An evaluation of teachers' digital learning competencies to integrate technology-supported materials in the teaching-learning process

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ABSTRACT

There is a growing body of literature associated with teachers' digital competency levels and their ability to integrate digital tools and resources to support the teaching and learning process in order to gain a comprehensive understanding of the benefit to teachers, learners, the education process, and system. An important component of research to add to this field is an in-depth evaluation of how digitally competent South African teachers are to successfully integrate technology-supported materials in the teaching and learning process, leading to positive educational outcomes. The aim of this research is to gain an understanding of South African teacher's perceived or self-assessed competence on the curriculum focus competencies stipulated in the Department of Basic Educations Professional Development Framework. This thesis examines the digital learning competencies, specific to a curriculum focus, of in-service and pre-service teachers and their ability and readiness to explore the competencies gained through the curriculum delivery for learners. A quantitative approach was used to enable the collection of data for this study to be accomplished. A clearly structured survey was distributed through multiple approaches such as messaging and social media channels.

Overall, the study found that most teachers feel comfortable with their acquired skills and competency levels to integrate digital methods in the classroom in order to facilitate learning. The data collected confirms that most teachers have a medium to high perceived competence level in relation to the digital learning competences stipulated under the curriculum focus in the Professional Development Framework. Teachers are somewhat comfortable and confident in integrating digital technology to enhance learning in classrooms whilst simultaneously using it to explore and experiment with all available teaching techniques. The findings of this study enable quicker transition and integration of digital resources in classrooms which will improve the teaching and learning experience. Hence, the initiatives to develop teachers in digital learning competencies are effective. Recommendations for future studies are also discussed in chapter 5. Future research that can be linked to this

topic include studies that investigate if the integration of digital technologies in classroom learning impacts learning outcomes.

KEY WORDS

Keywords: Digital tools and resources, ICT integration in classrooms, integrate technology-supported materials in the teaching-learning process, South African teachers, teachers' digital learning competencies

DECLARATION

I, Tashlynne Naidoo, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name: Tashlynne Naidoo

Signed at Johannesburg

On the 23 day of October 2020

DEDICATION

This thesis is dedicated to my husband Rickie Naidoo and daughter Taylor Naidoo. I could never have imagined the amount of time, sacrifices and dedication this Master's programme required when I registered to be a candidate. Through it all, my husband stepped in to shoulder more responsibilities at home and with raising our daughter, for me to leap forward in this journey. His sacrifices were far more than mine, therefore, I will forever be grateful for this opportunity and his unconditional support throughout.

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The first and most important acknowledgment is to my Lord and Saviour; Jesus Christ, for sustaining me through this journey and giving me the hope and wisdom to pursue this degree. He has been my guide and my greatest source of motivation and encouragement during this period. I would not have gotten this far without deep-rooted faith in Him as it has allowed me to persevere against all odds.

Secondly, I would like to acknowledge my parents, Jeevanathan Govender and Salome Govender, for raising me with the conviction that education is the key to success. They have made countless sacrifices for me to be where I am and who I am today.

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LIST OF ACRONYMS

ACRL	Association of College & Research Libraries
CEO	Chief Executive Officer
CK	Content Knowledge
CSIR	Council of Scientific and Industrial Research
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
FET	Further Education and Training
ICT	Information and Communications Technology
ISPFTED	Integrated Strategic Planning Framework for Teacher Education and Development
IT	Information Technology
MIT	Massachusetts Institute of Technology
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
SADC	Southern African Development Community
SAMR Model	Substitution, Augmentation, Modification and Redefinition
TCK	Technological Content Knowledge
TK	Technological Information
TPACK	Technological Pedagogical Content Knowledge

TPK	Technological Pedagogical Knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund

CHAPTER 1. INTRODUCTION

1.1 Purpose of the Study

The core purpose of this quantitative study is to develop, through evaluation; a comprehensive understanding of teachers' digital learning competencies and their readiness to assimilate technology-supported constituents in the teaching-learning procedure.

The purpose of the proposed study will therefore be uncovered by identifying statistical relationships between the training and development of pre-service and in-service teachers, specific to their digital learning competencies and their subsequent ability to use these competencies to facilitate improved learning in classrooms. Digital learning is defined by the Department of Basic Education's (DBE) Professional Development Framework for Digital Learning (2017) as any activity within the teaching and learning process that exploits digital technology to improve the learners' experience and understanding. For purposes of this study, both pre-service and in-service teachers from public schools only are included in the evaluation. Pre-service teachers are known to be teacher candidates that are enrolled for education programmes to become practising teachers. Pre-service teachers who attend public universities in South Africa are included in the proposed research.

1.2 Context of the Study

In the wake of the digital era, knowledge society and Fourth Industrial Revolution, the possibilities provided by digital technologies in the arena of education and skills development are very broad, and one of its key attributes is its potential to overcome time and resource constraints through flexible and shorter learning pathways (The Global Commission on the Future of Work, 2019). The opportunities now include access to wide-reaching quality education that is effected by teachers who have the relevant skills and digital learning competencies and lastly whose competencies, proficiencies and mentorship cannot be replaced by education technologies (The Global Commission on the Future of Work, 2019).

For ages, the term ‘digital divide’ had been used in academic environments to articulate the social inequality that existed between people who have access and those who lack access to information and communications technology (ICT) (Ritzhaupt et al., (2013) and Kajee and Balfour., (2011). Ritzhaupt et al, (2013) documented that numerous components are interrelated to the digital divide. Over the years it has become multifaceted and some of these dimensions include: an individual’s access to computers, their computer usage, and related skill. Their research further declared that the term ‘digital divide’ is no longer only relevant to physical access to technology and digital tools but also includes whether people have the necessary information and communications technology (ICT) skills (Ritzhaupt et al., 2013). In a study conducted by Kajee and Balfour (2011), the authors marked the digital divide as a legacy of South Africa’s past as a result of the apartheid system, however South Africa can be seen as one of the most information-integrated societies within sub-Saharan Africa (Bornman, 2015).

South Africa is often seen as having a very unequal society in a world where the "historical disadvantaged still experiences an overwhelming lack of access to basic services, skills training and employment opportunities" which is a result of the apartheid era (Violence Prevention Through Urban Upgrading, 2019). The study conducted by Fuchs and Horak (2008), confirmed a similar belief that the continent of Africa is furthermost affected by destitution and where the digital divide is more prominent. The digital divide is not only limited to those whom have internet access and those that do not, but a rift is likewise apparent among persons who have digital literacy adeptness, the skill to yield any form of content online, and the monetary independence for optimum internet consumption than those who do not have the same (Violence Prevention Through Urban Upgrading, 2019).

Multiple access routes to digital literacy is a principal factor lacking in South Africa for the less-privileged majority as indicated by the research conducted by Kajee and Balfour (2011). Such individuals descend from underprivileged social backgrounds where digital instrumentation is almost non-existence, nor is it a focus due to other basic amenities receiving greater priority for survival. The researchers argue that South Africa is a country where there is an evident disparity in wealth; there's an advantaged educated minority, who now have access to technology and digital literacy access, and a disadvantaged majority which creates an escalating digital divide (Kajee & Balfour, 2011). In addition, Kajee and Balfour's, (2011) research infers that there is an accompanying disparity caused by schools being under-resourced with a lack of premeditated support to drive digital literacy initiatives as well as a gap between industry requirements to employ people, and higher education deficiencies to meet industry needs in order to improve employment rates.

In recent years, there has been some investment in researching the prospects of digital instrumentation for learning in isolated rural areas (De Lange et al., 2010) to uplift the socio-economic standards and levels of digital competence amongst rural citizens.

Recognising the paramount importance of the development of digital competencies among teachers and students also has an overarching impact on the future employability of students. Chetty et al. (2017) has revealed that the minimum requirements for an individual to secure employment is digital literacy, hence the need to ensure that teachers are digitally competent to enable digital literacy has never been more vital. The DBE in South Africa has identified its e-Education goals through the launch of the 'Draft White Paper on e-Education' (2003). e-Education is defined by the Department of Basic Education's 'Draft White Paper on e-Education' (2003) as a process of fast-tracking the success of national education goals using ICT. Some of the goals are described below. Using ICT, networks are created where learners can be connected to each other, teachers have access to professional support services through digital tools and they are able to provide digital platforms to facilitate learning (Department of Education, 2003). The sharing of information and ideas between students and teachers will enable effectual amalgamations of pedagogics and technology (Department of Education, 2003).

The value of e-Education in the digital age cannot be underestimated. Some of the presumed benefits include lower costs, higher quality, and a more efficient education system and curriculum (Frost & Sullivan, 2017). South Africa has not fully implemented the use of technology at large in classrooms to supplement all learning (Frost & Sullivan, 2017). Some of the most notable challenges experienced by the South African government include the lack of funding for technology and supporting of infrastructures

in schools, as well as the reluctance of teachers to incorporate digital learning solutions due to their unfamiliarity with the technology (Frost & Sullivan, 2019).

Whilst South Africa is a chief participant in the technology arena in the Southern African Development Community (SADC) region, the digital literacy of its populace is lower than many of the neighbouring SADC areas (Aitchison & Rule, 2005). E-skills is the capability to practice and advance ICT usage to be a participant having access to electronically enabled information and having the aptitude to analyse the information into constructive and applicable knowledge (Ikamva National eSkills Institute, n.d.). People can use and create various forms of digital tools and resources to improve their learning environments and social engagement while being active participants in the economy (Ikamva National eSkills Institute, n.d.). Research directed by Merkofer and Murphy (2009) suggests that stakeholders such as the government, industry and teachers in South Africa must join forces to address the shortages in e-skills development and consciously create an ICT powerhouse in the country (Merkofer & Murpy, 2009, p. 686).

There is insufficient evidence to support that the university curriculums and their mode of delivery in education campuses as well as training, development and support for in-service teachers are effective in developing digital learning competencies in teachers. With South Africa's legacy of apartheid, there has been many socio-economic developments by the South African government to lower levels of digital inequity amongst its previously disadvantages citizens, however, the impact of the digital divide and digital literacy of teachers and universities' curriculums to address this has not been investigated at length. Moreover, it's pertinent to understand if teachers are ready - based on the training and development that they undergo - to develop digital learning

competencies and to successfully integrate such learnings and practices in the classrooms for the benefit of both teachers and students.

The next section provides a detailed explanation of the research problem.

1.3 Research Problem

Main Problem

ICTs and digital media have created new and improved facets that have a positive impact on the learning and teaching process in the discipline of education. The revolution of digital media and the global impact of ICTs have shifted traditional learning environments by exposing new learning opportunities through the implementation of digital technology (Department of Education, 2004). Many schools across South Africa are now able to explore the benefits, offered through implementing digital tools and resources, to ameliorate the teaching and learning experiences as there is also a deliberate effort to provide higher telecommunication infrastructure penetration across the country (Department of Education, 2004). Other than the advantages that digital resources provide through management and organisational dimensions to schools, teachers and learners, there are also new ingenious ways to engage in information selection, gathering, sorting and analysis (Department of Education, 2004).

Digital learning mechanisms incorporated in education curriculums has been recognised to help the teaching and learning process. Some benefits include the promotion of inclusive education whilst ensuring that there is a better quality of learning

material available to students; quality of learning methods is improved, teachers' productivity is improved, and lastly it's seen for its potential to bridge the digital divide between various socio-economic strata (Basargekar & Singhavi, 2017).

South Africa is a developing country that has to consider the need for increased access, equity and redress in their attempt to improve the quality of education for economic growth and social development which is also an expectation of the public White Paper on e-Education, 2004. Curriculum development and delivery in the digital age creates a wide array of challenges for education and training systems globally. Some of the challenges include participation and contribution to the information society, impact of ICTs on access, cost effectiveness and quality of education, and integration of digital tools and resources into the learning and teaching process (Department of Education, 2004).

A limitation, considered to be one of the foremost, to successfully integrate ICT in classroom learning are teachers themselves and this is due to their attitudes and knowledge related to computers which mostly relates to fear and feelings of skill deficiencies (Lawson & Comber, 2006). Teachers also fail to understand and recognise the value and benefit of such integration to the students' learning experience (Lawson & Comber, 2006).

To ensure sustainability of digital learning in schools, teachers need to have their digital learning competencies developed. The Department of Education (2004), recognises a base of teachers within the education ecosystem, who've had limited to no access to electronic technology and this is therefore a limitation in their integration of digital tools and resources in classrooms. The need for teacher development and support in digital

learning competencies was known. It was also noted that ICTs will be a core development area for pre-service teachers and ongoing professional development of practising teachers (Department of Education, 2004).

Prior enquiry conducted through the study of Chetty et al. (2017) recognised that there is scarcity of accessible and comparable data which poses as a serious challenge in trying to quantify the extent of digital integration and relevant use of digital apparatuses in different contexts. In addition, their study emphasises the need for policies that promote digital learning as employees in the digital era need to be digitally capable and collaborations amongst education authorities, industry leaders and students can ensure that digital learning programmes are aligned to evolve at the same pace as technological innovation (Chetty et al., 2017).

Chetty et al. (2017) contend that the lack of measurement for digital literacy is not being given sufficient attention, and the development of digital learning is not being focused on as a result. Basargekar and Singhavi (2017) stipulate that teachers' reluctance and lack of confidence to leverage off digital tools and resources in classrooms to enable enhanced learning are some of the major barriers in any attempt by government to improve the quality to education.

