.09%
iPad or other tablet	71.21%	28.79%

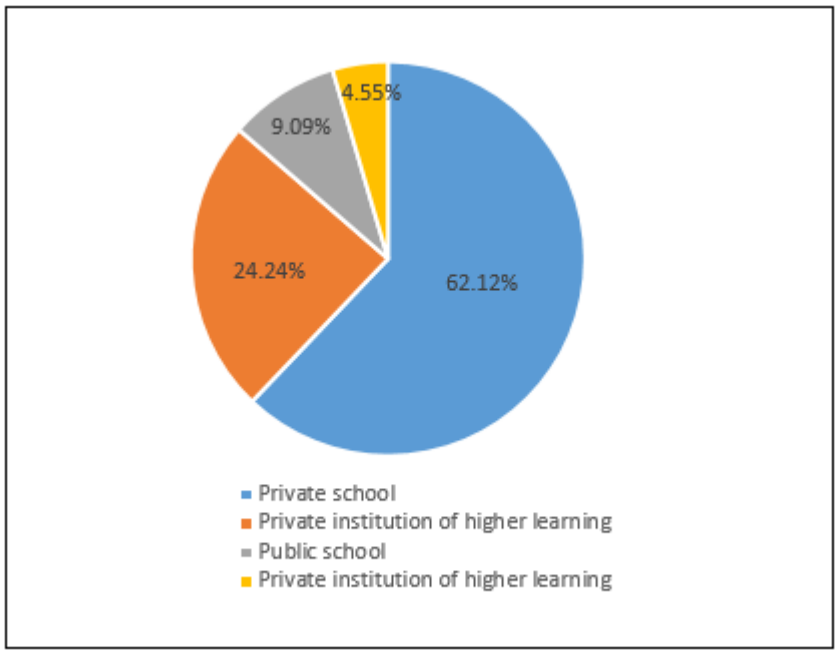
As seen above in Table 5-7, all respondents had access to a digital device. The personal computer (PC) was the most accessible device (100%), followed by the Smartphone. 89.39% of the respondents had smartphones, indicating that even the 'older' educators had access to Smartphones. Only 25.76% of respondents had access to a game console. Similarly, 59.09% of the respondents did not have an iPod (or other mp3 player). A vast majority of the respondents, 71.21%, had an iPad or other tablet, possibly due to the functional applications and benefits of an iPad for professional and educational purposes, over tools such as Games consoles and iPods.

5.3.5 Educators' institution type

As presented in Figure 5-6 below, and as outlined in the sample description section, a large number of respondents were educators in private schools. This demographic accounted for 62.12% of the respondents. This was followed by public institutions of higher learning, which accounted for 24.24% of the respondents. The least number of respondents came from public schools and private institution of higher learning, which were represented by 9.09% and 4.55% respectively.

Figure 5-6

Institution Type of Educators' Employers

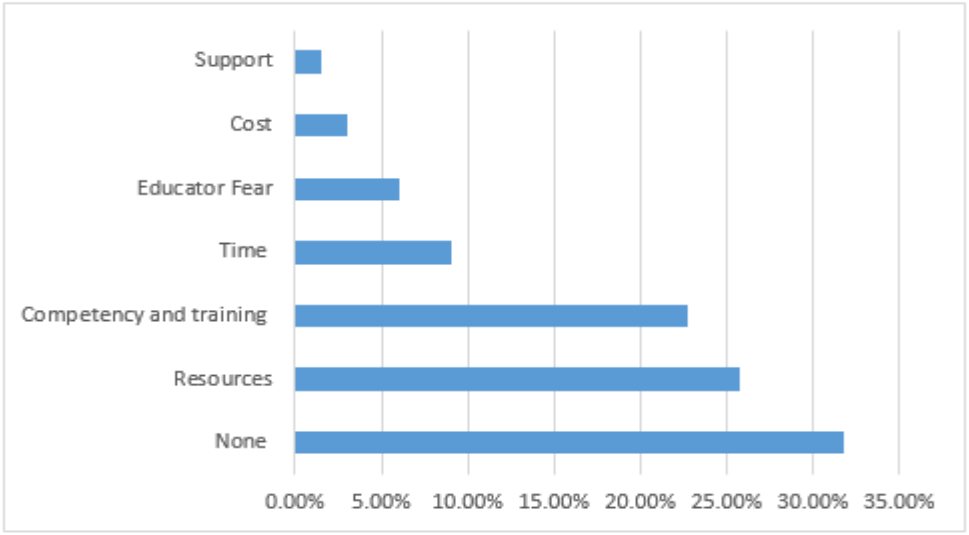


5.3.6 Educators personal barriers

Surprisingly, at 31.82%, a large number of respondents indicated that they had no personal digital barriers in the integration of technology in their classrooms, as seen in Figure 5-7. 25.76% of the respondents cited resources as a personal barrier, perhaps corroborating results of Section 5.4.4 that highlighted that 28.79% of the respondents did not have an iPads or tablet. Competency and training also came up as a significant personal barrier at 22.73%. This factor was isolated in Section 5.4.3. Other peripheral personal barriers highlighted were time and fear, accounting for 9.09% and 6.06% of the responses respectively. Cost and support were the least identified personal barrier at 3.03% and 1.52% of the respondents respectively. The institution type may be a factor in the personal barriers identified.

Figure 5-7

Personal Barriers



5.3.7 Educators institutional barriers

The respondents identified the following institutional barriers as hindrances to the optimal integration of technology in the classroom:

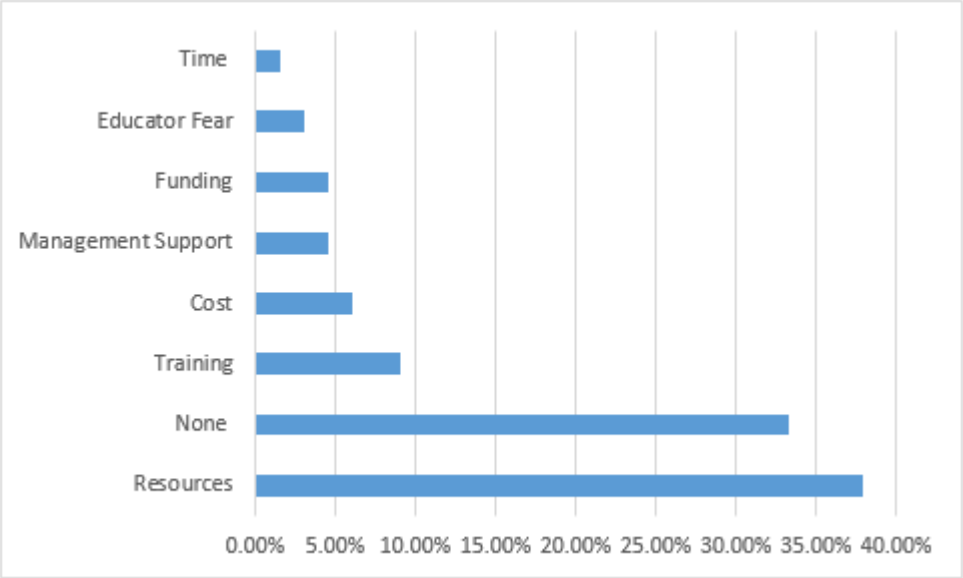
Resources were the most widely mentioned barrier, with 37.88% of the respondents highlighting that their institutions did not have adequate resources to optimally integrate technology in their schools. Interestingly, most of the barriers highlighted as personal barriers were duplicated in institutional barriers. As the two questions were open-ended

questions, respondents could have merely copied the barriers cited in a personal barriers in institutional barriers, without necessarily applying themselves to the second question.

Alternatively, there may be a significant overlap between personal and institutional barriers in their minds. Similar to the findings on personal barriers, almost 10% of the respondents cited Training as an institutional barrier. Cost was selected by 6.06% of the respondents. Funding and management support, equally, were mentioned by 4.55% of the respondents respectively. Fear and time, just like in personal barriers, also came up. Those two barriers, fear and time, were the least cited institutional barriers by the respondents at 3.03% and 1.52% of the responses received respectively.

Figure 5-8

Institutional Barriers



5.3.8 Technology integration

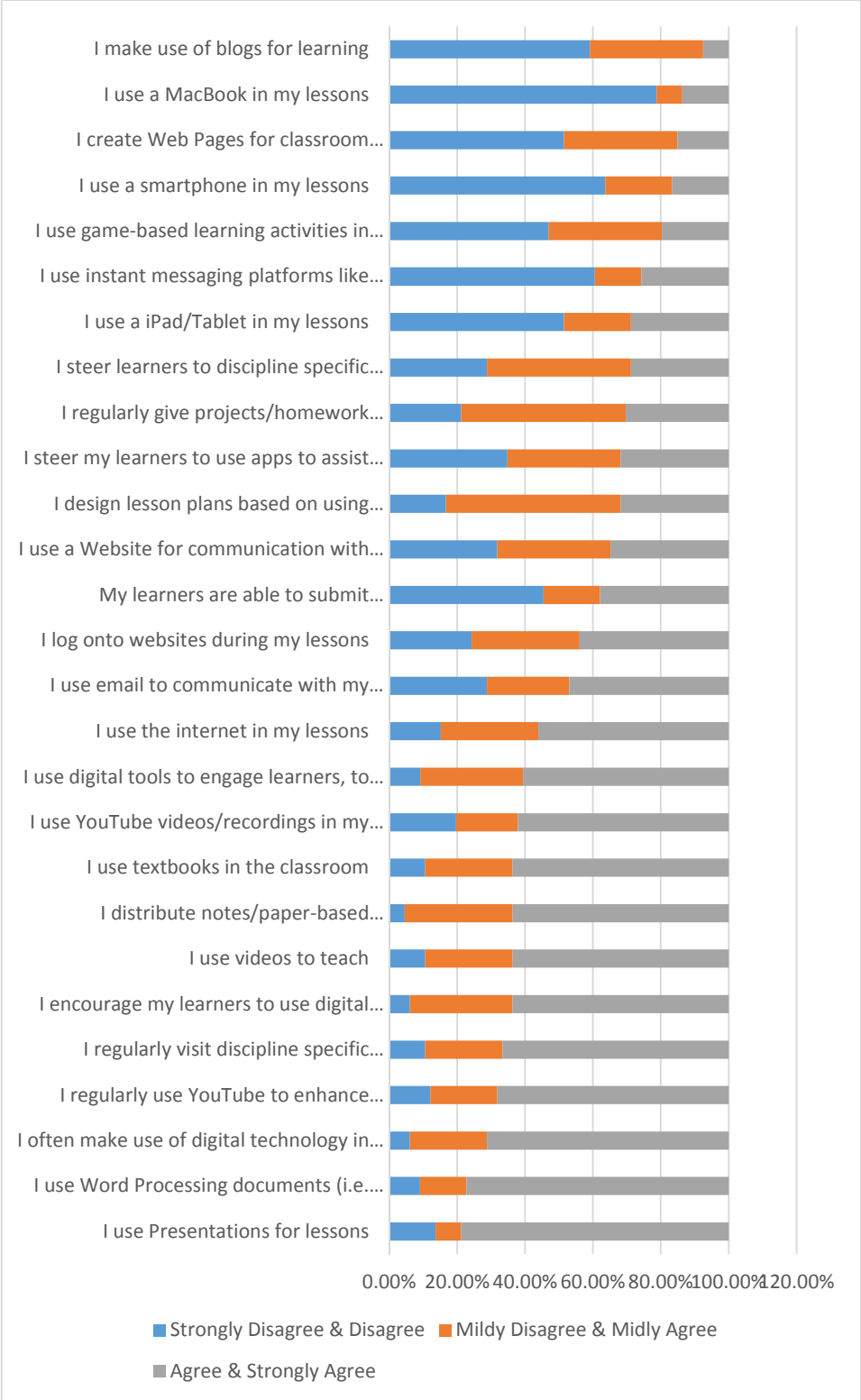
As the research title alluded, technology integration was the main theme of the study. It was defined as the dependant variance in the statistical analysis. Considering the significance of this theme, the online survey consisted of a comprehensive set of questions on the use of digital tools in the classroom, and the overall extent of technology integration in the respondents' classrooms.