1.4 Research Objectives

The study shall evaluate the competence of teachers to integrate digital instrumentations to facilitate enhanced classroom learning. Therefore, the objective of the study is to conduct a critical assessment of teachers' digital competency levels that are developed through their tertiary education or through in-service training and

development that's aligned to the Professional Development Framework for Digital Learning (2017) created by the DBE.

The DBE was guided by the United Nations Educational, Scientific and Cultural Organization's (UNESCO) ICT Competency Framework for teachers (ICT CFT), however, they chose not to benchmark but rather develop a framework relevant for South Africa's teaching context. The ICT CF tool is a guide created for teachers on how to use ICT within an education context to support the national and institutional educational strategies (UNESCO, ICT Competency Framework for Teachers Harnessing Open Educational Resources, 2019). The tool also incorporates recent technological and pedagogical developments which was founded in the field of ICT and education (UNESCO, 2019). Some of the principles that this tool purposefully included in its attempt to integrate ICT in the education delivery is that of non-discrimination, open and equitable information accessibility, and gender equality (UNESCO, 2019).

This Professional Development Framework for Digital Learning (2017) was based on extensive consultation with all public universities in South Africa, including the Deans Forum of all Deans from Education Faculties in all public universities. It was also developed in consultation with all five teacher unions and all nine provincial education departments. The Department of Higher Education and Training (DHET) was also extensively involved in the consultation and design process. This entire process was supported in partnership with the United Nations International Children's Emergency Fund (UNICEF) South Africa. This framework was formally adopted by the Council of Education Ministers (from all nine provinces) in September 2017, following endorsement by all stakeholders (Department of Basic Education, 2017).

1.4.1 Research Questions

The researcher has therefore recognised, based on prior investigations, that there is insufficient research that assesses a teacher's competency levels and readiness to integrate digital tools and resources in classrooms, hence this is a significant study and is of great relevance in equipping the workforce of the future. The questions that this study aims to answer are as follows:

- Are teachers able to integrate digital tools and resources to enhance learning objectives in various learning environments?

- Are teachers able to develop learners' global awareness and understanding using digital communication and collaboration tools?

- Are teachers able to transform learning through the innovative use of digital tools and resources?

- Can teachers enhance class management, assessment and feedback processes with digital resources?

- Are teachers able to integrate learners' skills development in terms of digital literacies with curriculum-based learning?

1.5 Significance of the Study

The significance of the proposed research is that it will provide the education sector (policy makers and funders) with insights into the effectiveness of university curricula in Bachelor of Education degrees in developing digital competencies in candidate

teachers, as well the ability to assess the effectiveness of training and development programmes for in-service teachers.

A benefit to the DBE is that additional insight will be available to specify whether the relevant ICT and education policies, resourcing, and curricula development ecosystem, including the delivery mode from universities, are effective to improve education quality through developing the required skills in teachers that enable a lifelong learning ecosystem, which finally leads to good education outcomes for learners. The notion of education being a crucial constituent of a country's digital transformation journey and enabling an information society was also noted in the International Telecommunication Union Report (2003).

Education is a significant fragment of a country's transformation on the road to vigorously and copiously participating and contributing in the global information society. Studies confirm that educational establishments can have a noteworthy role as internet access locations (International Telecommunication Union, 2003). Research also seems to show that linking schools and bringing students online in developing countries may have a paramount bearing on raising the number of ICT users (International Telecommunication Union, 2003).

The Global Commission on the Future of Work (2019), stated that there should be an entitlement to lifelong learning that is inclusive of formal and informal education from early childhood and basic education through adult learning. Lifelong learning needs to enable a learning environment where people are empowered to attain skills, and to reskill and upskill. The responsibly to provide an effectual and aptly financed lifelong

learning ecosystem is that of the government, workers, employers and educational institutions (Global Commission on the Future of Work, 2019).

A report compiled, paper commissioned for the Global Education Monitoring Report (UNESCO, 2016), noted that digital literacy is more than ever becoming an indispensable competence required in our lives, and when people are limited in accessing ICT, it creates an obstruction for them to socially integrate and develop personally and professionally (UNESCO, 2016).

The value of being digitally literate and developing digital learning competencies is becoming more evident and therefore there is a growing need to monitor the magnitude to which teachers and learners develop skills and knowledge for tomorrow's world. This opinion is confirmed by Chetty et al. (2017), who stated that the possession of digital literacy, in the contemporary digital economy, enables people to attain other esteemed outputs in life.

Showcasing digital learning competence has an all-encompassing impact on employability and this is being recognised globally. Lifelong learning spreads beyond having practical ICT skills to skills more aligned to collaborative and artistic uses of novel technologies for employability and societal inclusion (Government Office for Science, 2017). The constituents of digital capabilities include information management, alliance, communication and sharing, creation of content, and problem-solving (Ferrari, 2012).

The *World Economic Forum's White Paper Digital Transformation of Industries* (2016) quoted Erik Brynjolfsson and Andrew McAfee, MIT Initiative on the Digital Economy:

> There's never been a better time to be a worker with special skills or the right education, because these people can use technology to create and capture value. However, there's never been a worse time to be a worker with only 'ordinary' skills and abilities to offer because computers, robots and other digital technologies are acquiring these skills and abilities at an extraordinary rate. (p.27)

The report compiled by the World Economic Forum (2016) further claimed that there will be a 22% increase in global jobs by 2022 and those individuals whom effectively mastered the use of technology will be more desirable in the job labour markets. Chetty et al. (2018) recommends that digital learning programmes should be inclusive in that it caters for a multidisciplinary need of organisations for current and future digital skills shortages.

The ongoing introduction and integration of new digital competencies are changes that are inherently part of a progressive life and economy. The teaching landscape in South African schools is being shifted to move in line with the digital era where technology and electronic media are used as tools to teach across all spectrums while enhancing the digitally literacy and learning competence of students (Kajee & Balfour, 2011). Digital literacy and digital learning are changing the legacy approaches within learning environments, from reading books to reading from electronic devices, and from writing in books to writing on electronic devices or typing. Chetty et al. (2017) in their research state that it's imperative to investigate and understand the link between the demand and supply of digital-related skills as well as tertiary institutes' role in supplying highly competent individuals into the labour pool through school-based digital learning development training programmes or vocational training programmes. Therefore, collaboration and alignment among education authorities, national governments and

employers is pertinent to move the country towards the uphill digital transformation journey where all parties can enjoy a broad spectrum of benefits which include: better quality of candidates within the supply pool of the labour market, and employment opportunities in South Africa where the right skills have already been catered for through structured collaboration.

In the final chapter, recommendations are provided to improve the integration, usage and delivery of digital methods to enhance the teaching-learning process, capacity building and resourcing, as well as if there needs to be additional activities to enable teachers to be more comfortable, ready and experimental in classrooms.

1.6 Delimitations of the Study

The proposed research has the following delimitations:

α. This study is limited to a South African lens, hence the scope of relationships and resources to aid the intended research include South African universities – education faculties and students.

β. A quantitative research design will be utilised, due to its merit of being used to provide a broader understanding of the proposed topic. It is also an appropriate research design for the cross-sectional nature of this study.

χ. South Africa recognises 11 official languages. The research instrument used in the proposed study is limited to English only. As such, only users proficient in the English language are eligible to participate in the interview, questionnaire and survey.

1.7 Definition of Terms

In this section a list of definitions for key terms or concepts used through the proposed research is provided.

Digital Divide – (Chetty et al., 2018) explains that there are two characteristics that define the digital divide, and these include: (1) limited and costly infrastructure and (2) limited digital literacy in low/middle income communities. Owing to digital technologies being expensive in nature and lack of infrastructure specific to sporadic supply of electricity and ICT facilities, low/middle income societies therefore have restricted access to digital technologies.

Digital Literacy Measurement is a measurement that policy makers use to monitor the dissemination of digital skills (Chetty et al., 2018).

Digital Literacy is defined by United Nations Educational Scientific and Cultural Organisation (2018), as the capability to access, manage, comprehend, assimilate, connect, evaluate and generate information securely and suitably through digital instruments to be more suitable for employment and entrepreneurial opportunities. This encompasses terms such computer literacy, ICT literacy, information literacy, and media literacy.

ICT – refers to a range of technological instruments and resources that society is able to use to connect with each other as well as to generate, disseminate, store and manage information (Basargekar & Singhavi, 2017).

e-Education – This concept is defined by the use of ICT to accelerate the government's strategy to achieve national education goals (Department of Education, 2003).

Digital Learning – United Nations Educational Scientific and Cultural Organisation (2018) has defined digital learning as any activity within the teaching-learning sphere that utilises digital instruments to improve the learning experience for the learner.

Digital Tools and Resources refer to the digital devices and accompanying resources that may be used to support teaching and learning (UNESCO, 2018). United Nations Educational Scientific and Cultural Organisation (2018) considers digital tools and resources to be inclusive of computers, laptops, tablets, cellular phones, document cameras, interactive whiteboards, digital cameras, gaming consoles, response systems, and digital microscopes. "Resources" refers to all digital content and information sources (UNESCO, 2018).

Digital Competencies according to the DBE's Professional Development Framework signify skills to which teachers using digital instruments and content resources can aspire (Department of Basic Education, 2017).

1.8 Assumptions

The following assumptions were made by the researcher in the proposed study:

- The criticism from the study can provide insight into educational authorities and national government to develop relevant and contextual digital literacy and digital learning programmes for pre-service and in-service teachers.

- Universities will be able to closely align their curriculums to the Department of Basic Education's Professional Development Framework for Digital Learning if not already done.

- Users could be biased in their responses, given that the questions may pertain to areas where they wanted to feel socially included.
- The sample of students are across diverse ethnic backgrounds, inclusive of both genders and different socio-economic standings.
- All respondents are proficient in the English language.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This segment observes and critiques the various research conducted in the digital field, specific to the education sector, with a narrowed focus on elements that enhance the objectives of this proposed research. It begins with a background discussion on the topic and key concepts being defined.

2.2 Digital Disruption within the Realms of the Traditional Educational Landscape

The uses and volumes of information have increased drastically in both developed and developing countries over the last few years, with more and more content available through different channels such as radio, television, internet, books, newspapers, and magazines (Nath, 2017). The wide spreading of information has been enabled through progress in the technology domain (Nath, 2017). The developments in ICT over the years have transformed societies in ways previously unexplored (Nath, 2017).

‘Knowledge Society’ or its variant ‘knowledge societies’ has been adopted by the United Nations Educational Scientific and Cultural Organisation (UNESCO, 2003) within its established policies. In an interview published in the last issue of "A World of Science", the quarterly newsletter of UNESCO's Natural Sciences Sector, Abdul Waheed Khan, the Organization's Assistant Director-General for Communication and Information explains how information and knowledge can contribute to development in

a world where 80% of people still lack access to basic telecommunication tools (United Nations Educational Scientific and Cultural Organisation, 2003). He stated:

> Information society is the building block for knowledge societies. Whereas I see the concept of ‘information society' as linked to the idea of ‘technological innovation', the concept of ‘knowledge societies' includes a dimension of social, cultural, economic, political, and institutional transformation, and a more pluralistic and developmental perspective. In my view, the concept of ‘knowledge societies' is preferable to that of the ‘information society' because it better captures the complexity and dynamism of the changes taking place. As I said before, the knowledge in question is important not only for economic growth but also for empowering and developing all sectors of society. Thus, the role of ICTs extends to human development more generally - and, therefore, to such matters as intellectual cooperation, lifelong learning and basic human values and rights. (UNESCO, 2003).

The last century has seen rapid change in various paradigms. The most relevance for this study is the rapid shift from TVs, telephones and newspapers to web technologies and digital tools in how we are informed and entertained (Gilster, 1997). There has been a subsequent impact on countless facets, where digital modes and mediums have disrupted traditional ways of doing things, including how ICT can generate novel possibilities for learners and teachers in terms of how they engage in new-fangled ways of information selection, gathering, sorting and analysis (Department of Education, 2003).

In the book of “Bridging the Digital Divide”, the authors confer that the elements which contribute significantly in bridging the digital divide are the local and provincial governments in South Africa, the non-governmental agencies, research and development organisations, ICT human resources, access to ICT in terms of cost and convenience, local investment and awareness, and lastly, the development of ICT infrastructure at the local level (Baskaran & Muchie, 2007). Barzilai-Nahon (2006) took a slightly different stance contending that “networks and associated technologies are not neutral artefacts but are political and social spaces in their structure as well as in their content levels” implying that the digital divide goes beyond access-oriented thinking such as proprietorship, obtainability and affordability of infrastructures. Van Dijk's (2006) research suggests that certain applications such as bookkeeping, spreadsheets and presentations are used more intensely by persons with superior levels of education and income in comparison to persons with lower levels of education and income (Van Dijk, 2006, p. 182). Van Dijk and Hacker (2003) states that problems of digital skills access and usage alone is insufficient to bridge the digital divide.

According to Gartner (n.d.), digital disruption is the upshot that changes the central expectations and behaviours within a culture, market, industry, organisation or process where the casual factor is a result of the implementation of digital capabilities, channels or assets.

Several researchers are now examining the impact of digital disruption and its impact in numerous fields and its sub-components. The World Economic Forum, in collaboration with Accenture, (2016) compiled a report which states that business executives across several industries are concerned with the impact of digital transformation and digital disruptions on their organisations. They have been looking at the different components

within their businesses that must reviewed considering the digital changes. A key component, that's most relevant to this research and that requires significant consideration by the government and corporates, is the skill sets of employees needed in a digital age to meet business requirements (World Economic Forum, 2016).