The 27 questions and statements aimed to determine the nature and extent of technology integration in South African classrooms. All 27 questions were on a 6 point

Likert scale between ‘Strongly Disagree and Strongly Agree’. The summarised questions and results are tabled below**.**

Figure 5-9

Rank Ordered Results for Technology Integration in Classrooms



As shown in Figure 5-9, the nature and extent of technology integration in classrooms varies widely across different technology tools and media. The most commonly used technology tools and media in the classroom, based on the percentage of respondents who either agreed or strongly agreed with the statements, were:

- Use of Presentations for lessons (78.79%)
- Use of Word processing documents to create lessons (77.28%)
- Use of YouTube to enhance learning (68.18%)
- Use of discipline specific websites for self-study purposes and/or to help learners (66.67%)

The least commonly used technology tools and media in the classroom, based on the percentage of respondents who either disagreed or strongly disagreed with the statements, were:

- Use of blogs for learning (59.09%)
- Creation of Web Pages for classroom practices or to share classroom practices (51.51%)

Over 60% of respondents indicated that they encourage their learners to use digital tools and resources to enhance their knowledge and understanding of the curriculum/content; and that they used digital tools to engage learners, to explore real-world issues and solve authentic problems. That said, an overwhelming majority of the respondents agreed that they used text books, and distributed notes/paper-based activities and instructions in their classrooms. Surprisingly, even with the level of perceived technology integration in the classrooms of respondents, most respondents indicated that they didn't use devices such as the MacBooks (78.79%), smartphone (63.64%) and iPads or Tablets (51.52%) in their lessons. All educators had access to either a laptop or PC and are assumed to use those as primary tools for technology integration in their classrooms.

In addition, only 31.82% of respondents conclusively agreed that they designed their lesson plans using digital technologies, which are developmentally appropriate and support the needs of diverse learners. Just over half of the respondents (51.51%) mildly disagreed or mildly agreed in their responses.

5.4 REGRESSION AND HYPOTHESES TESTING

To test the five hypotheses articulated in Chapter 3, regression analysis was used to examine the relationship between the aggregate scores for each of the five independent variables- that is, educator attitudes, educator digital capabilities (knowledge and skills), educator digital training, educators' digital resources, and educators' institution type- with the aggregate score of the dependent variable, technology integration. The mean scores of all the questions that used the Likert 6 point scale on each of the independent variables were tested against the mean scores of all the questions using the Likert 6 point scale codes on the dependent variables.

This results of the test provided a sense of whether respondents' responses on each of the five themes in the research hypotheses had an impact on the responses on the independent variable, which is technology integration. Even though data for the dependant variable was purely numerical, the underlying categorical data was transformed into numeral data through the coding of the Likert scale categories.

Each category of the Likert scale ranged from 1 representing Strongly Disagree, to 6 representing Strongly Agree. At an aggregate level, the test measured whether the intensity of the responses on the questions relating to the independent variables influenced the intensity of the responses on the questions measuring the dependant variable. The hypotheses were measured using the SPSS 24 software. All five variables that were included as independent variables and technology integration as the dependent variable. To ensure consistency, no items were removed.

5.4.1 Educator attitudes and technology integration | H1 - Attitudes impact on technology integration in the classroom

Table 5-8
Model Summary- Educator Attitudes and Technology Integration

				Std. Error	Change Statistics				
Model	R	R Square	Adjusted R Square	of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.463[a]	.214	.202	19.37038	.214	17.417	1	64	.000

a. Predictors: (Constant), Educator Attitudes

Table 5-9

Educator Attitudes and Technology Integration - ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6534.946	1	6534.946	17.417	.000[b]
	Residual	24013.539	64	375.212		
	Total	30548.485	65			

a. Dependent Variable: Technology Integration

b. Predictors: (Constant), Educator Attitudes

A regression analysis was done to test hypothesis H1, i.e. educator attitudes as the independent variable and technology integration as the dependent variable. Table 5.8 shows the summary statistics. The R value of 0.463 means than there was a statistically significant and positive association between educator attitudes and technology integration. The two characteristics move together. The R squared value, which is the coefficient of determination, explains the variability of technology integration explained by educator attitudes. This value was 21.4%. This means that only 21.4% of variation was explained by educator attitude. Table 5-9 above summarises the findings of the regression test used to measure H1. As presented, educator attitudes are significant in explaining technology integration (P<0.05). The significant value for H1 was 0.000, supporting the hypothesis at 5% level of significance.

Table 5-10

3..0.0.3 Hypothesis H1 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	20.839	20.192		1.032	.306					
	Educator Attitude	1.125	.270	.463	4.173	.000	.463	.463	.463	1.000	1.000

a. Dependent Variable: Technology Integration

As seen in Table 5-10 above, Beta (Path coefficient), measuring the strength of attitudes as a predictor of technology integration, was 0.463, and the t-value, a measure of the

precision with which the regression coefficient is measured, was 4.173. This result strongly supports the hypothesis that educator attitudes have an impact on technology integration.

5.4.2 Educators' digital capabilities and technology integration | H2 - Digital capabilities (knowledge and skills) have an impact on technology integration in the classroom

As detailed below, the exercise was repeated for all seven hypotheses.

Table 5-11
Model Summary – Educators' Digital Capabilities and Technology Integration

				Std. Error of		Change Statistics			
Model	R	R Square	Adjusted R Square	the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.538[a]	.290	.279	18.40980	.290	26.135	1	64	.000

a. Predictors: (Constant), Digital Capabilities

Table 5-12
Educators digital capabilities and technology integration - ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8857.549	1	8857.549	26.135	.000[b]
	Residual	21690.935	64	338.921		
	Total	30548.485	65			

a. Dependent Variable: Technology Integration

b. Predictors: (Constant), Digital Capabilities

Similarly, a regression analysis was done to test hypothesis H2, i.e. educator digital capabilities as an independent variable and technology integration is a dependent variable. Table 5-11 shows summary statistics. The R value of 0.538 means that there was a statistically significant and positive association between educator digital capabilities and technology integration. The two characteristics move together. The R squared value explained the variability of technology integration by educator digital capability. This value was 29%. This means that only 29% of variation is explained by educator digital capability. Table 5-12 above summarises the findings of the regression used to measure H2. As seen, educator digital capabilities were seen to have a significant impact on technology integration ($P<0.05$). The significant value for H2 was

0.000, supporting the hypothesis that digital capabilities are a driver and predictor of technology integration in classrooms

Table 5-13
Hypothesis H2 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	41.512	12.531		3.313	.002					
	Digital Capabilities	1.499	.293	.538	5.112	.000	.538	.538	.538	1.000	1.000

a. Dependent Variable: Technology Integration

The Beta (Path coefficient) was 0.538, and the t-value was 5.112. These results indicate that the mean scores of questions relating to digital competency had a material impact on the mean scores of the results relating to technology integration. As seen in Table 5-13, the strength of the relationship was 0.538 (Beta), where 0 indicates no impact, and 1 indicates full variable impact, excluding the constant. Therefore, similar to H1 on attitudes, this result supported the hypothesis that educator attitudes have a significant impact on technology integration.

5.4.3 Educators' digital training and technology integration | H3 - Digital training has an impact on technology integration in the classroom

A regression analysis on ANOVA was conducted to measure hypothesis H3. In this study, educator digital training is an independent variable, and technology integration as a dependent variable. Table 5-14 shows summary statistics. The R value of 0.371 means that there was a weak and positive association between educator digital training and technology integration. The two characteristics moved together. The R squared value explained the variability of technology integration by educator digital training. This value was 13.8%. This means that only 13.8% of variation was explained by educator digital training. Table 5-15 below captures the findings of regression used to test H3. Scores of educator digital training had a significant impact on scores on technology integration ($P<0.05$). The significant value for H4 was 0.002. Therefore, hypothesis H4 was supported and significant.

Table 5-14

Model Summary – Educators' Digital Training and Technology Integration

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.371[a]	.138	.124	20.28628	.138	10.231	1	64	.002

a. Predictors: (Constant), Digital Training

Table 5-15

Educators Digital Training and Technology Integration - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4210.372	1	4210.372	10.231	.002[b]
	Residual	26338.113	64	411.533		
	Total	30548.485	65			

a. Dependent Variable: Technology Integration

b. Predictors: (Constant), Digital Training

Table 5-16

Hypothesis H4 coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	86.282	6.223		13.864	.000					
	Digital Training	2.096	.655	.371	3.199	.002	.371	.371	.371	1.000	1.000

a. Dependent Variable: Technology Integration

As seen in Table 5-16 above, Beta (Path coefficient) was 0.655, and the t-value was 3.199, recognising that educator digital training had a significant impact on technology integration.