Consequently, the World Economic Forum (2016) indicated that there is a need for all educational institutes to collaborate with industries through partnerships with the purpose of creating a workforce that will develop the right digital skills for bridging the long-term skills gap. Whilst Chetty et al. (2018), suggested that digital literacy training is an important component in reducing technophobia in disadvantaged communities, there is no index indicating the digital literacy skills gap measurements to ensure that digital training programmes are aligned to current industry needs and future industry skills gaps specific to digital. In the study conducted by (Chetty et al., 2018), 33% of respondents that participated in their study saw no relevance in using the internet and these responses were received from the disadvantaged communities in South Africa where a percentage of the population were not part of any formal employment. This study argues that whilst the disadvantaged majority in South Africa is aware of their personal limitations in advancing towards digital transformation, the responsibility sits with government authorities to identify and measure the digital literacy gaps per location. The reasons for not having access to the internet is summarised in figure 1.

The latent use of ICT within the education spectrum is firmly understood by the South African education sector. The ability of ICT to improve the education system is seen through its potential to advance cognitive skills in learners such as comprehension, problem-solving and artistic thinking (Department of Education, 2003). To enable learners to be active participants of the knowledge society before they leave a further-

education and training (FET) institution, it's imperative to have the effective implementation of ICT in teaching and learning practices (Department of Education, 2003).

The Department of Education (2003) noted that the provincial districts in South Africa have disparate integration of ICT in schools. Some provinces experience significant ICT integration in schools, e.g. Western Cape, while other provinces are lagging (Department of Education, 2003).

Owing to the benefits exposed through the digital surge, the education sector is now feeling the pressure to stay relevant in the learning space and is therefore promoting the development of digital literacy in schools, which is enabled by teachers and their ability to integrate ICT in classrooms (Hutchison & Reinking, 2011).

2.3 The Impact of Digital Disruption on the Education Sector

This section of the research looks at the various challenges experienced by South African teachers that impact the integration of digital constituents to facilitate classroom learning. The sub-headings that expose these challenges include: (1) The relationship between the Digital Divide and Digital Literacy Levels; (2) Digital Education Policy in South Africa; (3) Challenges in Understanding the Digital Literacy Levels of Teachers; (4) Factors Influencing Technology Adoption by Teachers; (5) Initiatives to Promote Digital Learning for Teachers.

2.3.1 The Relationship Between the Digital Divide and Digital Literacy Levels

The link between the digital divide and the digital literacy levels of teachers can directly impacts a teacher's ability to integrate digital tools and resources in classroom lessons. The term 'digital divide' was explained by Castells (2002, p. 248) as a divide that causes "inequality of access to the internet". Van Dijk and Hacker (2003), identified four types of impediments that give rise to the digital divide:

- Deficiency of 'mental access' refers to the lack of basic digital experience due to the user not having any interest or finding the digital encounter to be unappealing.
- Deficiency of 'material access' signifies that people may not have access to computers and network connections.
- Deficiency of 'skill access' refers to people's lack of digital skills and the relevant support to learn and understand how to use digital resources.
- Deficiency of 'usage access' indicates the lack of consequential usage opportunities where digital is relevant and contextual to the user.

Digital literacy was then recognised by Kajee & Balfour (2011) for its potential to bridge the digital divide between rural and urban communities as internet accessibility made available a vast amount of information to all, and that is not restricted by any user's physical location. Their article also states that due to socio-cultural environments, people who are considered to be the 'advantaged elite minority' have various routes to access digital literacy.

Specific to the educational sector, Fuchs and Horak (2008) states through their study that students from rural areas, who have access to study at universities, access computers as first-time users. They further affirm that “with access to digital literacy still associated with middle class, higher education’s mandate to provide access to learning to students from a variety of class, race, gender and age groups, is consequently constrained” Kajee & Balfour (2011).

In an article compiled by Tondeur et al., (2015), it was distinguished that teachers need to be enabled from a training perspective to adequately integrate ICT into educational curriculums and practices of teaching methods to keep students engaged while going through rapid digital transformation.

The topic of digital literacy is being given a greater focus globally and its effects on teachers and learners has also been examined by several authors. Bulfin and North (2007), in a case study, mentioned that educational authorities have been looking at the connection between younger people, new technologies, and the learning process which is influenced by teachers and new paradigms.

Several authors pen down the digital divide on a similar understanding and some common elements noted by Crenshaw and Robison (2006), is that a country’s technological adoption and digital maturity is affected by most developed counties still having dial-up connectivity to the internet through telephone lines. Van Dijk (2006) study noted that in almost all developed countries, the physical access limitation is declining, and the digital divide seems to be closing. However, in terms of the digital skills impediment, the rift seems to be broadening.

Considering the digital divide in South Africa as a developing country, a digital literacy and digital learning programme to educate the previously disadvantaged and disconnected population on the various digital tools and their uses is key to leverage the full potential of any infrastructure development (Chetty et al., 2017).

While the digital literacy levels vary across countries, the study conducted by Chetty et al. (2017) does not include a comparative view of digital literacy to comprehend the extent of the global digital divide and how South Africa measures in comparison. The authors also mentioned that in an ever-changing business environment, the likelihood of digital skills becoming obsolete is high. Therefore, it's imperative that school curriculums and programmes specific to digital literacy for students and digital learning competencies development for teachers are constantly reviewed to remain relevant and contextual. They need to be fluid and agile (Chetty et al., 2017).

In a research report by Hutchison and Reinking (2011), they acknowledged that literacy teachers are not the only parties that should be accountable for digital tools and resources implementation in classrooms.

There is narrowed research available on the development of digital learning competencies of teachers and consistent ICT implementation and integration in classrooms, in a South African context.

2.3.2 Digital Education Policy in South Africa

The digital education landscape in South Africa is known by its traditional methods that were developed and relevant for the industrial era. In a study of the South African digital education policy conducted by Frost and Sullivan (2017), it was recognised that

to enable a digital education system, a viable solution to address the education crisis in the county is needed. The key mechanisms within this policy include teachers, learners, curriculum content and delivery of the material.

The South African government has acknowledged that the quality of education is a key contributor to the future prosperity of the country and is therefore given much deserved focus and priority (Telkom, 2015). The Department of Basic Education is responsible for the education sector in the country, with a focus on primary and secondary schools, and the DHET is accountable for tertiary institutions and vocational training (Telkom, 2015). The education sector encompasses of public schools, private schools, early childhood centres and special-needs schools (Telkom, 2015). The educational sector aims to stay abreast of technology advancements through continuous review of the educational curriculums to serve as effective tools for the success of learners and teachers in the digital age (Telkom, 2015). The aid of ICT in teaching practices, to enhance engagement and learning, cannot be underestimated as it can enable improved educational content, teaching aids and effective administrative systems that lighten the load on teachers (Telkom, 2015).

This sector also faces various challenges that hinder a quick adoption of technology within schools. Some challenges that arise from the digital divide include the lack of infrastructure, teachers' digital literacy levels, ability to implement ICT in classrooms, learners' comfort with using ICT, and other challenges encountered by the government which include: cost of utilising ICT as an effective tool in education on a limited budget; sustainability in implementing ICT needs to viable from the onset; and lastly, effective utilisation of ICT is key within the sector, as its success is dependent on many factors (Telkom, 2015).

Despite the challenges experienced within this sector, the e-Education policy intends for all South African learners to be ICT capable (Telkom, 2015). Learners should have the necessary confidence in using ICT as it will benefit them in a personal and professional context (Telkom, 2015).

The study conducted by Telkom (2015), correspondingly states that the South African government is committed to implementing ICT into South Africa's educational system to ensure sustenance, to improve the quality and accessibility of education, and lastly to achieve all departmental goals. Some of the strategic objectives of the government include: ongoing training and development of teachers, effecting a streamlined curriculum that lessens the administrative workload on teachers, and to enable web-based education where learners get access to information (Telkom, 2015).

2.3.3 Challenges in Understanding the Digital Literacy Levels of Teachers

According to (Chetty et al., 2018), implementing digital literacy training initiatives by the government becomes a challenge when there is a lack of consistent and comparative measurement indicators which identify the locations and populations that are digitally illiterate, and the disparity amongst these locations and populations. In another study by (Chetty et al., 2018), the authors claim that policy makers would be able to monitor the dissemination of digital skills through having a digital literacy measurement index that is consistent and comparable, and that would subsequently enable international benchmarking for digital literacy competence.

Conferring with Chetty et al. (2017) it's imperative to design a digital literacy index that is internationally accepted in order to ensure that digital training programmes are managed well, and that they have the fluidity to cater to the changes imminent from the

digital economy as well as the constantly maturing requirements from employers. An understanding of the current status quo can enable the South African education authorities to implement the right digital literacy initiatives that enable the creation of a great level of mastery of digital technologies that have an overarching effect on the productivity gains across the country, by having citizens with highly mature digital skills and digital learning competencies (Chetty et al., 2017).

In the modern age where change is the only constant, continuously understanding the new meaning, relevance and application of digital literacy and digital learning is crucial (Chetty et al., 2017). Superior digital skills today may become the normal state of the digital maturity in students in the future, and therefore, monitoring this shift in digital maturity in digital learning is pertinent in the digital evolution (Chetty et al., 2017).

The various challenges that have limited the educational system from steering towards becoming digitally enabled, include high costs, low retention rates, poor content from educational institutions, and untrained teachers (Frost & Sullivan, 2017).

The value of enabling a digital educational system is recognised as being worth the investment because it has the potential impact to address the unemployment rates in the country, since skills gaps will be identified and the necessary skills will be developed within educational boundaries (Frost & Sullivan, 2017).

South Africa's educational digital system is viewed under four pillars which consist of infrastructure, technology, the policy, and funding. Each pillar is broken down into detail below in the report compiled by Frost & Sullivan (2017):

- *Infrastructure:* The lack of widespread internet connectivity is a limitation experienced by the South African government to enable digital education systems, hence bridging the digital divide gap should be a priority as it limits access (Frost & Sullivan, 2017). The paradigm of educational practices can shift to provide more relevance in a digital era, where digital collaborative tools can be used to facilitate the sharing of information and knowledge between teachers and learners (Frost & Sullivan, 2019).

- *Technology:* According to Frost & Sullivan (2017), EdTech is the use of various digital tools to enhance learning, pedagogy and instruction, therefore increasing accessibility to the masses.

- *Human:* Therefore, it's suggested that ongoing training for teachers is key to enable the use of technology in classrooms as a tool to facilitate learning in the digital age where traditional education practices no longer keep learners engaged (Frost & Sullivan, 2017). The South African teachers are seen to be reluctant to adopt e-Education practices in their pedagogy because of the low digital literacy levels (Frost & Sullivan, 2017). Research also advises that the curriculum for higher education for teachers need to be reviewed and have an inclusive focus on information technologies with context of what the different technologies are, and how they can be leveraged in a classroom environment to facilitate and enhance learning (Frost & Sullivan, 2017).

- *Government:* South Africa has experienced a small penetration of digital programmes within schools, however, capital investment to provide a large-scale rollout was limited (Frost & Sullivan, 2017). There is an apparent lack of

funding to support the ongoing need of digital training courses for teachers, and to meet the costs of infrastructure and technology (Frost & Sullivan, 2017).

2.3.4 Factors Influencing Technology Adoption by Teachers

Several factors exist that could affect a teacher's ability and readiness to integrate ICT in lesson plans. In the research article of Basargekar and Singhavi (2017), the researchers contend that teachers' perceptions of their own digital literacy levels are a key component on whether implementation of digital resources and adoption to facilitate better learning practices in classrooms is successful or not (Basargekar & Singhavi, 2017). Their research further addresses two influencing factors that are specific to the perception related to a teachers' digital literacy proficiency which is: (1) non-manipulative teachers factors (demographic characteristics of the teacher such as age, years of experience, etc., which cannot be influenced by any government intervention); and (2) manipulative teachers factors (such as language of delivery, training facilities, etc., which can be influenced by the external environment and through interventions to improve the education system and curriculum) (Basargekar & Singhavi, 2017).

The research by Basargekar and Singhavi (2017) indicates that an individual who has had exposure to technology through their lives as well as access to learning about and using software applications are seen to be proficient in digital literacy, and therefore, a similar positive relationship exists for teachers who have had the same or similar exposure to computer self-efficacy. Such teachers would be more successful in implementing digital tools and resources in classrooms. A person's attitude towards computers is also affected by their gender, and in a classroom context, this attribute is

seen to have an impact on a teacher's implementation of digital tools and resources for enhancing teaching practices (Basargekar & Singhavi, 2017). A teacher's years of experience in the education field is also seen to be an important factor in the successful implementation of digital tools and resources in classrooms, however, previous research conducted by Basargekar and Singhavi (2017) reflected a mixed blend of results when comparing teachers work experiences to their implementation of digital tools and resources for learning practices in classrooms.

There has not been enough research that examines the possible access routes for digital literacy and digital learning competencies specific to South African teachers. Gudmundsdottir (2010) looked at the ICT competence of students in four schools in Cape Town, of which three of the schools cater to disadvantaged students and the fourth school was previously for whites only. The findings of this study confirmed that digital literacy levels amongst these schools and students differed. In addition, another result of the study was that there is no apparent difference in ICT usage and skills based on gender.

There are several other factors that can impact students' ICT usage and skills, and some of these include: the digital literacy levels of teachers, digital learning strategies used by teachers, access to support when needed, and home access to digital tools (Gudmundsdottir, 2010).