5.4.4 Educators digital resources and technology integration | H4 - Digital resources have an impact on technology integration in the classroom

Table 5-17

Model Summary – Educators' Digital Resources and Technology Integration

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.620[a]	.384	.375	17.14373	.384	39.939	1	64	.000

a. Predictors: (Constant), Digital Resources

Table 5-18

Educators' Digital Resources and Technology Integration - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11738.406	1	11738.406	39.939	.000[b]
	Residual	18810.079	64	293.907		
	Total	30548.485	65			

a. Dependent Variable: Technology Integration

b. Predictors: (Constant), Digital Resources

A regression analysis on ANOVA was conducted to measure hypothesis H3. In this study, educator digital resources is an independent variable, and technology integration is a dependent variable. Table 5-17 shows summary statistics, the R value of 0.620 means that there was a good and positive association between educator digital resources and technology integration. The two characteristics moved together. The R squared value explained the variability of technology integration explain by educator digital resources, this value is 38.4%. This means that only 38.4% of variation was explained by educator digital resources. Table 5-18 above encapsulates the discoveries of the regression used to test H3. As seen, educator digital resources have a significant impact on technology integration ($P<0.05$). The significant value for H3 was 0.000. Therefore, hypothesis H3 was supported and significant.

Table 5-19

Hypothesis H3 coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	20.455	13.468		1.519	.134					
	Digital Resources	4.403	.697	.620	6.320	.000	.620	.620	.620	1.000	1.000

a. Dependent Variable: Technology Integration

As seen in Table 5-19 above, Beta (Path coefficient) was 0.620, and the t-value was 6.320. Therefore, corroborating that mean scores on educator digital resource questions had a significant impact on mean scores on technology integration questions.

5.4.5 Institution type and technology integration | H5 - Institution type has an impact on technology integration in the classroom.

Table 5-20

Model Summary: Institution Type and Technology Integration

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.039[a]	.001	-.014	21.83139	.001	.095	1	64	.758

a. Predictors: (Constant), Institution Type

Table 5-21

Institution Type and Technology Integration - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.482	1	45.482	.095	.758[b]
	Residual	30503.003	64	476.609		
	Total	30548.485	65			

a. Dependent Variable: Technology Integration

b. Predictors: (Constant), Institution Type

Table 5-20 and 5-21 above review the results of regression used to measure H5. Table 5-21 shows summary statistics. The R value of 0.039 illustrates that the association between institution type, and technology integration was very weak. The correlation was very close to zero, and, therefore, does not explain much about technology integration, and might not be a good factor to use. The R squared value explained the variability of technology integration by institution type. This value was 0.1%. This means that only 0.1% of variation was explained by institution type. Table 5-21 above reviews the results of regression used to measure H5. As offered, institution type did not have a significant impact on technology integration (P>0.05). The significant value for H5 was 0.758. Therefore, hypothesis H5 was not supported, and was insignificant, failing to accept the null hypothesis.

However this result is most likely a limitation of the research instrument and test. The research instrument only had one question measuring institution type, against 27 questions on technology integration. Additionally, data was significantly skewed on a specific institution type, namely private schools. Therefore the mean score for institution type was not meaningful as the underlying scores were from only one question, which resulted in the actual mean score being the mean score of the one question. For the results to be valid, more questions would have had to be asked.

Table 5-22

Hypothesis H5 coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	105.757	4.836		21.869	.000					
	Institution Type	-.651	2.106	-.039	-.309	.758	-.039	-.039	-.039	1.000	1.000

a. Dependent Variable: Technology Integration

As shown above in Table 5-22, Beta (Path coefficient) was -0.039, and the t-value was -0.309, thus confirming inconsistencies with the research hypothesis proposed in this study, and highlighting the limitations of this hypothesis.

5.5 CONCLUSION OF RESULTS

The results obtained from measuring the research hypotheses, established that there was a statistical relationship between the projected directions of the research conceptual model. Overall, four out of five hypotheses were supported by the collected data. Institution type was found not to have a significant impact on technology integration. As highlighted in the discussion of the hypothesis, this finding is due to a research methodology limitation. The next chapter discusses the results and the implication thereof.

CHAPTER 6: DISCUSSION OF RESULTS

6.1 INTRODUCTION

This chapter offers a critical discussion of the research results, taking into account literature reviewed. The structure of this chapter will be based on research questions and hypotheses outlined in Chapters 3 and 4 of this document. Further, findings per research question and hypothesis will be contrasted with prior literature set out in Chapter 2. Finally, the discussion of the relevance of these findings, and their implications in the South African business and academic contexts, will be discussed.

The section proceeds with a summary of the results of the research questions (RQ) and hypothesis (H) results, which will be referred to throughout the discussions. In Chapter 3, the following research questions and hypotheses were outlined:

RQ1 & H1: Attitudes – Nature and impact on technology integration in the classroom.
RQ2 & H2: Digital capabilities (knowledge and skills) – Nature and impact on technology integration in the classroom.
RQ3 & H3: Digital training – Nature and impact on technology integration in the classroom.
RQ4 & H4: Digital resources – Nature and impact on technology integration in the classroom.
RQ5 & H5: Institution type has an impact on technology integration in the classroom.
RQ6: Personal digital barriers – Nature of personal barriers to technology integration in the classroom.
RQ7: Institutional digital barriers – Nature of institutional barriers to technology integration in the classroom.

Table 6.1 provides a summary of the results of the hypotheses tests discussed in Chapter 5.

Table 6-1

Summary of the Hypothesis Results

Hypotheses	Path	Path coefficient	t-value	Sig.	Results
H1 (attitudes)	EA→TI	0.463	4.173	0.000	Supported (P<0.05)
H2 (capabilities)	DC→TI	0.538	5.112	0.000	Supported (P<0.05)
H3 (training)	DR→TI	0.620	6.320	0.000	Supported (P<0.05)
H4 (resources)	DT→TI	0.655	3.199	0.002	Supported (P<0.05)
H5 (institution)	IT→TI	-0.039	-0.309	0.758	Not Supported (P>0.05)

6.2 RESEARCH QUESTION AND HYPOTHESIS 1: ATTITUDES – NATURE OF EDUCATORS ATTITUDES AND THE IMPACT ON TECHNOLOGY INTEGRATION IN THE CLASSROOM

The attitude theme was explored in two aspects. Firstly, as a research question seeking to understand educators' attitudes towards technology and its role in learning. Secondly, as a hypothesis to test whether such attitudes had any impact on the integration of technology in the classrooms.

Overall attitudes towards technology integration were largely positive, as seen in Section 5.4.1. The strength of the hypothesized relationship between educator attitudes and technology integration was found to be material at 0.463. Thus attitude is an important predictor of technology integration. An overwhelming majority of respondents readily agreed that they would adopt digital technologies in their teaching in the next 5 years, and believed that the new digital learning technologies would assist in their teaching. However, a number of inconsistencies were noted in some of the responses. For example, more than three quarters of the respondents, believed that good teaching does not necessarily require teachers to use digital learning tools/techniques.

These sentiments are supported by Kirkwood & Price (2005), who assert that technology is a mere enabler, and cannot replace a well-crafted curriculum facilitated by a well-trained teacher. In this instance, 'good teaching' transcends technical competence of digital tools, to effective pedagogy *using* those tools. That is to say, the application of structured teaching methods using digital tools is of greater value than merely possessing technical knowledge on those tools. This sentiment is supported by findings in the study by Drent & Meelissen (2008), and Tezci (2001), who affirm that ICT cannot be viewed as a replacement of existing proven teaching methods, but rather as a

supplementary medium aimed at supporting newer ways of teaching and learning. They argue that ICT adoption can assist in teaching cooperation, problem solving, and communication skills.

However, for technology integration to be a 'way of life', educators must believe that embracing technology can be used to promote subject/discipline understanding in a way that non digital tools cannot. The use of YouTube videos, GIFS[1] can readily promote understanding of a learner by presenting information in a visual manner, with animations and graphs that enable learners to quickly grasp concepts in a way that an inanimate book or a teacher orally describing and explaining cannot. In the digital era, using digital technology in the classroom will also help to promote engagement by the learners. It will prepare them for the digital economy, by giving learners a competitive edge in the world of work and higher education (should they chose that path).

Thus, while it is true that historically, digital learning tools were not required in the classroom, this will is no longer true. It is also becoming increasingly clear that learning can take place entirely online via websites and 'apps' (smartphone applications). While the best of these (such as Khan Academy and BrainPoP®[2]) will be informed by pedagogy and curriculum developments, they are also indicative of how the world of teaching and learning is rapidly changing in the digital era. How well the respondents appreciate this was not clear, but their responses indicate that their level of awareness in this regard may be low.

Another significant finding was that educators form public institutions reported an attitude that digital technologies 'dumb down' learners. This perception was especially prevalent in the older demographic, possibly indicating a generation or age gap between these educators, and their young learners. In this case, the digital divide between digital natives and digital immigrants is very evident.

In summary, the results for Hypothesis 1, confirmed a material positive relationship between educator attitudes, and technology integration. Actively addressing educators' attitudes towards technology, and its use in the classroom, can enhance the integration of those technologies in schools. Further, by creating a positive attitude through an

enabling environment, management can impact technology integration. In other words, by embracing new technologies to develop new ways of doing things, educators can build positive attitudes, confidence, and motivation to successfully integrate technology in their classroom.

This finding corroborates a number of studies. For example, Ertmer et al. (2012), and Blackwell, Lauricella and Wartella (2014) found that educators' personal beliefs and attitudes about the significance of technology for learning have the greatest impact on successful adoption. Similarly, Nana (2012) showed that educators with positive attitudes towards ICT in education and their instructional practice tended to be the most willing to use it in their classrooms. Kale and Goh (2014) confirmed that educators with negative attitudes toward using ICT, lacked understanding and knowledge of how to effectively use technology tools, or were inhibited by limited learner or educator technology access, were highly unlikely to utilise technology tools in their classrooms.

However, findings showed that the issue of educators' attitudes was complex and multilayered, evident in the contractions and misconceptions observed. There is perhaps a need for deeper understanding of how attitude towards technology and its use in the classroom links to educators' motivation, in order to offer plausible explanations to the observed contradictions and misconceptions. This nuance on attitudes presents an avenue for future studies. What remains unclear is how effective the schools' efforts are in genuinely instilling the belief that leveraging technology in their pedagogy can offer educators a competitive edge over their peers, making them 'better' educators, affirming the fact that technology is not just a fad or a crunch for lazy teachers, as observed in some of the responses.

6.3 RESEARCH QUESTION AND HYPOTHESIS 2: NATURE OF EDUCATORS DIGITAL CAPABILITIES AND THE IMPACT ON TECHNOLOGY INTERGRATION IN THE CLASSROOM

The importance of educators' digital competencies in the successful integration of technology in the classroom was viewed in two ways. Firstly, the study sought to gain a high level of understanding of the current state of educators' digital competency. Secondly, the study aimed to ascertain if digital capabilities had an influence on technology integration. A critical finding from Section 5.4.2 was that, in the main, educators were highly capable and comfortable with using digital tools for 'basic' tasks such as preparing word documents and presentations. This finding was expected, as

most educators would have had exposure to those tools, either as part of their training or expectations in the classroom.

Interestingly, only a few educators admitted to being able to creatively use presentations. This finding indicates that even though educators are increasingly becoming comfortable with the use of technology, fewer educators have been able to extract maximum value from the tools. This may be due to the effort, in the form of time, that it takes to become fully proficient in these tools, and the level of training that is often required to fully optimise the value. These findings almost mirror findings in the study by Etmers (2005) that drew a distinction between lower and higher level tasks. The study purported that increased competency in the use of technology tools is likely to move users away from superficial activities, to meaningful, value-adding activities that seek to convert information into knowledge. The study termed those value-add activities as higher level tasks. Etmer's (2005) view was shared by Okojie & Olinzock's (2013) research, which concluded that educators' expertise in using technologies need to extend to the integration of technology in the instructional setting in order to cultivate meaningful learning, (Okojie & Olinzock, 2013).

The findings of this study, therefore, appear consistent with most findings in prior studies, and further highlight the distinction between lower level tasks, such as competency in Word and Presentation documents, and higher level tasks, such as the use of technology in converting information to knowledge. Respondents appeared to only possess proficiency in lower level tasks despite their high levels of post matric qualifications.

Another interesting finding was that, even with the high capability levels, educators still battled to solve their own IT problems, often requiring IT support. This further highlight that the skill is isolated to basic use. The findings above were inconclusive in terms of whether or not educators' capabilities had morphed into using technology as pedagogical tools, as envisioned by Aslan & Zhu (2015).

The digital capabilities scale used had an excellent Cronbach's alpha score of 0.879, indicating that all the measurement scales reliably measured digital capabilities of teachers and lecturers. It was apparent from the regression results that there is a positive relationship between educators' digital capabilities, and technology integration. This finding highlights that the more knowledgeable and skilled educators are about technology, the more likely they are to integrate it in their classrooms. Driving digital knowledge and skills will eventually lead to an increase in the utilisation of technology in

classrooms. As seen in Table 6-1 above, the educators' digital capabilities have a significant impact on technology integration ($P<0.05$).

These findings indicate that if educators are competent and comfortable with using technology, they will be more likely to use it to prepare for their lessons using various digital tools. This capability will undoubtedly impact on implementation of technology in the classroom, and further make lessons more engaging for their learners. The finding that educators create presentations with ease, and are able to solve technical problems in the classroom, is an indication that they are drawing closer to closing that digital divide, and narrowing the skills gap.

Similarly, these findings also support earlier studies that explored the impact of the educator's digital capabilities on technology integration. In a study done by Ertmer et al. (2012), educators noted that the biggest barrier preventing other educators from using technology were their current levels of digital knowledge and skills (capabilities). Similarly, Ertmer and Ottenbreit-Leftwich (2013) in their study flagged the development of educators' technology skills as critical. Tondeur, Kershaw, Vanderlinde, and van Braak (2013) described educators that are technologically skilled and knowledgeable as those who are innovators, agile, and motivated. They have a better understanding of learners' learning and previous experiences, use a wide range of teaching strategies, and know the teaching opportunities and potentials of technology tools and resources. Such educators are dedicated to continuous learning.

From the findings, it was unclear whether educators saw themselves as innovators that were equipped to offer a wide range of instructional strategies based on their experience, and learners' needs. This perhaps speaks to the maturity of schools when it comes to technology integration. Most schools are possibly still in the phase of familiarising themselves and gaining competence in the technologies, and have not yet moved to the phase of fully exploiting the opportunities that technology offers in driving learner outcomes. This factor could make for an interesting future study, understanding the evolution of schools towards meaningful technology integration.

These findings also supported a study by Buabeng-Andoh (2012) in Ghana, a study that revealed that there is a rising demand on educational institutions to use technology to teach the skills and knowledge that learners need for the 21st century. Consistent with this study, Rosenfield and Martinez-Pons (2005) also added to the voice that asserts that educators' mastery of digital skills is important to successful integration of technology into teaching.

6.4 RESEARCH QUESTION AND HYPOTHESIS 3: DIGITAL TRAINING – EXTENT AND NATURE OF DIGITAL TRAINING AND IMPACT ON TECHNOLOGY INTEGRATION IN THE CLASSROOM

Research question and H4 four focused on the extent of digital training among educators, and the impact that such training has on the integration of technology in classrooms.

A critical finding, outlined in Section 5.5.4 was that digital training still lags behind desirable levels. Most respondents readily admitted that even though they were self-confident on some aspects of technology, such as presentation skills, they had not formally received training in the use of apps in the classroom and integrating digital tools in the classroom. This finding positioned educators for lower level tasks, as discussed above. However, what was most concerning about the training received was the absence of training on higher level tasks such as lesson planning using digital tools. Only 34.85% of respondents agreed that they had received training in lesson planning using digital tools. This means that only 34.85% of respondents felt adequately equipped to use technology to enhance learning. This finding is fundamental, and needs to be highlighted.

In essence, even in well-resourced private schools, training on technology integration appears to still be focused on superficial and elementary aspects, referred to as low level tasks. A significant training gap exists on higher level tasks, as indicated by Aslan & Zhu (2015). There is evidently a need to focus efforts on the training of educators if we desire a digitally skilled society that will thrive in the knowledge and digital economy. Training educators, particularly on higher level tasks, will undoubtedly promote technology adoption in the classroom, which will, in turn, encourage learners to adopt technology in both their personal, and academic lives, positioning them to be effective participants in the knowledge economy.

To test the impact of digital training on technology integration, respondents had 9 statements to measure what digital training they have been exposed to. The digital training scale had a Cronbach's alpha score of 0.618, indicating that all the measurement scales reliably measured digital training. Upon analyzing the relationship between educator's digital training and technology integration, the results indicated that digital training does have a material influence on technology integration ($P<0.05$), with significant value of 0.002.

Previous literature echoed the same sentiments. A study by Aldunate and Nussbaum (2013) acknowledges technology anxiety, which stems from equipping educators with technology or digital tools, but failing to inadequately provide them with suitable training. The results are consistent with those of Guzman and Nussbaum (2009), who identified technology integration training as crucial in the technology adoption process in schools. Hew & Brush (2007), further found that educators who typically struggle with effective integration of technology in their classrooms, often cite inadequate digital training as the cause. Furthermore, Hew & Brush (2007), found that most preservice educators know little about the effective use of technology in the classroom. This finding was further supported by (Wei-Ying, 2012) and Cervera and Cantabrana (2015) who argued that developing pedagogical content knowledge, through training, is an essential factor in overall technology integration efforts in schools

The South African context, and its past lend themselves to an interesting dynamic. It seems that even these highly trained teachers, working in well-resourced private schools, have not had adequate training to prepare them for the efficient use of technology in instruction. If this is the case, how much more likely is it that educators who did not have access to similar tertiary training as the sample group, who work in far more under resourced schools (namely black educators in public schools) would have adequate training in ICT? While the purpose of this study was not to determine this, it does bring to the surface a need to fully explore how effective the mass roll out of smartboards and tablets in many Gauteng public schools has been.

6.5 RESEARCH QUESTION AND HYPOTHESIS 4: NATURE OF AVAILABLE RESOURCES AND IMPACT ON TECHNOLOGY INTEGRATION IN THE CLASSROOM

Research question four sought to determine the digital resources available to educators, and how they impacted on technology integration in the classroom (H4). The respondents had 9 statements to measure what digital resources they used. The digital resources scale had a good Cronbach's alpha score of 0.509, indicating that all the measurement scales reliably measured digital resources used by educators and lecturers. A significant relationship was established between digital resources and technology integration. As seen in Table .1, educator digital resources have a significant impact on technology integration ($P<0.05$). The significant value was 0.000. The findings revealed a material relationship between digital resources and technology integration (0.620). The study suggests that access and availability of digital resources directly

impacts the integration of technology in classroom. This finding suggests that having access to computers/laptops, and internet connection plays a significant role in whether or not educators will implement technology in their classrooms. The finding also highlights the necessity for education administrators and teacher training institutions to invest in the resources that deliver value for both educators and learners. The online survey fell short of quantifying the number and spread of resources that deliver optimal technology integration. It may be a useful exercise to ascertain optimal learner to device ratio where possible.

The finding that digital resources have an impact on technology integration is consistent with Tsai and Chai (2012) findings, which found a high correlation between digital resources and, technology integration, highlighted that even if educators have adequate capabilities, facilities, and management support, inadequate resources hinder technology integration in the classroom. Similarly, Buabeng-Andoh (2012) found that the reasons for low integration of digital technology in schools could be attributed to lack of access to digital tools, and lack of training in the use of the tools.

Sugar and van Tyron (2014) also found in their study that educators emphasised that engaging with technology resources or tools assisted in the development of their digital skills. Educators also value subject or discipline-specific technology resources. As evident in Section 5.5.4, access to digital resources was not found to be an issue; all respondents at the very least had access to a PC or laptop. An overwhelming majority also had smartphones and an iPad or tablet. However, this study did not establish if educators had any subject or discipline specific digital tools. Understanding the nature of the digital tool assists with gauging the relevance of resources in use, in order to best deliver the subject outcomes. Tondeur et al. (2016) shared this sentiment.

Finally, Lai, Trewen, & Pratt (2002), and Rogers (2000) further indicated that over and above the availability of resources, educators must have adequate technical and administrative support to encourage them to successfully use ICT in classrooms. Those elements could be explored in future studies.