The effort made by educational authorities to decrease the digital inequality cannot go unrecognised; the ICT policy being one of the initiatives where learners now have material access to digital literacy programmes (Gudmundsdottir, 2010). However, a limitation of the policy is that it does not cater for the challenges experienced by

learners in environments outside of the school. Disadvantaged students are still not able to access digital literacy in other environments. For example: at home (Gudmundsdottir, 2010).

The confidence and competence of teachers to lead the digital transformation journey in the education arena has therefore never been more pertinent. ICT integration in schools can only be successful if teachers have the appropriate competencies and mastery skills of ICT integration that is contextual and relevant to facilitate enhanced learning in classrooms (Ghavifekr et al., 2014).

Feelings of fear and lack of skill in using ICT has been one of the limitations of teachers' ability to integrate ICT in classrooms (Lawson & Comber, 2006). Such feelings, in addition, create a barrier in understanding the possible benefits offered by ICT to improve the learning and teaching experience (Lawson & Comber, 2006). The teaching culture therefore requires a radical shift starting with feelings, attitudes and traditional practices to promote the adaptation of ICT in classrooms.

Lawson and Comber (2006) have indicated that the following dimensions could affect a teacher's readiness to implement ICT in a classroom: (1) teachers' attitudes prior to innovation; (2) the role of the IT coordinator; (3) the attitudes of senior management, and lastly; (4) the existence of appropriate support and training.

- Teachers' attitudes prior to innovation.

  A school's structure specific to timetables and curriculum focus can sometimes reduce a teacher's ability to test the assimilation of ICT in the classroom as teachers feel the pressure of needing to complete the syllabus in order to

prepare students for upcoming exams (Lawson & Comber, 2006). Subsequently, room for exploration becomes limited in such instances (Lawson & Comber, 2006). Another notable hindrance in the exploration of digital tools and resources is the traditional set-up of schools where access to the internet is only limited to teachers in areas where students are prohibited. For example: in the teachers' lounge (Lawson & Comber, 2006).

- The role of the IT coordinator

The presence of an IT coordinator to enable and support teachers in their transformative journey is not always a necessary condition. Support to drive usage and exploration can also come from any teacher who has a strong IT inclination. Lawson and Comber (2006) however, proved that the selected individual can determine the success of the integration of digital tools and resources to facilitate improved classroom learning. There are some challenges that the IT liaison may face. If a teacher within the school is used as the IT coordinator, they lack spare 'work' time and begin to use personal time to drive the digital learning agenda. Additional examples in the study by Lawson and Comber (2006) proved that when an IT coordinator is only designated to plan the ICT activities with teacher collaboration and support, there is more effectiveness in the role. IT coordinators can target specific teachers to pilot the integration of ICT in the lessons and plan future lessons (Lawson & Comber, 2006). They can also develop strategies for reluctant staff members who have an interest although they require technical support to execute (Lawson & Comber, 2006).

- The attitudes of senior management

  The sustainability and long-term future of ICT in schools is dependent on the support and commitment from senior management, which often is in the form of strategic plans of how to integrate ICT in classroom lessons, frequency of usage, and in which lessons it would prove to add most value. (Lawson & Comber, 2006). Senior management should also find the balance in investments that relate to administrative efficiencies and improvement in learning for students. An investment in administrative efficiencies include improving the e-mail facilities for teachers whilst an investment in improving the learning for students include the installation of projection boards in all classrooms and provision of internet access (Lawson & Comber, 2006).

- The existence of appropriate support and training

  Lawson and Comber (2006) recognised that in-school training for teachers is a challenge as senior management limits the time that teachers are afforded to attend training, and follow-up support post the training was not a focus. This results in a loss of interest from teachers as they no longer have the time to explore and test the learnings, and they do not have any support to make this learning transition easier.

These factors have to be considered in the skills-development plan for teachers in order to attain successful results for the initiative.

2.3.5 Initiatives to Promote Digital Learning for Teachers

Professional development through training programmes is one method which builds teacher competencies in facilitating learning with digital tools and resources, helping them to understand ICT and enabling them to effectively integrate ICT into their classroom, thus empowering better learning processes that keep learners engaged (Hutchison & Reinking, 2011).

A further recommendation in Gudmundsdottir's (2010) research is that to reach increased levels of digital equity, it is imperative to carefully orchestrate the digital learning programmes in schools, since merely implementing such programmes in classroom environments is no longer adequate. Teachers require more support in disadvantaged schools where they are limited by their socio-economic situations and have no access to digital resources and opportunities outside of the school environment, to practice and prepare lessons (Gudmundsdottir, 2010).

Some of the initiatives to promote digital learning in the education curriculum include the Khanya Project and the Meraka Institute (Telkom, 2015). The Khanya Project was aimed at using ICT to address the need in the Western Cape to deliver the educational curriculum in schools where the focus was on developing the digital learning skills of teachers. 16 000 teachers were upskilled on how to use digital tools and resources to deliver the approved curriculum, with 24 000 computers being provided to schools (Telkom, 2015). This initiative created awareness of the need of both teachers' and learner's development in digital learning, as merely providing the infrastructure and digital tools is inadequate to meet the need of promoting digital learning (Telkom, 2015).

The Council of Scientific and Industrial Research (CSIR) effected the Meraka Institute initiative where there is a fully supportive research body available to the South African educational sector to understand the educational needs and challenges, and how to achieve the educational sector's goals for digital learning competence amongst teachers and learners (Telkom, 2015).

Telkom has also extended their support in improving the educational system by creating "Telkom Business's Education Solution" which offers ICT services such as internet access, mobile tablet devices, etc., and education content services by using approved third-party providers, as well as a financial services component providing the ease of electronic purchases via the Telkom education portal (Telkom, 2015). The aim of this initiative is to "connect every learner and teacher to high-quality educational material and content by employing leading-edge information and communication technologies" (Telkom, 2015).

Additional initiatives proposed by the Department of Education (2003) include some of the following: all teachers will be given basic training on how to use digital tools and resources; incentives offered to schools which have a high ICT usage; teachers will have access to in-service training opportunities on how to integrate digital tools and resources into teaching and learning; ICT technical support will be available to schools; schools should have internet access; and digital tools and resources is incorporated in the education curriculum.

2.4 Theoretical Frameworks for Digital Learning

Globally, several frameworks have been formulated to measure rudimental digital literacy and digital learning competencies for successful integration of digital tools and resources within an education and learning context, however not all are relevant and contextual to South Africa due to our history and current challenges being unique in comparison to most countries. Some of the frameworks developed for this purpose include: The Essential Elements of Digital Literacy by Doug Belshaw; Digital Literacy Framework by British Columbia; and Framework for Information Literacy for Higher Education from ACRL (Walsh, 2017). Many of the teacher development frameworks are underpinned by theoretical frameworks that relate to the information society and/or diffusion of innovation.

Within the parameters of the information society theory, the terms refer to the post-industrial society where information has been seen to play a fundamental role. Nath (2017) mentions that there has not been any consensus agreement on what 'information society' means or what the defining characteristics are. As a result, five underlying characteristics have been developed and associated with the concept of information society. These characteristics include technological, economic, sociological, spatial and cultural. Each characteristic is explained in detail below.

- *Technological* – The unprecedented advances in information and communications innovations have revolutionised how we live our lives as things unimagined are now possible. Within the education spectrum, the technological characteristic has enabled distance learning through ICT. This has immensely benefitted developing countries. Example: India.

- *Economic* – There is no consensus on the definition of 'information economy', a term first used by Porat and Rubin (1977), described as the phase of the post-industrial economy that is increasingly based on information-related activities. However, there is vagueness associated with the 'information economy' term as information activities still lack a consensus definition.

- *Sociological* – This view highlights correlations between the growth of information and information occupations for social life, however, it's not reliant on any quantitative measure. For example, the rapid technology advancements shift how teachers deliver and share information, hence the learning competencies of a teacher have shifted from traditional approaches to more tech-savvy modes of information delivery.

- *Spatial* – Whilst there is no clear definition, the special characteristic refers to the removal of constraints that were previously imposed by time and space through the presence of information networks. When people are connected to the information network, the physical location of people is no longer seen as a constraint and more opportunities can be explored. For example, students can hold dialogues with other students globally to expand their understanding of certain topics through using the internet and video tools.

- *Cultural* – This characteristic is meticulously linked to the information environment in which we now live in, where the environment is more infiltratory, more intimate, and more constituent of our everyday lives. There are three elements related to this characteristic which include: (1) more information is shared socially as a result of technological developments and access to the

various channels such as social media, internet, etc.; (2) social interactions have become multidimensional and vocal, and written communications have been deficient in keeping up with these complexities; (3) excessive infiltration of information has also devised new problems where there is more and more information with less meaning. This impacts the education sector as opportunities to learn can come from shared social information and social groups through social networks. For example, teachers can share ideas and best practices in online focus groups.

Designed for the South African education landscape, considering the long-lasting effects of the apartheid system and the current array of challenges thereof, the most applicable and contextual frameworks to evaluate the digital learning for teachers are the following models developed by the DBE guided by UNESCO: Professional Development Framework for Digital Learning, Technological Pedagogical Content Knowledge (TPACK) Framework, and the SAMR Framework.

2.4.1 Professional Development Framework for Digital Learning

The Professional and Development Framework for Digital Learning (2017) in South Africa, indicates that successful implementation of digital learning in classrooms is dependent on the teacher's ability to effectively plan and facilitate digital learning. The core aim of the framework is to "define professional development for digital learning in an education system that seeks to improve access, quality, equity, redress and efficiency" (Department of Basic Education, 2017,p. 8).

The potential of digital instruments to augment classroom learning is also recognised with a conscious effort in the Department of Basic Education's (DBE) Action Plan

2019, for improving performance in key subjects through enabling better teaching practices using digital tools and resources (Department of Basic Education, 2017). Therefore, we can deduce that learning outcomes are affected by teaching practices.

The framework identified three key areas of digital learning as success criteria for teachers who are looking to achieve curriculum aims and objectives (Department of Basic Education, 2017). The three key areas consist of: professional growth and knowledge, curriculum focus, and leadership. Each area has key competencies and indicators that will be discussed in detail below (Department of Basic Education, 2017).

- Professional growth and knowledge

  This refers to a teacher's comfort, interest and willingness to enquire on and explore the possible uses and benefits of digital tools for their professional growth, with the core benefit of them being able to expand their understanding of how digital tools can promote better learning practices in classrooms (Department of Basic Education, 2017). All competencies, under this theme, are discussed in detail below with their measurement indicators.

  Competency 1: Adopt the habit of an enquiring mind regarding the educational value of using digital tools and resources (Department of Basic Education, 2017).

  Under this competency, some indicators include:

  - Teachers undertaking research on how they can use technologies to enhance the practice of teaching (Department of Basic Education, 2017).

- Teachers undertaking research on how digital tools and resources can improve learning methods and achieve learning outcomes (Department of Basic Education, 2017).

- Teachers having comfort and confidence in using digital tools and resources to identify opportunities for teaching and achieve learning objectives (Department of Basic Education, 2017).

- Appreciate the value that digital tools offer in the classroom environment that allows teachers to develop informed opinions that enable greater achievement of learning/lesson objectives (Department of Basic Education, 2017).

Competency 2: Be reflective about challenging current digital learning and teaching practice (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers reflecting on the use of digital tools and resources in their classrooms and the value, quality, and effectiveness of these in facilitating enhanced learning (Department of Basic Education, 2017).

- Teachers should be able to identify areas that require improvement and implement digital solutions where applicable (Department of Basic Education, 2017).

Competency 3: Understand the role of the teacher, the learner, and the digital resources during digital learning (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should be able to identify different teaching strategies required based on different circumstances, and when and how to use digital tools and resources to implement the strategy (Department of Basic Education, 2017).
- Learning objectives must be decided on before the digital media and resources are selected, to facilitate the learning process (Department of Basic Education, 2017).
- Gaining an understanding and awareness of when digital tools and resources should be avoided in the learning process (Department of Basic Education, 2017).

Competency 4: Participate in local and global professional learning communities (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should participate in workshops and conferences for skills development (Department of Basic Education, 2017)
- Share best practices with their network of teachers in their communities (Department of Basic Education, 2017).

Competency 5: Select appropriate digital tools and resources when fulfilling the roles of the teacher (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Produce written documents, process numerical data; design and deliver PowerPoint presentations using multimedia; create, publish and share content; design graphics and interactive learning activities (Department of Basic Education, 2017).

- Curriculum focus

This curriculum focus aspect looks at the teacher's ability to use digital tools and resources appropriately in trying to reach curriculum objectives (Department of Basic Education, 2017). All competencies under this theme are discussed below with their indicators.

Competency 6: Integrate digital tools and resources to enhance learning objectives in various learning environments (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should plan how to integrate digital content resources in their lessons prior to delivery (Department of Basic Education, 2017).
- Learners should have the opportunity to actively participate, therefore teachers should plan learner-centred access to digital resources where possible and appropriate (Department of Basic Education, 2017).
- The digital levels and needs of learners should be identified and catered for through providing equitable access to suitable digital resources (Department of Basic Education, 2017).
- Engage learners to participate more through knowledge sharing exercises which explore the use of digital resources (Department of Basic Education, 2017).

Competency 7: Develop learners' global awareness and understanding using digital communication and collaboration tools (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Addressing current challenges aligned to the curriculum through digital learning (Department of Basic Education, 2017).
- Teachers need to design learning objectives that incorporate engagement between learners and a local or global community using digital resources (Department of Basic Education, 2017).