6.6 RESEARCH QUESTION AND HYPOTHESIS 5: INSTITUTION TYPE AND IMPACT ON TECHNOLOGY INTEGRATION

Research question five sought to define the nature or type of education institutions and to determine whether institution type influenced technology integration in the classroom (regression). It is worth noting that no reliability measure was conducted on the scale as

this question was measured with a single question that sought to categorise institutions between public schools, private schools, public higher education institutions (HEI's), and private HEI's. It is quite evident from the findings that private schools were by far the most dominant institutions in the data collected, accounting for 62.1% of the respondents as seen in Figure 5.6. This was followed by public HEI's, which accounted for 24.24% of the respondents. The least number of respondents came from public schools, and private HEI's, which were represented by 9.09% and 4.55% respectively.

This result is pertinent, though unintended, as it almost lends itself to being a study on private schools, as the dominant institution type. The skew towards private schools is profound. Though it may be seen as a limitation, the unintended skew has provided valuable insights on private schools in relation to technology practices. This is particularly important because the body of research in this field has largely been focused on public schools. The 'voice' of the private school educators has not been prominent in literature. This development signifies a contribution to literature. It is, therefore, important to realise that most of the findings discussed in this chapter pertain to private schools. Observed variances generally relate to the other three institution types that collectively account for 37.9% of the respondents.

Surprisingly though, the findings of the regression test point out that there is no significant relationship between institution type, and technology integration, and Hypothesis 5 is therefore not supported. This, however, can be explained by the limitations of the research instrument. The online survey only had one question on institutions, essentially bringing the validity of a regression test into question. It is standard practice that regression tests should be run on a minimum of ten data points. For these reasons, findings of the regression test are of little value in this context. It is, however, very evident from the descriptive statistics that institution type has a significant bearing on all factors (independent variables), including technology integration (dependent variable).

A study by Yasmeen, Alam, Mushtaq and Bukhari (2015) found that there was a substantial difference between the availability of technological resources between public and private institutions. Private universities were generally better equipped than public institutions. This phenomena was observed in the results of this study as well. This question of 'better' speaks to a multitude of factors, including availability of funding (resources), leadership, attitude, and motivation. By design, private institutions traditionally fare better on these factors. This contrast provides a competitive edge to educators and learners in private institutions.

Affirming these finding, Chaaban and Moloney (2016) also found that the difference in all aspects of quality between public and private schools is enormous, including the extent of technology funding and access. This observation brings into sharp focus issues of socio economic status (SES), which drive the digital divide. These issues also impact on the drive to successfully integrate technology in South African classrooms. Worth noting is that technological changes have been extensive over the last 20 years, even though they have been at varying speeds in both public and private school learning environments. Yet, the inequality gap, which is largely a function of SES factors, continues to drive the digital divide. Progress in the adoption of technology for learning purposes has been well documented in developed economies and developing economies, but South Africa still lags far behind other developing countries. Only in the last 2 years has the Gauteng Department of Education (GDE) actively started introducing paperless classrooms.

Unfortunately, the majority of public schools in South Africa are yet to integrate technology in their classrooms. From a global competitiveness perspective, efforts should be made by all stakeholders to expedite 'improvement' efforts in public schools. This includes government as policymakers, and the private sector as potential funders. The need for an urgent rebalancing will see students from public schools being on par with their private school counter parts. In achieving this, educators can implement a variety of teaching methods from a wide array of technological resources. Addressing these glaring disparities will lead to a steady increase in the nation's global competitiveness. Future studies could fully explore the impact of institution type on technology integration, by contrasting different institution types across multiple data points.

6.7 RESEARCH QUESTION 6: PERSONAL BARRIERS TO THE INTEGRATION OF DIGITAL TECHNOLOGY (ICT) IN THE CLASSROOM

This final research question was largely intended to triangulate findings from the survey responses on each of the five identified factors, namely, attitudes, capabilities, training, resources, and institution type. The question on the online survey used to collect data on this research question was designed to be an open-ended question that allowed respondents to capture their own thoughts, and words on what they perceived to be their personal barriers.

The findings highlighted an overlap between factors that were identified in the open ended questions, and the factors that had been isolated as research questions and hypothesis in the study. Interestingly, as seen in Figure 5-7%, among the more than a quarter of the cited resources as a personal barrier, triangulating findings from Section 6.4 confirmed resources as a key factor in technology integration in classrooms . Competency and training were also found to be significant personal barriers, at 22.73%, similarly corroborating findings from Sections 6.2 and 6.3. Other peripheral personal barriers that came up were Time and Fear. Fear was possibly linked to the attitude, competence/capability and training of educators. Cost and support, linked to resources and institution respectively, were also noted as personal barriers, though marginally by 3.03% and 1.52% of the respondents respectively. In addition to findings by Hew & Brush (2007), Alston, Miller, and Williams (2003) acknowledged the cost of equipment as the biggest barrier to integrating technology. This supports the findings above.The institution type may be a factor in the personal barriers identified.

Perhaps the most surprising finding was that almost a third of respondents indicated that they had no personal digital barriers in the integration of technology in their classrooms. As discussed in Section 6.6, this respondents are likely to be from private schools that have invested resources (time and money) in the eradication of barriers to technology integration.

Earlier, studies corroborated some of the findings of the study. For example, a study conducted by Kopcha (2012) found that educators' perceptions of the barriers to technology integration impacted on professional development. Kopcha (2012) went further to say that there is a gap between the volume of technology that is available and accessible in today's classrooms, and educators' use of that technology for learning purposes. The study cited personal barriers to digital integration that educators face as a primary reason, (Kopcha, 2012). A number of personal barriers could hinder its implementation. Williams et al. (2014) found the lack of accessibility and availability of technology to educators was one reason for the lack of use. These results were consistent as 25.76% of the respondents in this study indicated resources were a personal barrier in technology integration in the classroom.

6.8 RESEARCH QUESTION 7: INSTITUTIONAL BARRIERS TO THE INTEGRATION OF DIGITAL TECHNOLOGY (ICT) IN THE CLASSROOM

This final research question was largely intended to triangulate findings from the survey responses on each of the five identified factors, namely, attitudes, capabilities, training, resources, and institution type. The question on the online survey used to collect data on this research question was designed to be an open ended question that allowed respondents to capture their own thoughts and words on what they perceived to be institutional barriers in their context.

The findings highlighted an overlap between factors that were identified in the two open ended questions, and the factors that had been isolated as research questions and hypothesis in the study

Similar to the question on personal barriers, findings suggest that a third of the respondents had no institutional barriers given that these respondents were from private schools where technology integration efforts are top of mind. Veletsianos, Kimmons and French (2013) found that educators face institutional barriers such as lack of leadership, lack of specialised training, policies, time, lack of rewards, high workload and pedagogical concerns. Effective implementation of technology efforts in education requires commitment from all stakeholders (government, institutions, teachers, students, parents, and the community) in order to overcome these barriers, (Khan, Hasan & Clement, 2012). As seen in the findings, support was one of the key institutional barriers identified by 4.55% of the respondents. Most of the findings that emanate from this research question confirmed findings in earlier sections.

Resources were the most widely mentioned barrier, with 37.88% of the respondents highlighting that their institutions did not have adequate resources to optimally integrate technology in their schools. Interestingly, most of the barriers highlighted as personal barriers were duplicated in institutional barriers. As the two questions were open ended questions, respondents could have merely copied the barriers cited in a personal barriers in institutional barriers, without necessarily applying themselves to the second question. However, it is this researcher's belief that there was a significant overlap between personal and institutional barriers in the respondents' understanding of the concepts.

6.9 CONCLUSION OF THE CHAPTER

The current chapter provided a critical discussion on the findings from the data analysed, as the discussion delved into the consequences of the projected hypotheses. Furthermore, findings revealed nuances in private institutions that were not abundant in prior literature, particularly in South Africa. Findings were supported by prior literature. Finally, the application of the findings, together with interim thoughts on future studies, was presented.

From the findings discussed, it is obvious that these findings largely represent the experiences of private school educators. There is evidently a higher SES educator, typically white, and working in private schools, who has a strong desire, and more positive attitude to adopt technology in the classroom. However, the same high SES educator is significantly hampered in their efforts by lack of training. What should be of grave concern is if this is true for high SES educators, how much more applicable is it for poorly resourced, low SES public school educators who make up the vast majority of the educators in the system? Answers to these questions can best be addressed in future research studies, as the scope of this study didn't extend to those issues.

Even though size and the demographic skew of the sample are limitations of the study, the study is still significant because of these revelations: (1) Evidence that high SES educators working in a well-resourced institution suffer from training deficiencies indicates that the educator training system may be flawed; and (2) as indicated earlier, the findings contribute to the literature on private school educators whose voice, attitudes, and daily teaching life is significantly underrepresented in the South African literature. This is particularly useful because as more private schools (and universities) open in South Africa, the need to understand this segment of the educator population is amplified.

CHAPTER 7: CONCLUSION

7.1 INTRODUCTION

The aim of the study was to gain a deeper understanding of the state of technology integration in South African classrooms. To achieve the understanding, the study sought to describe technology integration efforts by examining key factors that either promote or hinder technology integration. Further, the study expanded to testing whether identified factors had a notable impact on technology integration in South African classrooms.

The study built a case for technology integration in South African classrooms using the perceptions and experiences of educators. As preempted in the first chapter, the need to expedite efforts in the integration of technology in South African classrooms is twofold. Firstly, it will aid positive learner outcomes; and secondly, it will prepare a generation of learners for the knowledge economy that awaits them. Education institutions on technology integration, therefore, play a pivotal role in bridging the learner digital divide and ultimately the nation's digital gap that leads to the skills gap.

Flowing from the literature reviewed, the study was built on seven research questions and five hypotheses. Each research question aimed to describe educators' perceptions and experiences towards one of the factors identified as possible an enabler or hindrance to technology integration in South African classroom. The five factors explored were educator attitudes, educators' capabilities (skills and competence), educator resources and educators' digital training. These five factors were mainly grounded in Hew & Brush's (2007) study on integrating technology into K-12 teaching in America. The last two research questions, six and seven, were on personal and institutional barriers. These questions were deliberately designed to be open ended in order to triangulate and validate findings from quantitative data collected for research questions one to five. Research hypotheses flowed naturally from the first five research questions. The hypotheses were designed to test whether each of the five factors highlighted had an impact on technology integration in classrooms.

This final chapter, therefore, discussed the main findings of the study. Additionally, the chapter discussed the implications of the study, its contribution to the body of literature,

and offers some recommendations. Finally, the chapter will put forward suggestions for future research.

7.2 SUMMARY OF MAIN FINDINGS AND THEIR IMPLICATIONS

Overall, findings concluded that four of the five hypotheses are significant. The four hypotheses that were confirmed to be significant were: (1) educators' attitude; (2) educators' digital capabilities; (3) educators' digital resources and (4) educators' digital training all positively influence technology integration. Institution type was found not to have a statistically significant impact on technology integration. However, if the path coefficients are closely examined, technology integrations varied materially across institutions. The section that follows will articulate the key findings of the study.

7.2.1 Educator attitudes towards technology integration

The findings on teacher attitudes revealed an unexpected dichotomy. Even though attitudes towards technology integration were largely positive, educators still felt that the use of technology did not necessarily make for better teaching. This finding highlighted the complexity of attitudes. This finding revealed that contradictions and misconceptions may still exist, such as technology, 'dumbs learners down', despite an overall positive attitude towards technology. This finding could imply that educators question the value of ICT in their classroom even though they believe, or have been made to believe, that it is the right thing to use in the classroom. Thus, they may be 'reluctantly' positive about technology, rather than passionate adopters thereof.

Understanding of motivational theories, as discussed in Chapter 2, may assist with understanding the various layers of attitudes, and how those layers influence technology integration. This finding is significant because it demonstrates the dissonance that may result from a top down approach to technology integration that is not supported by comprehensive change management plans that encapsulate professional development and training interventions.

7.2.2 Digital training programs

From the findings, it is apparent that possibly one of the major hindrances to effective ICT integration in schools, including well-resourced schools, is the absence or inadequacy in educator preparation programmes. Even though educators portrayed confidence and knowledge of technologies, their integration efforts were not optimal as evidenced by the superficial nature of the task performed, including Word documents and PowerPoint presentations. Current training programmes, therefore, appear to lack integration of ICT pedagogical skills, and enabling educators to adapt teaching practices to align with current learner needs. In order to overcome these challenges, new training programmes are necessarily. These would need to include pre and inset educators in a way that enables professional development and upskilling.

Educator training institutions, arguably, have a responsibility to ensure that educators that emerge from their institutions are well equipped to handle the ICT demands of the classrooms that they will ultimately teach in. Unless this is the case, learners will continue to struggle to compete in a digital knowledge economy once they graduate from school. Thus, while schools need to enforce the use of ICT in the classrooms, both the state and schools must provide an enabling environment. It is also the responsibility of teacher training programmes to graduate digitally skilled educators. Ultimately, educator preparation programmes not only need to familiarize educators with technology but more fundamentally, need to extend to the development of electronic pedagogical content knowledge and skills, that prepare incoming, current, and future educators to connect curriculum with technology.

The significance of this finding is that without actively addressing the current digital training deficit, many educators who are digital immigrants will be ill equipped to meaningfully integrate technology in their classrooms. Their technology integration efforts will continue to be limited to lower order tasks, such as observed in the study by Etmer, (2005). To eradicate the digital divide in South African classrooms, educator training programmes must both focus on competence in technology, and on leveraging technology to drive instruction (that is, pedagogy and lesson planning). Creating such training interventions will undoubtedly shift educators' integration efforts from lower level tasks, to high level value adding tasks. There appears to be a relationship between the level of training received, and the educator's ability to perform technology driven second order tasks, although this was not explored in detail in this study. Most of these educators

appear to be self-taught in terms of technology, and so most can only perform first order tasks, such as preparing Word documents.

For South Africa to claim its rightful place in the global competitiveness index, these findings cannot be ignored. Addressing educator digital training gaps through well designed programmes will advertently increase technology integration efforts in schools. Ultimately, South Africa will have a generation of learners who are comfortable with using technology, which will significantly reduce the digital skill gap currently plaguing South Africa.

7.2.3 Institution type

From the results on Section 5.4.5, it is evident that the findings of this study largely represent the experiences of private school educators. While the study did not purposefully sample in this way, this skewness in the data occurred because the request to participate was sent to various online educator communities. Thus, it may be that the majority of educators participating in online educator communities are from a traditionally higher SES sector of the educator population (assuming race as a proxy for SES based on past apartheid policies). Thus, it can be said that it appears that educators with a higher SES profile are working in private schools, and they have a strong desire, based on attitude, to work with technology, especially in their professional life, but also in the classroom. However, these same high SES educators are significantly hampered in their efforts due to a lack of training. What should be of grave concern is that if this is true for high SES educators, how much more applicable is it for poorly resourced, low SES public school educators who make up the vast majority of the educators in the system? Thus, there is a significant gap in the training of educators with respect to ICT. While providers of educator training need to address this, there is clearly a gap that private, commercial providers could fill with respect to inset teachers.

The study also found that an abundance of digital resources in institutions does not necessarily translate to efficacy in using ICT in teaching. Thus, resources are ‘qualifiers’ to digital integration, but additional factors, such as preparation, training, and development programmes as described above, play an important role in the efficacy of technology integration efforts. An aspect of this is technology integration training. As discussed above, without a drastic redress of the digital training issue, institutions will continue to experience sub-optimal integration in their classrooms.

7.3 RECOMMENDATIONS TO STAKEHOLDERS

The recommendations that follow are built in the context of the prevalent digital divide and skills gap in South Africa, per the findings of this study. The suggestions will focus on interventions that can be targeted at alleviating the burden of barriers often associated with technology integration efforts in schools. This burden is often shouldered by the educators. Three key stakeholders, namely government, education institutions (schools) and educators, were identified for as critical to technology integration efforts in South Africa. Recommendations will address each one of the three stakeholders identified.

7.3.1 Government (as policy maker)

As the chief policy maker when it comes to education, the government can ensure, in an inclusive/collaborative approach with all stakeholders, that curriculum at institutions of higher learning that offer qualifications in the field of education include significant content on technology. As in the Malaysian study by Uzunboylu & Tuncay (2010) outlined, South African institutions can introduce ICT related courses as core courses in pre service educator training. This training would expose preservice educators to digital tools. Most importantly, it would educate preservice educators on how to leverage technology for instructional purposes (pedagogy). This suggestion essentially calls for the creation of robust programmes aimed at acquainting the educators with technology as a tool of trade.

7.3.2 Education institutions (schools)

Schools need to ensure that educators in their employ are not only upskilled on the latest technology tools and programmes, but are also kept abreast of the latest trends in student centered digital pedagogy, such as the TPACK framework, (Mishra & Koehler, 2006). These programmes should be bespoke to each school's particular circumstances, and ultimately lead to improved learner outcomes, and narrowing of the digital divide in those schools. This is something that schools will have to learn to budget for.

7.3.3 Educators

Educators need to actively embrace technology as an avenue that can enhance their own teaching and improve learner outcomes. This shift may call for a change in attitudes. To this end, schools can facilitate the shifting of attitudes through well designed change management frameworks, and plans that clearly articulate the business case for technology integration not only at the respective schools, but at a macro level, which is nationally. The business of positioning students for the knowledge economy, and lowering of the skills gaps enhances the global competitiveness of the country.

7.3.4 Private sector (Business)

As the ultimate beneficiaries of the digitally skilled labour, business can play a role in addressing the resource barrier, possibly through Corporate Sustainability Initiatives (CSI). These interventions can be earmarked for poorly resourced public schools, such as in rural and township communities. Given South Africa's past, resource inequity between private and public school is severe. For that reason, an opportunity exists for business to engage in mutually beneficial partnerships with government as it rolls out *Operation Pakisa*. In particular, corporate South Africa can consider, along with the professional associations (lawyers, accountants, engineers) of the role that they should play in sponsoring educator ICT training initiatives and, where necessary, ICT equipment.

7.4 CONTRIBUTION OF THIS STUDY

7.4.1 Contextual contribution

Contextually, the study makes a significant contribution to education research in the South African context. This study focused on educators from both schools and HEI's. The study honed in on the significance and impact of technology integration in classroom practices, and explored factors that impact on educators' ability to integrate technology in classrooms. There have been limited studies on technology integration from the perspective of educators in private schools in the South African context. Therefore, this study contributes to the contextual body of knowledge on factors that impact on educator's ability to integrate technology in South Africa

7.4.2 Theoretical contribution

The results of this study advance the understanding of factors that act as barriers to technology integration at schools, by offering a descriptive account of the state of technology integration as it relates to these factors. The literature built on this study largely corroborates and builds on work done by Davis (1986) on TAM, and Hew & Brush (2007) on barriers to technology integrations in schools and others, thereby validating findings that educator attitude, digital capabilities, digital resources and digital training are central predictors of technology integration. The presentation of descriptive results from the factors influencing technology integration in the classroom offers researchers in the developing body of literature an in-depth explanation of educator responses to technology integration.

More specifically, in the South African context, this study provides a useful window into the uncaptured world of private school educators. Currently, the voices, attitudes, and daily teaching lives of private school educators are significantly underrepresented in the South African literature. This study begins to build that body of work. As the trend suggests, this is particularly useful because, as more private schools (and universities) come into being, the need to understand that segment of the educator population is amplified.

Further, the study provides insights into the levers that South African education institutions can pull in order to expedite their technology integrations efforts, which are aimed at improving learner outcomes, while simultaneously closing the digital gap.

7.4.3 Policy contribution

As articulated in Section 7.3, by examining technology integration using the educator as the unit and lens of analysis, results can provide policy makers with a better understanding of strategies that may be implemented to drive positive technology adoption related outcomes. As outlined on the recommendation to government, this can be accomplished by implementing collaborative strategies between key stakeholders.

7.5 LIMITATIONS

Limitations are inherent is every research process. Research methodology limitations stated in Section 4.11 were as follows:

- Non-probability sampling method (Convenience and snowballing) means that the results are not statistically representative of the population.
- The use of targeted online groups represented segments, in this instance mainly Geography educators, in an online professional community. This means that the results are not statistically representative of the population.
- The choice of targeted online communities potentially resulted in a demographically unrepresentative view of the current state of digital integration in South African schools, for example, 'unconnected- not online' teacher communities may not have had a 'voice' in the study.
- The snowballing sampling technique may result in a homogenous sample, lacking diversity of thought, thus leading to a premature saturation point.
- The length of the online survey, at 89 questions, may have discouraged participation, and may have only attracted participation from participants with similar views, leading to non-response bias.
- The final sample was relatively small and, as indicated, may consist of respondents with similar demographic backgrounds. This issue was assumed to relate to respondents' time constraints, if the prospective respondents does not have the time to respond to the survey, it may lead to low response rates, which was the case with this study. Only 66 online surveys were completed. This issue was possibly exacerbated by the length of the online survey, as stated above.