Competency 8: Transform learning through the innovative use of digital tools and resources (Department of Basic Education, 2017)

Under this competency, some indicators include:

- Teachers must constantly be on the lookout for new ways of using digital resources to enhance learning (Department of Basic Education, 2017).
- Teachers must adopt and promote new learnings that were impossible before the introduction of digital instruments (Department of Basic Education, 2017).
- Teachers must aim to understand the influence of digital instruments on the nature of learning (Department of Basic Education, 2017).

Competency 9: Enhance class management, assessment and feedback processes through the use of digital resources (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers must use digital resources to improve productivity, where tests and exams are created and administered using digital resources (Department of Basic Education, 2017).

- Communication between teachers and learners can also be improved through the use of digital channels (Department of Basic Education, 2017).
- Digital instruments can be used to design diagnostic assessment tools which improve teacher productivity (Department of Basic Education, 2017).
- Teachers should also systematise and monitor learning activities by using online resources such as blogs or learning management systems (Department of Basic Education, 2017).

Competency 10: Integrate learners' skills development in terms of digital literacies with curriculum-based learning (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should ensure that learning objectives also include the development of learners' information skills (Department of Basic Education, 2017).
- Teachers should ensure that learning objectives also include the development of learners' digital literacy skills and media literacy skills (Department of Basic Education, 2017).

- Teachers should endorse, encourage and model the safe, protected, legal and moral use of digital information resources (Department of Basic Education, 2017).

- Leadership

Through their leadership, teachers are responsible for the digital learning vision and strategy, and the successful execution thereof. All competencies under this theme are discussed below with their indicators.

Competency 11: Demonstrate commitment to the vision for digital learning in the province, district and school (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should be able to adopt and integrate key ideas from this framework (Department of Basic Education, 2017).

- Teachers should be able to abide by the province's guidelines for planning, specific to digital learning. This refers to the implementation of the school's strategic plan for the digital learning integration (Department of Basic Education, 2017).

Competency 12: Accept responsibility for planning and implementing digital learning at the school (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should contribute to the school's digital learning planning process (Department of Basic Education, 2017).
- Teachers should be a catalyst for change, promoting the use of digital resources (Department of Basic Education, 2017).

Competency 13: Initiate peer support and collaborative, work-place learning (Department of Basic Education, 2017).

Under this competency, some indicators include:

- Teachers should engage with other teachers on the use of digital instruments in classrooms, and how to maximise the potential thereof while addressing challenges at the same time (Department of Basic Education, 2017).
- Share best practices with peers and support them while they explore new practices to facilitate or enable enhanced learning with digital tools (Department of Basic Education, 2017).

Whilst the framework is comprehensive in indicating the digital learning competency requirements that teachers need to develop, it lacks a scale that can assess the strengths and weaknesses of individual teachers, specific to their digital literacy levels.

The developmental needs, and subsequent support of teachers, may vary based on manipulative and non-manipulative factors.

2.4.2 Technological Pedagogical Content Knowledge (TPACK) Framework

The TPACK Framework is a knowledge framework that can be embedded into curriculums to promote the integration of digital tools and resources. This is a model used within the South African Education sector, under the Professional Development Framework for Digital Learning 2019. Under this framework, three areas of professional development knowledge areas were identified to achieve the goal of improved learner attainment (Department of Basic Education, 2017). The three areas include: technological knowledge, pedagogical knowledge, and content knowledge. The Technological Pedagogical Content Knowledge (TPACK) Framework was designed to provide a model that stipulates a deeper understanding of the kinds of knowledge teachers require for effective pedagogical practice in a digitally-enhanced learning environment (Department of Basic Education, 2017).

In 2006, researchers from Michigan State University, Punya Mishra and Matthew J. Koehler, designed one of the leading theories in educational technology: the TPACK Framework (Mishra & Koehler, 2006). This framework provides a useful approach to the challenges experienced by teachers while using digital tools and resources to improve learning practices (Kurt, 2018). It also recognises that the education sector should not only focus on the technology alone, as understanding the uses of technology prove to be more valuable (Mishra & Koehler, 2006). Through identifying these areas, the differences were recognised in formulating an approach where order is seen as an important factor. The digital instruments being employed must

communicate the content and support the pedagogy in order to improve learner attainment (Kurt, 2018). The framework articulates how content, combined with pedagogy, should form the foundation for any adoption and implementation of digital instruments for the facilitation of learning (Kurt, 2018). The flexibility and adaptability of the framework has sustained its relevance, as the framework is built to allow researchers and practitioners to use its generic foundation in order to adapt the model under differing circumstances (Kurt, 2018). There is no single monolithic combination of content, pedagogy and technology that's applicable to all settings (Kurt, 2018).

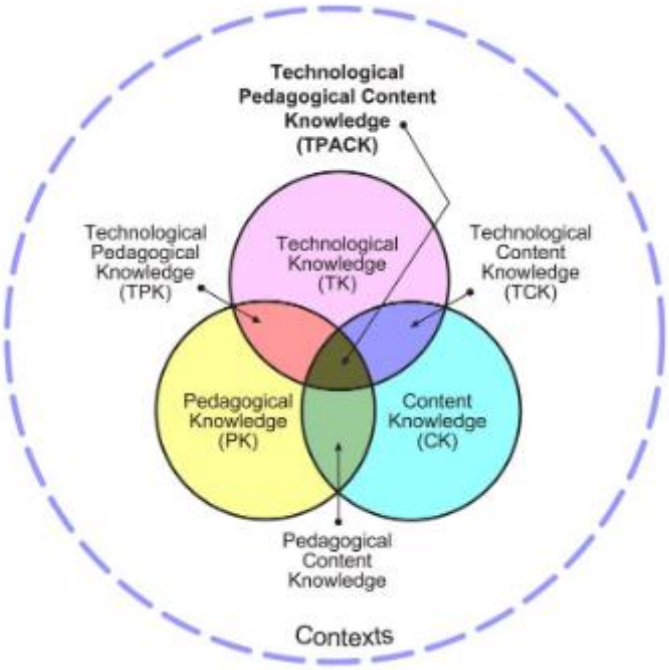

Figure 1: TPACK Relationships (Kurt, 2018)

These components can be viewed in pairs other than in isolation. The relationships include:

- Pedagogical Content Knowledge (PCK)

- Technological Content Knowledge (TCK)
- Technological Pedagogical Knowledge (TPK)

With all three relationships combined, the technological pedagogical content knowledge (TPCK) Framework was formed (Kurt, 2018). Each element in the framework is described below:

- **Content Knowledge (CK)** refers to the teacher's own knowledge of the subject matter (Mishra & Koehler, 2006). The content knowledge differs across the various disciplines and student academic levels (Kurt, 2018). The knowledge includes concepts, theories, evidence, and organisational frameworks that are available for subject matters (Kurt, 2018). The content knowledge may also include best practices and established approaches in how teachers could communicate this knowledge to students (Kurt, 2018).
- **Pedagogical Knowledge (PK)** refers to the teacher's knowledge of the practices, procedures, and modes regarding teaching and learning (Mishra & Koehler, 2006). It consists of the teacher's knowledge of the purpose, values, and aims of the education system (Mishra & Koehler, 2006). The teacher may also understand how receptive the student is, and what methods to employ to encourage learner receptiveness. They may have an understanding of classroom management skills, lesson preparation, and assessments criteria and measurements (Kurt, 2018).
- **Technological Information (TK)** refers to the teacher's mindfulness of the various education technologies and their ability to use it in a classroom

context for enhanced teaching and learning practices (Kurt, 2018). The teacher's knowledge can vary from basic teaching resources, such as hard-covered books and blackboards, to more advanced technologies such as the internet, Google search and YouTube (Mishra and Koehler, 2006). TK also refers to the teacher's ability to recognise when education technology can assist or impede learning (Kurt, 2018). In addition, a teacher should incessantly learn and acclimatise to novel technologies and to improve their potential for facilitating, teaching, and learning in classrooms (Kurt, 2018).

- **Pedagogical Content Knowledge (PCK**) refers to the teacher's familiarity with the foundational areas of teaching and learning which includes: curriculum development, student assessments, and reporting results (Kurt, 2018). PCK is also a teacher's ability to interpret the topic or lesson, and find different or new ways to represent it and make it accessible to learners (Mishra & Koehler, 2006). The focus of PCK is to promote learning and create a trail of links among pedagogy practices and their application to teaching practices (Kurt, 2018). The PCK differs across the various disciplines and student academic levels as well (Kurt, 2018).

- **Technological Content Knowledge (TCK)** refers to the teacher's consciousness of the forces between technology and context, when can it be used to influence learning, and when can it be pushed against each other (Kurt, 2018). TCK encompasses making meaningful correlations on when and how to use education technology to enhance learning; knowing

how to communicate content under specific subject matters to use with best-suited technologies (Kurt, 2018).

- **Technological Pedagogical Knowledge (TPK)** refers to the teacher's considerations of how technologies can influence or deter both learning and teaching experiences through using pedagogical affordances and constraints (Kurt, 2018).

To effectively create a basis for teaching using educational technology, the three underlying areas of content, pedagogy and technology need to be combined (Kurt, 2018). The TPACK Framework can be immersed into teaching practices, if teachers are willing and open to the following areas of focus:

- Teachers can leverage on existing technology to expand on concepts being taught from the curriculum (Kurt, 2018).

- Technology can be used for pedagogical techniques, where content can be communicated in non-traditional ways (Kurt, 2018).

- Students' needs can be addressed as education technology can help teachers to communicate different content concepts that require different skill levels from students (Kurt, 2018).

- Teachers can address the socio-economic disparity of students by teaching lessons on how to use education technology to bridge the divide (Kurt, 2018).

- Teachers can use education technology to broaden students' existing knowledge on topics (Kurt, 2018).

The TPACK Framework is therefore seen as an enormously productive approach for teachers to use education technology (Kurt, 2018). Their framework provides a comprehensive elucidation on the different types of knowledge that teachers require and how teachers could use this knowledge to facilitate better classroom learning (Kurt, 2018).

The key attribute of the TPACK Framework, that is highly relevant to this study, is its ability to serve as a measurement of instructor knowledge which has a direct impact on both training and development offerings by educational institutions and other service providers, for teachers at all levels of experience (Kurt, 2018).

2.4.3 SAMR Model

Dr Ruben Puentedura formulated the SMR Model that classifies four different grades of technology integration in the classroom (H.L., 2017). The acronym is representative of the following classifications: substitution, augmentation, modification and redefinition (H.L., 2017). The purpose of the SAMR framework was to share a common language across disciplines as teachers strive to communicate with students on building complex concepts (H.L., 2017). The SAMR model is seen as more of a spectrum because on one end, technology is used as a one-to-one replacement for traditional learning tools, and on the other end, using technology enables teaching and learning experiences that were never possible before (H.L., 2017). One of the key attributes of the model is that it's important to understand that merely substituting technology into obsolete tasks does not improve the teaching and learning experiences (H.L., 2017). There needs to be purposeful integration and implementation of technologies to improve learning.

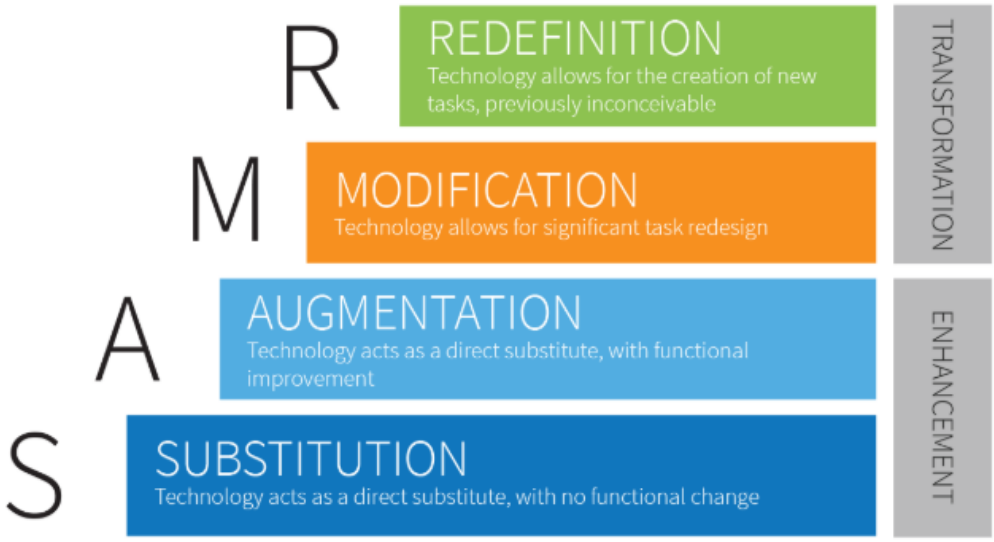

Figure 2: SAMR Model (H.L., Schoology, 2017)

The classifications under the SAMR model are explained in detail below:

- Substitution

  Within the constraints of the substitution classification, there is a direct replacement of a traditional tool that facilitates teaching and learning experiences with technologies (H.L., 2017). This could refer to a simple substitution like using e-books instead of hard-covered textbooks. There is no functional change when replacing a tradition tool with an advanced tool.

- Augmentation

  Under the augmentation classification, substitution occurs as explained under the previous point, however there is a conscious effort to improve the student's experiences (H.L., 2017). An augmentation approach would be to have experts

in the field of entrepreneurship. Example: CEOs video calling the class for a live conversation on how strategy drives business models.