Other limitations that were noted but unrelated to the research methodology were:

- Unrepresentative skew towards private school educators.
- The chosen research instrument (Online survey on 6 point Likert scale) made it challenging to conclusively determine the exact impact of the independent variables on the dependent variance (technology integration). Furthermore, respondents were bound to particular statements, and could not be probed for further insight, a limitation that is inherent in quantitative studies.

- Finally, by design the study only focused on understanding technology integration from the perspective of educators. As such, the study disregarded other key stakeholders such as technology administrators, institution administrators, and learners. It may have been beneficial to triangulate the findings with other stakeholders could be a research avenue in future.

7.6 FUTURE RESEARCH

The study revealed a myriad of opportunities for future studies. Some aimed at addressing the limitations of the current study, while others aimed at expanding on results and findings that emerged from this study.

- As discussed in the limitation above, quantitative research poses a range of challenges when attempting to unpack and probe data for more insight. Thus, it would be worthwhile to conduct future research using a mixed method design to allow for elaboration, and possible triangulation of findings.
- Due to the shortcomings of online surveys, a paper based self-administered survey could allow for a larger sample of participants.
- In addition, future studies should take into account educators that are demographically representative of the South African educator population.
- In light of the disparities between public and private schools in South Africa, it would be beneficial to conduct a study that contrasts the public and private schools on the same factors and dependent variable.
- Finally, future research areas could also explore the same study in other countries in similar contexts as a comparative study, other developing countries for benchmarking purposes. This could be achieved through a longitudinal study that measures the efficacy and success of technology integration implementation plans over time.

7.7 CONCLUSION

It is evident that as the South African government garners up efforts to close the digital divide in South African schools through initiatives such as *Operation Pakisa*, the role of educators as facilitators in this journey is magnified. Educators essentially become the conduit through which the governments' goals are delivered. Considering the urgency of these interventions, and the concerning state of the education system in South Africa, there has never been a more opportune time than the present to focus energies on addressing the demands of the future through equipping the youth with tools that allow them to compete on global stages, and to be meaningful contributors in a knowledge economy that values digital competence, and digitally-enabled critical thinking.

It is against this backdrop that educators must be empowered to deliver on these needs- to build a workforce that is digitally fluent for the 21st century knowledge economy, with skills mandatory to move this nation forward. For that reason, understanding the state of play in South African schools, as it relates to ICT integration, by analysing the factors that influence technology integration was critical.

In conclusion, the aim of this study was to explore and understand, through descriptions, the factors that impact on educators' ability to integrate technology in the classroom. These factors included educator attitudes, digital capabilities, digital resources, digital training, and institution type. Further, the study sought to ascertain whether these five factors had any impact on technology integration in classrooms. It was evident from the findings that these factors do impact on educators' ability to integrate technology in the classroom. Surprisingly, institution type was found not to have an impact on technology integration. Based on the above-mentioned factors, digital training during educators' training processes was isolated as the biggest limitation to technology integration in South African schools.

This final chapter delivered five concluding sections, presenting main findings and implications of the study, presenting recommendations based on these findings, articulating contributions made by the study, listing and discussing limitations of the study, and finally, initiating a conversation on future research.

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APPENDIX A : TECHNOLOGY INTEGRATION QUESTIONNARE

Informed Consent Letter

I am conducting research to understand the state of technology integration in South African schools. The study will explore factors that impact on educators' ability to integrate technology to bridge the digital divide in South African classrooms.

The survey will take approximately 15 minutes to complete and will help me describe educators perceptions across five factors that typically hinder or promote technology integration efforts in schools. Further, the study will seek to gauge the extent of technology integration efforts in South Africans schools, utilising the educator as the subject of analysis.

Your participation in this research is voluntary and you can withdraw at any time without penalty. Data provided by you in the survey will be kept strictly confidential. Participating in the research by completing the survey displays your voluntary agreement.

If you have any concerns, please contact my supervisor or me. Our details are provided below.

Researcher name: Zonke Mashile
Researcher email: zonke.mashile@gmail.com

Research supervisor: Tracey McKay
Supervisor email: mckaytjm@unisa.ac.za

Signature of participant: _____ Date: _____

Signature of researcher: _____ Date: _____

QUESTIONNAIRE

Gordon Institute of Business Science
University of Pretoria

** *Questionnaire is adapted from Hudgins and Anderson (2015) and Lei (2009)*

Respondent Number

Note: *Question numbering is based on the online survey sequence and does not follow sequentially on this print version.*

Section 1 : Device ownership

This section has questions that will help me understand whether you own or have access to any technology devices. Please put a cross (X) next to option that applies to you.

	Do you own or have regular access to the following devices?	Yes	No
1	Personal Computer (PC) or laptop		
2	Smartphone		
3	Game console		
4	iPod (or other mp3 player)		
5	iPad or other tablet		

Section 2 : Attitude towards technology

This section has questions that will help me understand your attitude towards to use and value of technology. Using a scale of 1 - 6, 1 Strongly Disagree **(SA),** 2 Disagree **(D)**, 3 Mildly Disagree **(MD),** 4 Mildly Agree **(MA),** 5 Agree **(A)** and 6 Strongly Agree **(SA).** Please put a cross (X) next to option that best describes your sentiment on the statements that follow.

		SD (1)	D (2)	MD (3)	MA (4)	A (5)	SA (6)
6	Computers and other digital technology tools are generally reliable						
7	The more technology one uses, the more respect you get from your peers						
8	I feel comfortable using digital technological tools/systems/programmes						
9	I do well with digital technologies e.g. computers						
10	Computers and related technologies isolate learners from each other						
11	I find computers and related technologies interesting						
12	I enjoy learning new technologies, new ways of doing things						
13	I think new digital learning technologies will assist in my teaching						
14	I believe that digital technologies promote learning						
15	I am likely to adopt digital technologies in my teaching in the next 5 years						
16	I seldom require IT support (technical support in the use of digital tools)						
17	I use digital technologies to self-teach/self-study						
18	I am confident in using technology to teach						
19	Digital technologies in teaching and learning are just another ‘fad’						
20	The socio-economic divide is replicated by the digital divide						
21	I believe that digital technologies ‘dumb down’ learners						
22	Digital technologies promote facilitation style teaching						
23	Digital technologies enable learners to become self-driven						
24	Good teaching does not necessarily require teachers to use digital learning tools/techniques						
25	I have concerns that apps, YouTube videos and websites are a crutch for lazy teachers						
26	My teacher training has taught me how to design lesson plans that support digital technology, are developmentally appropriate and support the needs of diverse learners						

Section 3 : Confidence levels and use of technological tools

This section has questions that will help me understand your confidence levels in the use of technology driven tools. Similarly, using a scale of 1 - 6, 1 Strongly Disagree **(SA),** 2 Disagree **(D)**, 3 Mildly Disagree **(MD),** 4 Mildly Agree **(MA),** 5 Agree **(A)** and 6 Strongly Agree **(SA).** Please put a cross (X) next to option that best describes your sentiment on the statements that follow.

		SD (1)	D (2)	MD (3)	MA (4)	A (5)	SA (6)
27	I create Word processing documents with ease (e.g. Ms Word)						
28	I create Presentation documents with ease						
29	I create Web Pages for classroom practices/to share classroom practices						
30	I use a Website for communication with learners/fellow teachers						
31	I regularly surf the internet for educational websites						
32	I regularly visit discipline specific websites for self-study purposes and/or to help my learners						
33	I often source lessons and curriculum advice/help from the internet						
34	I often make use of digital technology in the classroom						
35	I am creative when using presentation/multimedia software (e.g. PowerPoint and Google Presentation), my presentations are highly professional						
36	I regularly use YouTube to enhance learning						
37	I use technologies to improve my productivity (make the work of preparation, record keeping) to be efficient and effective						
38	I encourage my learners to use digital tools and resources to enhance their knowledge and understanding of the curriculum/content						
39	I use digital tools to engage learners, to explore real-world issues and solve authentic problems						
40	I design lesson plans based on using digital technologies which are developmentally appropriate and support the needs of diverse learners						

41	I make use of blogs for learning						
42	I solve technical problems in my classroom						
43	I use Word Processing documents (i.e. MS Word, Google Docs, etc) to create lessons						
44	I use Presentations for lessons						
45	I log onto websites during my lessons						
46	I steer learners to discipline specific websites to do homework or revision activities						
47	I use the internet in my lessons						
48	I use a MacBook in my lessons						
49	I use a iPad/Tablet in my lessons						
50	I use a smartphone in my lessons						
51	I use YouTube videos/recordings in my lessons						
52	I use instant messaging platforms like 'whatsapp' to communicate with my learners						
53	I use videos to teach						
54	I steer my learners to use apps to assist them to learn concepts/skills						
55	I use email to communicate with my learners						
56	I use game-based learning activities in my classroom/homework activities						
57	I regularly give projects/homework activities that require my learners to access the internet						
58	My learners are able to submit homework activities digitally						
59	I use textbooks in the classroom						
60	I distribute notes/paper-based activities/instructions in my classroom						

Section 4 : Training of digital pedagogy

This section has questions that will help me understand the level of training that you may have received as part of your studies in digital pedagogy (method and practice of teaching using digital/technology driven tools). Please put a cross (X) next to option that applies to you.

		Yes	No
61	I have received training on integrating digital tools in the classroom environment		
62	I am self-taught in terms of using Presentation e.g. Powerpoint in the classroom		
63	I have received training on lesson planning where digital tools are used in the classroom environment		
64	My training has taught me how to use apps in the classroom		
65	My training has equipped me to plan strategies using technology to enhance learning		

66	I have received training on lesson planning where digital tools are used in the classroom environment		
67	My teacher training has taught me how to design lesson plans that support digital technology, are developmentally appropriate and support the needs of diverse learners		
68	I have received training on creating/updating websites		
69	My training has taught me how to locate educational websites for student learning		

Section 5 : Additional information

70. When did you start using an electronic device such as a computer? Please put a cross (X) next to option that applies to you.