- Modification

  Transformation takes place under the modification classification (H.L., 2017). There is a complete change in how the lesson is usually delivered (H.L., 2017).

- Redefinition

  The redefinition phase represents the pinnacle of how technology can transform a student's experience (H.L., 2017). Students can participate in debates for specific topics with other students across the globe by utilising technology tools and resources as a means network (H.L., 2017).

2.5 Hypothesis Development

We consider the following hypotheses, based on existing literature, regarding the need for educators to have the relevant training and development specific to digital learning competencies, to successfully integrate digital tools and resources for improved classroom learning.

2.5.1 Hypothesis

Herewith is the list of the hypothesis (HP) that this study aims to support or contradict by assessing its plausibility:

HP1: *The Professional Development Framework for Digital Learning is effective in developing digital learning competencies in teachers.*

HP2: *The Professional Development Framework for Digital Learning has the potential to digitally transform the teaching-learning process if integrated strategically through the curriculum.*

HP3: *Teachers' feelings of fear and lack of skill are no longer one of the main limitations in integrating digital tools and resources in lesson planning.*

2.6 Conclusion of Literature Review

Kajee and Balfour (2011), recommended that it would not be advisable to replicate the digital literacy and learning project models from First World countries when trying to introduce technology and its uses in a developing country. There is a potential risk of using overly complex technology when the need is basic and not providing adequate relevant training for teachers and other key participants to drive technology usage to improve digital learning (Kajee & Balfour, 2011). Therefore, it's imperative to understand the South African landscape in order to ensure that any solution implemented is in fact relevant to the needs of teachers and skills gaps in the country.

The manipulative and non-manipulative characters have an impact on teachers' ability to succeed in integrating digital tools and resources in the classroom (Basargekar & Singhavi, 2017).

To conclude the literature review section of the proposed research, it's worth noting that understanding the competencies developed through education programmes by universities and in-service training and development initiatives for teachers, is beneficial to students, employers and the national authorities in various sectors as the required recourse to uplift the education system in South Africa can be developed to address the requirement according to the need.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Introduction of Research Methodology

The purpose of the research methodology chapter is to explain in detail the research methods and the procedure executed for this study.

In this chapter, the proposed methodology used to conduct research will be discussed. The research methodology chapter includes the following sections: 3.2) Research Approach and Design; 3.3) Data Collection Methods; 3.4) Research Setting; 3.5) Population and Sampling Frame; 3.6) The Research Instruments; 3.7) Procedure of Data Collection; 3.8) Data Analysis and Interpretation; 3.9) Limitations of the Study and 3.10) Validity and Reliability. The chapter is then concluded by addressing the demographic profile of respondents and ethical considerations of the proposed research topic.

3.2 Research Approach and Design

In commerce, the common research methods include qualitative, quantitative paradigms, and mixed methods.

A quantitative research design has been carefully chosen for this study due to some of its favourable characteristics which include: the results are based on weightier sample sizes so that it is - or can be - representative of the population; structured research

instruments are used to gather data; and lastly, the data can be used to generalise ideas, theories and conceptions more broadly, forecast future results, or explore causal relationships where possible (University of Southern California Libraries, 2019). The University of Southern California Libraries (2019), defines quantitative methods as: “quantitative methods emphasize objective measurements and statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques”.

By selecting a single approach, the results can be generalised, or inferences can be drawn from the results to a larger group. This method, in addition, enables the researcher to answer the pre-defined research questions.

The rationale of the research design is to enlarge the context and relevance of the answers to be collected through the research questions whilst maintaining a relatively low cost to collect the required information. Research design is the plan of how to collect data to answer the research questions, as well as indicate the method and approach that will be used to obtain data and the process undertaken to analyse the data.

This research comprises of primary data only. Primary data is information that has been accumulated directly from its source (Walliman, 2011). Primary data will be more reliable for the research objectives under this study (Walliman, 2011).

3.3 Data Collection Methods

Data will be collected through a single approach: a survey. This is a quantitative research design that is non-experimental and uses survey research through studying a sample of a population to provide quantitative descriptions of respondents' opinions as well as trends (Creswell, 2014).

A quantitative approach is suitable for this research, as its main aim would be to find the correlation between variables of interest that affect a teacher's capability to develop digital learning competencies in candidate teachers. Some of the variables include the content and delivery of the university's curriculum, the teacher's readiness and comfort stemming from manipulative and non-manipulative factors as discussed in the literature review and lastly, the teacher's sustainability to explore the benefits post training based on factors such as technical support, available time, etc.

The survey approach to collect data provides several benefits which include: it's cost-effective; the format of the questions will be multiple choice, and depending on the scale and reach of the questionnaire, results can be obtained quickly; data collected is quantifiable hence increasing the scope to compare and contrast information; and respondents remain anonymous (Debois, 2019). The most significant benefit of conducting a quantitative study is that it's seen as more objective and reliable due to it being based on mathematical calculations (Jovancic, 2019).

Some disadvantages include unanswered questions, differences in understanding and interpreting the questions will influence the answers provided, as well as questionnaire fatigue which occurs when a long questionnaire is administered or when the questions are not relatable to the respondent (Debois, 2019).

The most significant disadvantage to be conscious of in the proposed research is that social desirability is a great risk in the survey results (Maree, 2007). Some of the questions contained in the questionnaire may be of a personal nature which may leave some respondents feeling embarrassed about their social standing and consequently, they may feel obliged not to answer the questions honestly in order to feel socially included (Chung & Monroe, 2003).

3.4 Research Setting

This research is conducted within South Africa, across all nine provinces. South Africa is a developing country with high levels of digital illiteracy as expressed through the literature review. For this study, it's key to recognise that South Africa as an emerging country has physiognomies of both a developed and developing nation (Schoeman, 2000). Prior research on this subject has primarily been conducted to understand the reasons for the digital divide in South Africa, therefore this proposed research examines whether teachers have developed digital learning competencies through tertiary curriculums and in-service training and support.

3.5 Population and Sampling Frame

According to Walliman (2011), the term population refers to the "total quantity of things (or cases) of the type which are the subject" of the specific study undertaken. Therefore, a population can comprise of people, events and types of objects (Walliman, 2011). Within the population, there are only a few specific things that are relevant to a specific research topic, and that is referred to as the sampling frame (Walliman, 2011).

For this study, the population is identified as the in-service and pre-service teacher base in South African public schools and universities respectively.

Sample and Sampling Method

Sampling is a technique used to collect data from a small group of cases out of a large group, where the researcher can draw conclusions from those answers which can be related to the whole group (Walliman, 2011). This technique will be employed to source primary data.

3.5.1. Sampling Size and Method

The sampling techniques that was applied for the proposed research is the probability sampling method which begins with a complete sampling frame of all eligible individuals from which the researcher selects the sample (Barratt, 2009 & Shantikumar, 2018). For this study it's imperative for the researcher to be able to identify a representative sample from which to collect data for generalisability of results, therefore the probability sampling method was the most appropriate (Saylor Academy, n.d.). Generalising through this technique is easier (Barratt, 2009 & Shantikumar, 2018). Through probability sampling, all rudiments in the researched target population had a fair and equal chance of being elected to participate in the study which meets the criteria for random selection (Saylor Academy, n.d.). The random selection technique allows the researcher to estimate the sampling error by estimating how closely the sample represents the larger population (Saylor Academy, n.d.). The difference between the results obtained from the sample and the actual parameters of the population is the sampling error (Saylor Academy, n.d.).

The clustered sampling method under probability sampling is where subgroups of the population are selected as the sampling unit rather than individuals (Barratt, 2009 & Shantikumar, 2018). The subgroups are seen as clusters and the population is divided into subgroups. This method can be split into two stages: 1) In single-stage cluster sampling, the researcher includes all members of the chosen cluster in the study (Barratt, 2009 & Shantikumar, 2018) and; 2) In two-stage cluster sampling, individuals are randomly selected from each cluster for inclusion (Barratt, 2009 & Shantikumar, 2018).

The survey link was therefore randomly distributed to pre-service and in-service teachers in South Africa using a spectrum of communication channels that enable messaging and social media interactions such as Facebook, WhatsApp and Email. For pre-service teachers, the study was not limited to any specific South African University and not specific to the student's year of study, as many factors can influence a teacher's competency levels. For in-service teachers, only public-school teachers were included as the funding models for both public and private schools differ, leaving public schools less advantaged. Teachers of all specialisation phases were also included. Appendix C provides a view of the list universities that the pre-service teachers that participated in this study are registered with for the Bachelor of Education qualification.

There is a potential disadvantage associated with this study, which related to an increased risk of bias (Barratt, 2009 & Shantikumar, 2018). There could be an increased sampling error if the clusters selected are not a complete representation of the population (Barratt, 2009 & Shantikumar, 2018).

The underlying benefit of using this technique was that the researcher could obtain information from teachers without knowledge of the influencing factors that may have impacted a teacher's development of the digital learning competencies.

The time frame for participation in the survey was limited to a 30-day period. Thereafter the survey was inaccessible.

3.5.2. Sampling Size

Using the largest sample possible will always provide more precise results as it's more likely to represent the population accurately. The final sample size for this study was 209, however only 129 respondents completed 95% or more of the survey. The incomplete responses were discarded when presenting and analysing the results. The lack of completed surveys by some respondents could be due to the length of the survey or the distribution method. The volume of respondents was enough to conduct statistical analysis.

3.5.3. Sampling Criteria

The sample criteria consisted of:

- The participant must be a practising teacher or pre-service teacher.
- If the participant is a pre-service teacher, he/she must be registered for a Bachelor of Education degree.

3.6 The Research Instruments

An electronic survey was used as the research instrument due to its favourable characteristic which is to provide higher response rates from a target audience (SmartSurvey, n.d.). Additional benefits of this instrument are that it is a cheaper mechanism to collect data and it provides the researcher with real-time results for quick and easy analysis (SmartSurvey, n.d.). The survey link was distributed via messaging channels and social media channels to enable to an increased volume of participation.

The design of the survey was inspired by the Professional Development Framework for Digital Learning (2017) as the questions are specific to the curriculum focus described in the framework. The format and structure of the survey was primarily designed to study five competency levels. The survey consists of 24 questions with six sections. The first section obtains participants' agreement to participate as well as information related to the respondent's profile, such as specialisation phase, etc. The next five sections aim to answer the research questions. The questions are specific to the teacher's curriculum focus which looks at a teacher's ability to use digital tools and resources appropriately in trying to reach the curriculum objectives (Department of Basic Education, 2017). There are five competencies specific to the curriculum focus as developed by the Department of Basic Education (2017) with 19 indicators split amongst them.

A 7-point Likert scale was selected as a measurement tool to answer the survey. Respondents had the option to choose from a range of: strongly agree, agree, somewhat agree, neither agrees or disagrees, somewhat disagrees, disagrees, and strongly disagrees. A Likert scale allows respondents to rank their judgement of

articles, incidents, or other people, from a range of low to high or from poor to good (Formplus, 2020). The Likert scale is a continuum from highest to lowest points and has intermediate points in between these two extremities (Formplus, 2020).

The respondent was presented with statements that they were asked to evaluate by giving these a quantifiable value on any kind of impartial measurement, with a level of agreement and/or disagreement being the dimension most commonly used (Formplus, 2020).

The advantages of using a 7-point Likert scale is that it's the most precise of the Likert scales. It's easy to use, provides a superior reflection of the respondent's true evaluation and is recognised as the most suitable solution for surveys such as those in usability evaluations (Formplus, 2020). A disadvantage of using this Likert scale is that respondents' answers are influenced by previous questions (Formplus, 2020).

The survey questions were administered in English, since it is the official business language and it's widely spoken in South Africa. In addition, it will allow other researchers and/or scholars to review the results of the proposed study and conduct further research in this field.

3.7 Procedure for Data Collection

The author of the proposed research facilitated the coordination of administering the online surveys to pre-service and in-service teachers through random distribution. The Qualtrics System was used to design and collate survey results for analysis. The research design also consisted of survey questions that were closed ended, where respondents were given a list of pre-arranged questions and pre-defined responses to

select from (West, 2019). The use of closed-ended questions in the survey enable the easy analysis of the data (West, 2019). This survey method was selected as the researcher believes that it will provide the necessary answers that pertain to the research question. Some of the advantages of this method to the proposed research is that a wider range of responses would be collected, and respondents would not feel influenced in any way.

The survey questions were carefully crafted by the author to mitigate the questions from making respondents feel socially excluded and judged. Respondents were encouraged to respond honestly with no judgement experienced.

The survey included a confidentiality clause, declaring that all information documented will not be distributed or shared with public parties without the respondent's consent. Wits Business School and the researcher's supervisor has confirmed reliability and validation of the questionnaire through their endorsement.

Lastly, once the survey period lapsed, the researcher extracted the data for analysis.

3.8 Data Analysis and Interpretation

In this section of the research, the researcher indicates how the data synthesised was scrutinised to fulfil the purpose of the intended study. The data analysis was conducted by using the Qualtrics platform, as it allowed for easy collection and examination of data. The data is presented in tables and graphs to facilitate demonstration and discussion of the results. The following data analysis techniques were executed allowing the researcher to analyse and interpret the data collected through the mentioned data collection method:

- Descriptive Technique which relies on observation to collect data, whereby the researcher can observe and examine situations to establish what can be predicted under the same or similar circumstances (Walliman, 2011). Walliman (2011) noted that when using the descriptive technique, the scale of the research can be influenced by two variables which include the level of complexity in the survey questions, and the scope and extent of the survey.
- Correlation Technique which allows the researcher to examine if there is a relationship between two concepts, where one concept influences another concept (Walliman, 2011). A causal relationship defined by Walliman (2011) is a relationship where one concept causes change in another. The results of the correlation relationship will either be positive, negative or none.
- Comparative Technique allows the researcher to compare past and present or different parallel situations according to Walliman (2011). It allows the researcher to look at information and situations across different scales. The researcher can look at macro, international and national situations or micro; community and individual situations (Walliman, 2011). Certain events can be understood with this technique by exploring and testing what conditions were necessary for the event to happen (Walliman, 2011).

3.9 Limitations of the Study

Respondents participated on a voluntary basis with no incentives being offered for their participation. A limitation of this sample size is that it is too small to analyse the manipulative and non-manipulative factors that have in some way influenced each respondent, however, the sample size was adequate to conduct the data analysis as

described in the previous sections. A bigger sample could have potentially increased the reliability of the research.

An additional limitation to note is that it is possible that the disadvantaged teacher base may have not been reachable through the data collection procedure, either due to lack of internet access, data limitations, network challenges, and access to messaging and social media channels.

3.10 Validity and Reliability

In this section, the reliability and validity of the study is examined. Reliability defined by Heale and Twycross (2015) relates to the consistency of a measure. There are various methods that the researcher employed to ensure that the data collection and analysis is reliable, of which one to mention is the confidentiality cause mentioned under sub-heading 3.7. The different practices, specific to the proposed research, are discussed below.

Candidate teachers and practising teachers are located across the country and survey responses are indicative of the national teacher base. The researcher is also unaware of the amount of investment and initiatives taken by the government to develop and support all teachers across the country in specific schools, with developing digital learning competencies.

The validity of the study is also explained below. Heale and Twycross (2015) defines validity as *"*the extent to which a concept is accurately measured in a quantitative study".

It can be confirmed that the research does meet the content validity criteria as the research instrument fully represents the competencies and indicators stipulated in the Department of Basic Education's Professional Development Framework for Digital Learning.

External Validity

External validity has been capitalised in terms of the generalisability of the results (Maree, 2007) by ensuring that the research sample is representative of all teachers in South Africa. The respondents were randomly selected in all environments.

The procedures used to administer the survey was pre-tested (West, 2019). According to West (2019), pre-testing involves identifying any problems with how the question is asked, establishing if they are clearly understood by people whom are similar to those expected to participate in the study and lastly, to establish if the response options for the closed-ended questions are adequate to achieve the purpose and objective of the study.

To ensure enhanced validity of the survey questions, it was piloted to a focus group consisting of three teachers, where the various questions were reviewed. Clarification and terminology were improved where there was an apparent lack of understanding.

Internal Validity

A potential threat in terms of internal validity is that the researcher will not be aware of any differences in (demographic, class, gender, race, language) of the respondents.

The research does not indicate the measurements of living standards of the respondents.

The survey instrument has been reviewed by the approved supervisor to mitigate any additional internal threats.

Objectivity

To confirm reliability in the analysis of the data collected, any survey that is not more than 95% completed is excluded from the data analysis. This will ensure that the respondent's representation is an equal contribution to make final conclusions on the data.

3.11 Demographic Profile of Respondents

There are questions in the survey that pertained to the age of the respondents, however, these have been excluded from the presentation and discussion of results.

3.12 Ethical Considerations

To ensure that the research is ethical:

- A disclosure was attached to the survey that provides the respondent with information about the research as well as the intention and purpose of the proposed research. It also stated that participation is on a voluntary basis.

- Informed consent had been obtained from respondents confirming their willingness to participate in the survey after being provided with details of the research. This can be seen in appendix B.

- For the protection of respondents, the proposed research topic and methods of obtaining data was scrutinised by the Wits Business School Ethics Committee and approved as the approach was seen as ethical with no harm being imposed on respondents.

- For the confidentiality of respondent's personal information, names of the respondents and other key identifiers was not requested on the survey. Respondents will remain anonymous. All other information provided by respondents has been secured in an encrypted file.

CHAPTER 4. PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

The complete results of the study are presented in this chapter. This chapter discusses the data collected from 129 respondents who've completed the electronic survey. The analysis of the results was conducted by using the Qualtrics tool. It aims to, through a detailed discussion, evaluate the digital learning competencies of teachers and their confidence in integrating them into the curriculum based on the results. All respondents who have completed the 95% and more of the survey, have been included in the presentation and discussion of the data. This chapter proceeds with descriptive statistics on the profile of the respondents and the implications of those on the results. Then, the researcher provides the results specific to the hypothesis which looks at respondents' readiness from a skills perspective to integrate digital tools and resources through development and delivery of the curriculum. This section follows with an enlightenment that's contextual to the literature review.

4.2 Sample Description

A descriptive analysis of the sample is conferred in this section. The profile variables to be discussed under this section include: 1) Pre-Service Teachers vs. In-Service Teachers and 2) Specialisation Phase.

4.2.1. Pre-Service Teachers vs. In-Service Teachers

Figure 3 below reflects the percentage of respondents that fall within the categories of pre-service and in-service teachers. Both in-service and pre-service teachers were included in the study to assess the effectiveness of both the universities' curriculums in developing digital skills in candidate teachers, as well as the government's efforts to train and develop in-service teachers. From a total of 129 respondents, 54% (70 respondents) were pre-service teachers and 46% (59 respondents) were in-service teachers.

The DBE's Professional Development Framework for Digital Learning considers the need to improve the quality of teacher education and development which is based on the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011-2025 (ISPFTED). Hence, this framework was designed to develop digital learning competencies in both in-service and pre-service teachers simultaneously, however through different initiatives. Based on the responses received, both categories are fairly represented in this study.

It's also important to note an important element captured through the study conducted by Basargekar and Singhavi (2017) which states that individuals who have had exposure to technology through their lives and access to learning about and using software applications, are seen to be proficient in digital literacy and therefore a similar positive relationship exists for teachers who've had the same or similar exposure to computer self-efficacy. On this premise, the year of study of the students and the number of years that in-service teachers have under their belt, may be insignificant in understanding their competency levels as it is influenced by factors other than their development through tertiary education or in-service training.

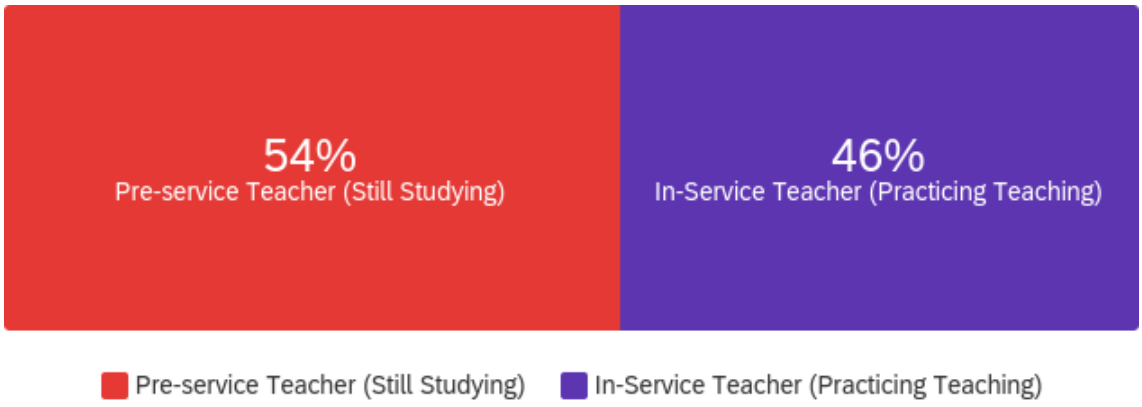

Figure 3: Percentage of respondents that fall within the categories of pre-service and in-service teachers.

4.2.2. Specialisation Phase

Teachers in South Africa have the option to formally specialise in one of four phases. The phases with their descriptions are provided below.

- Foundation Phase: consists of students in Grades R–3
- Intermediate Phase: consists of students in Grades 4-6
- Senior Phase: consists of students in Grades 7-9
- Further Education and Training (FET) Phase: consists of students in Grades 10–12

Figure 4 depicts the distribution of the specialisation phases of respondents as follows: there were 11.72% of respondents with the Foundation Phase; 24.22% were in the

Intermediate Phase; 14.06% were in the Senior Phase; and most respondents were in the FET Phase, with a percentage 50%.

The literature review does not identify any specific focus to develop digital learning competencies in pre-service and in-service teachers that specialise in any specific phase. Hence, the Professional Development Framework for Digital Learning aims to develop competencies in teachers across all phases.

These statistics, however, indicate the phases that are impacted most, positively or negatively, by the ability of teachers to integrate technology-supported materials in the teaching-learning process. Based on the respondents' profiles, the majority of respondents were in the FET phase, hence the results and conclusions of the study provide the most accurate representation for teachers within the FET phase.

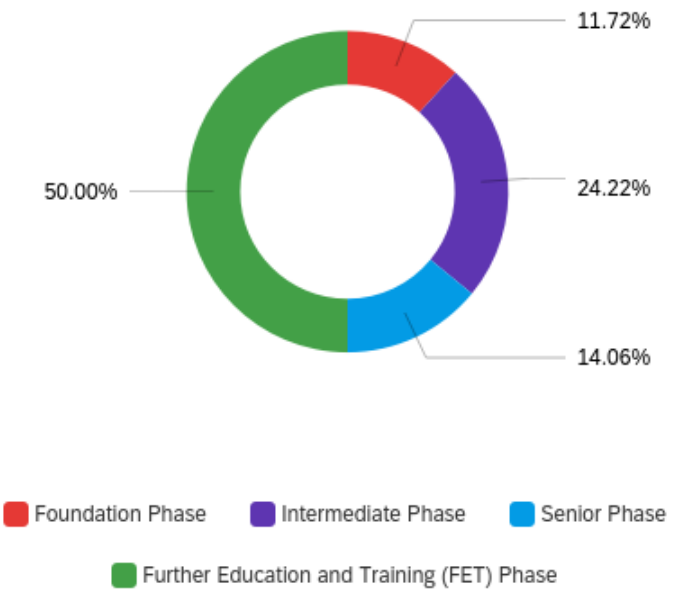

Figure 4: Distribution of the specialisation phases of respondents

4.3. Evaluation of teachers' digital learning competencies to integrate technology-supported materials in the teaching-learning process

In this section, the researcher illustrates and discusses the results from the survey questions with the 7-point Likert scales across the variables. The results are presented and discussed according to the literature review and hypotheses statements.

Previous research indicated that South Africa has not fully implemented the use of technology at large in classrooms to supplement all learning (Frost & Sullivan, 2017). Some of the most notable challenges experienced by the South African government to enable such integration includes lack of funding for technology and supporting infrastructures in schools, and the reluctance of teachers to incorporate digital learning solutions due to their unfamiliarity with the technology (Frost & Sullivan, 2017).

A key element to this research, which is captured through a previous study, is that one of the main limitations to successfully integrating ICT in classroom learning are teachers themselves, and this is due to their attitudes and knowledge related to computers which mostly stems from fear and feelings of skill deficiencies (Lawson & Comber, 2006). Teachers also fail to understand and recognise the value and benefit of such integration to the students' learning experience (Lawson & Comber, 2006).

The hypothesis (HP) statements are presented to serve as a reminder of what this study aims to investigate:

> ***HP1:*** *The Professional Development Framework for Digital Learning is effective in developing digital learning competencies in teachers.*
>
> ***HP2:*** *The Professional Development Framework for Digital Learning has the potential to digitally transform the teaching-learning process if integrated strategically through the curriculum.*
>
> ***HP3:*** *Teachers' feelings of fear and lack of skill are no longer one of the main limitations in integrating digital tools and resources in lesson planning.*

It has been noted through research that digital learning in education curriculums has been recognised to help the teaching and learning process. Some benefits include the promotion of inclusive education whilst ensuring that there's a better quality of learning material available to students, quality of learning methods is improved, teachers' productivity is improved, and lastly it's seen for its potential to bridge the digital divide between various socio-economic strata (Basargekar & Singhavi, 2017)

It has been established that curriculum development and delivery in the digital age creates a wide array of challenges for education and training systems globally. Some of the challenges include: participation in the information society; impact of ICTs on access, cost effectiveness and quality of education; and integration of digital tools and resources into the learning and teaching process. These challenges are important to note while analysing and discussing the results.

By looking at teachers' digital learning competencies specific to the curriculum focus, there were only five competencies that could be included in this study with 19 indicators split amongst them. Each digital learning competency and the related results will be presented below. The respondents provided feedback to the indicators applicable to the digital learning competency. The digital learning competencies are extracted from the Professional Development with Framework for Digital Learning (2017), therefore only those specific to the curriculum focus were encapsulated in this study and its results. It starts from Digital Learning Competency 6 and ends at Digital Learning Competency 10, which is aligned to the Professional Development with Framework for Digital Learning (2017).

This curriculum focus aspect looks at the teacher's ability to use digital tools and resources appropriately in trying to reach curriculum objectives (Department of Basic Education, 2017). A 7-point Likert scale was used, and respondents had to select the most applicable option.

The results and the discussion thereof will be presented in the sub-sections below.

4.3.1. Digital Learning Competency 6: Integrate digital tools and resources to enhance learning objectives in various learning environments.