A. Before nursery school		B. Between nursery school and Grade 4		C. In Grade 4 -5	
D. In Grade 6 - 8		E. In Grade 9 -12		F. After Grade 12	

71. Do you have access to Free Wifi? Please put a cross (X) next to option that applies to you.

Yes	
No	

72. How often do you login to the internet? Please put a cross (X) next to option that applies to you.

A. Very often, approximately once a day		B. Often, approximately once a week	
C. Occasionally, approximately every second week		D. Rarely, approximately once a month	

E. Very rarely, less than once a month		F. Never	

73. How often do you use an electronic/digital device? Please put a cross (X) next to option that applies to you.

A. Very often, approximately once a day		B. Often, approximately once a week	
C. Occasionally, approximately every second week		D. Rarely, approximately once a month	
E. Very rarely, less than once a month		F. Never	

74. How would you rate your ability to meet the digital needs/expectations of your learners? Please put a cross (X) next to option that applies to you.

Poor (1)		(2)		Fair (3)		(4)		Exceptional (5)	

75. How would you rate your learner's digital abilities and aptitude? Please put a cross (X) next to option that applies to you.

Poor (1)		(2)		Fair (3)		(4)		Exceptional (5)	

76. What are your personal barriers, if any, to the integration of digital technology in your classroom? Please elaborate below:

77. What are the institutional and/or structural barriers, if any, to the integration of digital technology in classrooms? Please elaborate below:

78. What is your age (in years)? Please put a cross (X) next to option that applies to you.

A. Under 18		C. 25 – 34		E. 45 – 54		G. 65 or older	
B. 18 – 24		D. 35 – 44		F. 55 – 64			

79. What is your race? Please put a cross (X) next to option that applies to you.

A. African		B. Coloured		C. Asian		D. White	

80. What is your gender? Please put a cross (X) next to option that applies to you.

A. Male		B. Female	

81. What is your highest qualification? Please put a cross (X) next to option that applies to you.

A. Less than Grade 12		D. 3 year undergraduate degree	
B. Grade 12		E. 4 year undergraduate degree	
C. 3 year diploma		F. Postgraduate qualification	

82. Are you a preservice teacher, inservice teacher or lecturer? Please put a cross (X) next to option that applies to you.

A. Preservice teacher		B. Inservice teacher		C. Lecturer	

83. If you are a preservice teacher, how far are you with your studies? Please put a cross (X) next to option that applies to you.

A. 1st year		C. 3rd year		E. N/A (not a preservice teacher	
B. 2nd year		D. 4th year			

84. Which grade(s) do you teach? Please put a cross (X) next to all the options that apply to you.

A. Grade 1		D. Grade 4		G. Grade 7		J. Grade 10	
B. Grade 2		E. Grade 5		H. Grade 8		K. Grade 11	
C. Grade 3		F. Grade 6		I. Grade 9		L. Grade 12	
M. Tertiary							

85. What is the name of your institution? Please fill in your response below:

86. Where is your institution situated? Please fill in your response below:

A. Eastern Cape		D. KwaZulu-Natal		G. Northern Cape	
B. Free State		E. Limpopo		H. North West	
C. Gauteng		F. Mpumalanga		I. Western Cape	

87. What type of institution do you work? If you are a preservice teacher, what type of institution have you worked for? Please put a cross (X) next to option that applies to you.

A. Private school		C. Private Institution of Higher Learning	
B. Public school		D. Public Institution of Higher Learning	

88. Years of teaching experience? Please put a cross (X) next to option that applies to you.

A. Less than 1		C. 6 - 10		E. 21 – 30	
B. 1 – 5		D. 11 - 20		F. Greater than 30	

89. What is (are) your field(s) of specialisation/subject(s)? Please fill the response below:

Thank you for taking the time to complete this questionnaire!

APPENDIX B : CODING OF RESEARCH QUESTIONS TO RESEARCH THEMES

Online Survey Question Number	Survey Question	Research Question Number	Research Question Theme
78	What is your age?	0	Demographic
79	What is your race?	0	Demographic
80	What is your gender?	0	Demographic
81	What is your highest qualification level?	0	Demographic
82	Are you a preservice teacher, inservice teacher or lecturer?	0	Demographic
83	If you are a preservice teacher, how far are you with your studies?	0	Demographic
84	Which grades do you teach?	0	Demographic
85	What is the name of your institution?	0	Demographic
86	Where is your institution situated?	0	Demographic
88	Years of teaching experience?	0	Demographic
89	What is(are) your field(s) of specialisation/subject(s)	0	Demographic
6	Computers and other digital technology tools are generally reliable	1	Attitudes
7	The more technology one uses, the more respect you get from your peers	1	Attitudes
10	Computers and related technologies isolate learners from each other	1	Attitudes
11	I find computers and related technologies interesting	1	Attitudes
12	I enjoy learning new technologies, new ways of doing things	1	Attitudes
13	I think new digital learning technologies will assist in my teaching	1	Attitudes
14	I believe that digital technologies promote learning	1	Attitudes
15	I am likely to adopt digital technologies in my teaching in the next 5 years	1	Attitudes

18	I am confident in using technology to teach	1	Attitudes
19	Digital technologies in teaching and learning are just another 'fad'	1	Attitudes
20	The socio-economic divide is replicated by the digital divide	1	Attitudes
21	I believe that digital technologies 'dumb down' learners	1	Attitudes
37	Digital technologies promote facilitation style teaching	1	Attitudes
38	Digital technologies enable learners to become self-driven	1	Attitudes
64	I feel embarrassed when my learners are more digitally competent than I am	1	Attitudes
66	Good teaching does not necessarily require teachers to use digital learning tools/techniques	1	Attitudes
67	I have concerns that apps, YouTube videos and websites are a crutch for lazy teachers	1	Attitudes
74	How would you rate your ability to meet the digital needs/expectations of your learners?	2	Digital Capabilities
8	I feel comfortable using digital technological tools/systems/programmes	2	Digital Capabilities
9	I do well with digital technologies e.g. computers	2	Digital Capabilities
16	I seldom require IT support (technical support in the use of digital tools)	2	Digital Capabilities
17	I use digital technologies to self-teach/self-study	2	Digital Capabilities
22	I create Word processing documents with ease (e.g. Ms Word)	2	Digital Capabilities
23	I create Presentation documents with ease	2	Digital Capabilities
30	I am creative when using presentation/multimedia software (e.g. PowerPoint and Google Presentation), my presentations are highly professional	2	Digital Capabilities
39	I solve technical problems in my classroom	2	Digital Capabilities
65	I help others in terms of using digital tools in the classroom	2	Digital Capabilities
70	When did you start using an electronic device such as a computer?	2.1	Digital Capabilities (Classification - More demographic)
72	How often do you login to the internet?	2.1	Digital Capabilities (Classification - More demographic)

73	How often do you use an electronic/digital device?	2.1	Digital Capabilities (Classification - More demographic)
58	I have received training on integrating digital tools in the classroom environment	3	Digital training for educators
59	I am self-taught in terms of using Presentation e.g. Powerpoint in the classroom	3	Digital training for educators
60	I have received training on creating/updating websites	3	Digital training for educators
61	My training has taught me how to locate educational Websites for student learning	3	Digital training for educators
62	I have received training on lesson planning where digital tools are used in the classroom environment	3	Digital training for educators
63	My training has taught me how to use apps in the classroom	3	Digital training for educators
68	My teacher training has taught me how to design lesson plans that support digital technology, are developmentally appropriate and support the needs of diverse learners	3	Digital training for educators
69	My training has equipped me to plan strategies using technology to enhance learning	3	Digital training for educators
1	Do you own or have regular access to a Personal Computer (PC) or laptop?	4	Digital resources
2	Do you own or have regular access to a smartphone?	4	Digital resources
3	Do you own or have regular access to a game console?	4	Digital resources
4	Do you own or have regular access to an iPod (or other mp3 player)?	4	Digital resources
5	Do you own or have regular access to an iPad or other tablet?	4	Digital resources
26	I regularly surf the internet for educational websites	4	Digital resources
28	I often source lessons and curriculum advice/help from the internet	4	Digital resources
32	I use technologies to improve my productivity (make the work of preparation, record keeping) to be efficient and effective	4	Digital resources
71	Do you have access to free WiFi?	4	Digital resources
87	What type of institution do you work? If you are a preservice teacher, what type of institution have you worked for?	5	Institution type
76	What are your personal barriers, if any, to the integration of digital technology in your classroom? Please elaborate.	6	Personal Barriers

77	What are the institutional and/or structural barriers, if any, to the integration of digital technology in classrooms? Please elaborate.	7	Institutional Barriers
24	I create Web Pages for classroom practices/to share classroom practices	DV	Technology Integration
25	I use a Website for communication with learners/fellow teachers	DV	Technology Integration
27	I regularly visit discipline specific websites for self-study purposes and/or to help my learners	DV	Technology Integration
29	I often make use of digital technology in the classroom	DV	Technology Integration
31	I regularly use YouTube to enhance learning	DV	Technology Integration
33	I encourage my learners to use digital tools and resources to enhance their knowledge and understanding of the curriculum/content	DV	Technology Integration
34	I use digital tools to engage learners, to explore real-world issues and solve authentic problems	DV	Technology Integration
35	I design lesson plans based on using digital technologies which are developmentally appropriate and support the needs of diverse learners	DV	Technology Integration
36	I make use of blogs for learning	DV	Technology Integration
40	I use Word Processing documents (i.e. MS Word, Google Docs, etc) to create lessons	DV	Technology Integration
41	I use Presentations for lessons	DV	Technology Integration
42	I log onto websites during my lessons	DV	Technology Integration
43	I steer learners to discipline specific websites to do homework or revision activities	DV	Technology Integration
44	I use the internet in my lessons	DV	Technology Integration
45	I use a MacBook in my lessons	DV	Technology Integration
46	I use a iPad/Tablet in my lessons	DV	Technology Integration
47	I use a smartphone in my lessons	DV	Technology Integration
48	I use YouTube videos/recordings in my lessons	DV	Technology Integration
49	I use instant messaging platforms like ‘whatsapp’ to communicate with my learners	DV	Technology Integration
50	I use videos to teach	DV	Technology Integration
51	I steer my learners to use apps to assist them to learn concepts/skills	DV	Technology Integration

52	I use email to communicate with my learners	DV	Technology Integration
53	I use game-based learning activities in my classroom/homework activities	DV	Technology Integration
54	I regularly give projects/homework activities that require my learners to access the internet	DV	Technology Integration
55	My learners are able to submit homework activities digitally	DV	Technology Integration
56	I use textbooks in the classroom	DV	Technology Integration
57	I distribute notes/paper-based activities/instructions in my classroom	DV	Technology Integration

**** DV denotes Dependant Variable – Technology Integration**