Digital Learning Competency 6 aims to answer research question 1: Are teachers able to integrate digital tools and resources to enhance learning objectives in various learning environments?

For this competency, there are four indicators. The results of each indicator will be presented and discussed separately.

- Indicator 6.1: I am able to address the diverse needs of all learners and provide equitable access to appropriate digital tools and resources.

  In table 1, it's visible that 18.60% of respondents strongly agree that they can address the diverse needs of all learners and are able to provide equitable access to appropriate digital tools and resources. Meanwhile, 28.68% agree, 26.36% somewhat agree, 6.98% nether agrees nor disagrees, 3.88% somewhat disagree, 12.40% disagree, and lastly, 3.10% of respondents strongly disagree.

  Some of the tasks included in this indicator are a teacher's ability to integrate devices such as computers, tablets and cellphones to drive remedial activities among learners, as well as the teacher's ability to ensure that both genders have fair and equal access to technology instruments during classroom activities in which several learners have to share the use of one device (Department of Basic Education, 2017). Figure 5 shows that 74% of respondents leaned towards the ranges within the "agree" variable while 26% of the responses range between neither agree nor disagree to strongly disagree. It's important to note that while the teacher's competency to drive this indicator is key, it's also worth considering that a teacher's ability to do may be limited by the school's availability of digital tools, resources and technical support, etc. These considerations either promote or demote a teacher's keenness to adopt and integrate digital tools and resources in classrooms. Telkom (2015) acknowledged some of the challenges that hinder a quick adoption of technology within schools. Some challenges that arise from the digital divide include the lack of infrastructure, the teacher's digital literacy levels and ability

to implement ICT in classrooms, learners' comfort with using ICT, and other challenges encountered by the government which include the following: cost of using ICT as an effective tool in education on a limited budget, sustainability in implementing ICT needs to viable from the onset, and lastly, effective utilisation of ICT is key within the sector as its success is dependent on many factors.

- Indicator 6.2: I am able to afford learners the opportunity to share knowledge and skills using digital platforms.

  As seen in table 1, 17.97% of respondents strongly agree that they are able to afford learners the opportunity to share knowledge and skills using digital platforms. Whereas, 36.72% agree, 18.75% somewhat agree, 4.69% neither agree nor disagree, 7.03% somewhat disagree, 13.28% disagree, and a small minority comprising of 1.56% of respondents strongly disagree.

  It's imperative to have the successful implementation of ICT in teaching and learning practices, as it will enable learners to be active participants of the knowledge society before they leave a further-education and training (FET) institution (Department of Education, 2003). Some of the activities that teachers can deploy to empower learners to be active participants in the knowledge society include: enabling learners to create blogs for sharing findings of research projects, and enabling students to develop a YouTube channel where their drama projects can be showcased (Department of Basic Education, 2017). The graphical illustration showcases, through figure 5, that 73% of teachers are comfortable with this task whilst 27% of the responses range from neither agree

nor disagree to strongly disagree. Again, this could be related to many reasons of which some relate to lack of resources, and training and development of teachers, etc.

- Indicator 6.3: I am able to plan learner-centred access to digital tools and resources as and when appropriate.

  Table 1 reflects that 20.16% of respondents strongly agree that they are competent in this indicator in that they can plan learner-centred access to digital tools and resources as and when appropriate, while 39.53% of respondents agree, 20.16% somewhat agree, 5.43% neither agree nor disagree, 6.20% somewhat disagrees, 6.98% disagrees, and lastly 1.55% of respondents strongly disagree.

  The Department of Education (2003) has recognised the ability of ICT to improve the education system and has seen its potential to advance cognitive skills in learners such as comprehension, problem-solving and creative thinking. Hence, learners' participation in digital transformation in classroom learning is imperative. Some of the planned learner-centred access to digital tools and resources include: asking learners to demonstrate their findings and conclusions through presentations after a group task, and booking the computer room for a creative writing exercise using a word processor (Department of Basic Education, 2017). Figure 5 illustrates that 80% of respondents are able to plan learner-centred access to digital tools and resources as and when appropriate, however 20% of the responses range from neither agree nor disagree to strongly disagree. This could be a result of schools not having the

relevant digital tools and resources, systems, and time afforded to support the teachers in planning learner-centred access to digital tools and resources, or it could be that the teacher is not yet comfortable in doing so. In the study conducted by Lawson and Comber (2006), it was recognised that in-school training for teachers is a challenge as senior management limits the time that teachers are afforded to attend training, and follow-up support post the training was not a focus. This results in a loss of interest from teachers as they no longer have the time to explore and test the learnings, and they do not have any support to make this learning transition easier.

- Indicator 6.4: I am able to plan the strategic use of digital content resources before, during and/or after the lesson.

  As presented in Table 1, 24.81% of respondents strongly agree that they are completely able to plan the strategic use of digital content resources before, during and/or after the lesson. Meanwhile, 43.41% just agree, 24.03% somewhat agree, 2.33% neither agree nor disagree, 1.55% somewhat disagree, 2.33% disagree, and lastly 1.55% of respondents strongly disagree.

  The Professional and Development Framework for Digital Learning (2017) in South Africa, indicates that successful implementation of digital learning in classrooms is dependent on the teacher's ability to effectively plan and facilitate digital learning. It's evident from figure 5 that 92% of respondents have selected extremes that lean towards them agreeing that they are competent in this indicator. It can therefore be concluded that through university curriculums and

in-service teacher training and development, teachers are developing the required skills that draw their focus to the strategic and purposeful use and the benefits thereof to the teaching-learning process. This figure also confirms that there is a small minority, consisting of 8%, which does not feel that they are able to conduct this task. This could be due to several reasons ranging from lack of enough training and support, and insufficient time to explore its benefits, to lack of planning and lack of strategic insight to deploy digital methods in a classroom, etc.

Table 1: Descriptive statistics reflecting respondents' ability to integrate digital tools and resources to enhance learning objectives in various learning environments.

#	Field	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Total
3	I am able to address the diverse needs of all learners and providing equitable access to appropriate digital tools and resources.	18.60% 24	28.68% 37	26.36% 34	6.98% 9	3.88% 5	12.40% 16	3.10% 4	129
4	I am able to afford learners the opportunity to share knowledge and skills using digital platforms	17.97% 23	36.72% 47	18.75% 24	4.69% 6	7.03% 9	13.28% 17	1.56% 2	128
2	I am able to plan learner-centered access to digital tools and resources as and when appropriate.	20.16% 26	39.53% 51	20.16% 26	5.43% 7	6.20% 8	6.98% 9	1.55% 2	129
1	I am able to plan the strategic use of digital content resources before, during and/or after the lesson.	24.81% 32	43.41% 56	24.03% 31	2.33% 3	1.55% 2	2.33% 3	1.55% 2	129

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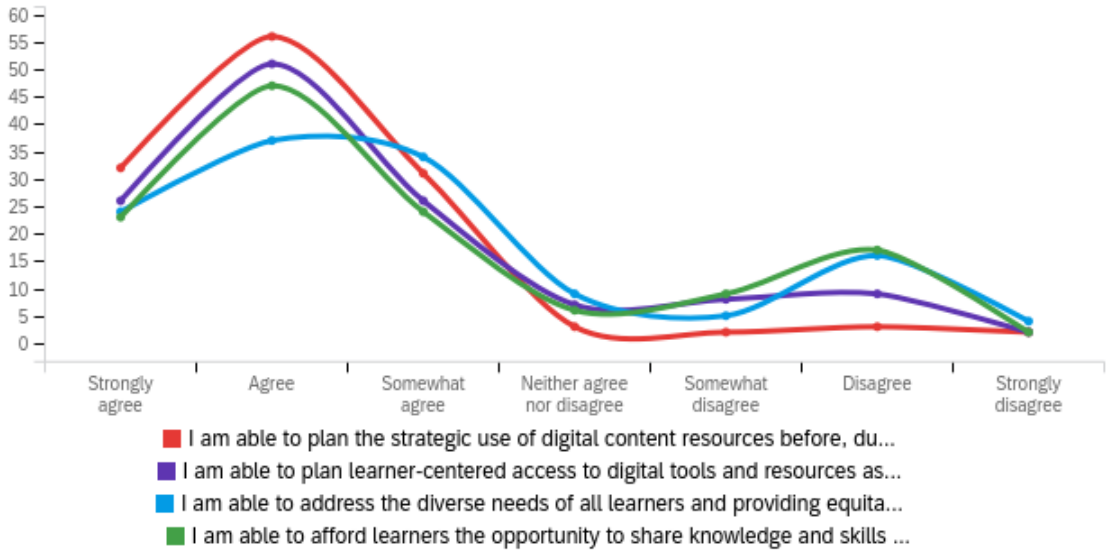

Figure 5: Graphical display of respondents' range of selections related to whether they can integrate digital tools and resources to enhance learning objectives in various learning environments.

4.3.2. Digital Learning Competency 7: Develop learners' global awareness and understanding using digital communication and collaboration tools.

Digital Learning Competency 7 aims to answer research question 2: Are teachers able to develop learners' global awareness and understanding using digital communication and collaboration tools?

For this competency, there are three indicators. The results of each indicator will be presented separately.

- Indictor 7.1: I can design learning activities that require interaction or collaboration between my learners and a local or global community.

  Table 2 reflects that 19.69% of respondents strongly agree that they are competent in this indicator, whereas 40.16% just agree, 26.77% somewhat agree, 2.36% neither agree nor disagree, 3.94% somewhat disagree, 7.09% disagree, and lastly 0% of respondents strongly disagree.

  There are several activities that can allow interaction between learners and the local community. Two of these activities are: 1) learners working with community representatives to formulate strategic plans in order to address challenges regarding school safety and; 2) learners doing a project on water usage in which they collaborate with the community to identify issues related to water conservation and together, develop a strategy to solve challenges (Department of Basic Education, 2017). Figure 6 confirms that 77% of respondents are comfortable to identify and execute such opportunities through the curriculum delivery where learner-community collaboration can be made possible for mutual benefit.

- Indicator 7.2: I can design learning in a class in which learners use digital communication and collaboration tools.

  Table 2 depicts that 15.08% of respondents strongly agree that they can design learning in a class in which learners use digital communication and collaboration tools. Meanwhile, 38.89% agree, 25.40% somewhat agree, 5.56%

neither agree nor disagree, 5.56% somewhat disagree, 7.94% disagree, and lastly 1.59% of respondents strongly disagree.

There are several creative ways for teachers to capitalise on this indicator, some of which include: arranging for business CEOs to video call the class for a live conversation on how strategy drives business models; and learners sharing project findings with a professor from another country through video calling, and then receiving feedback and guidance to proceed (Department of Basic Education, 2017). This indicator is a classic example of the augmentation classification in the SAMR Model. Under the augmentation classification, substitution occurs when there is a conscious effort to improve the student's experiences (H.L., 2017). Teachers in South Africa seem to be comfortable in understanding where augmentation is possible as 79% of respondents have agreed with the statement as graphically displayed in figure 6. It's important to also note that the lack of widespread internet connectivity is a limitation experienced by the South African government to enable digital education systems (Frost & Sullivan, 2017). This could therefore be a potential reason for the 21% that selected answers which ranged from neither agree nor disagree to strongly disagree. There could be several other reasons as well, some of which include that the teachers are competent, but they lack the necessary resources (example: a laptop) to effectively engage learners, or that the teacher actually feels that they are not ready for such integration from a skills and confidence level.

- Indicator 7.3: I can design learning that addresses real-life issues aligned to the curriculum.

  In table 2, it's apparent that 30.71% of respondents strongly agree that they can design learning that addresses real-life issues aligned to the curriculum, whereas 45.67% agree, 12.60% somewhat agree, 3.94% neither agree nor disagree, 1.57% somewhat disagree, 5.51% disagree, and none of the respondents strongly disagree.

  By utilising ICT, social networks are created where learners can be connected to each other, teachers have access to professional support services through digital tools and they are able to provide digital platforms to facilitate learning (Department of Education, 2003). The sharing of information and ideas between students and teachers can also enable effective combinations of pedagogy and technology (Department of Education, 2003). Competency in this indicator is measured by a teacher's ability to encourage activities such as finding a class online that their class can collaborate with for a project, and working collaboratively with a class in south-east Asia to jointly develop an awareness strategy about the sale of Rhino horn to name a few (Department of Basic Education, 2017). A teacher's Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK) strengths come into play for this indicator as the teacher's consciousness of the forces between technology and context; when can it be used to influence learning and when can it be pushed against each other, ultimately defines whether technology will be used or not. The graphical display as illustrated in figure 6 shows that 77% of respondents are comfortable with their Technological Content Knowledge (TCK) and

Technological Pedagogical Knowledge (TPK) strengths and will be able to address real-life issues aligned to the curriculum as a result.

Table 2: Descriptive statistics reflecting respondents' ability to develop learners' global awareness and understanding using digital communication and collaboration tools.

#	Field	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Total
2	I can design learning activities that require interaction or collaboration between my learners and a local or global community	19.69% 25	40.16% 51	26.77% 34	2.36% 3	3.94% 5	7.09% 9	0.00% 0	127
3	I can design learning in a class in which learners use digital communication and collaboration tools.	15.08% 19	38.89% 49	25.40% 32	5.56% 7	5.56% 7	7.94% 10	1.59% 2	126
1	I can design learning that addresses real-life issues aligned to the curriculum	30.71% 39	45.67% 58	12.60% 16	3.94% 5	1.57% 2	5.51% 7	0.00% 0	127

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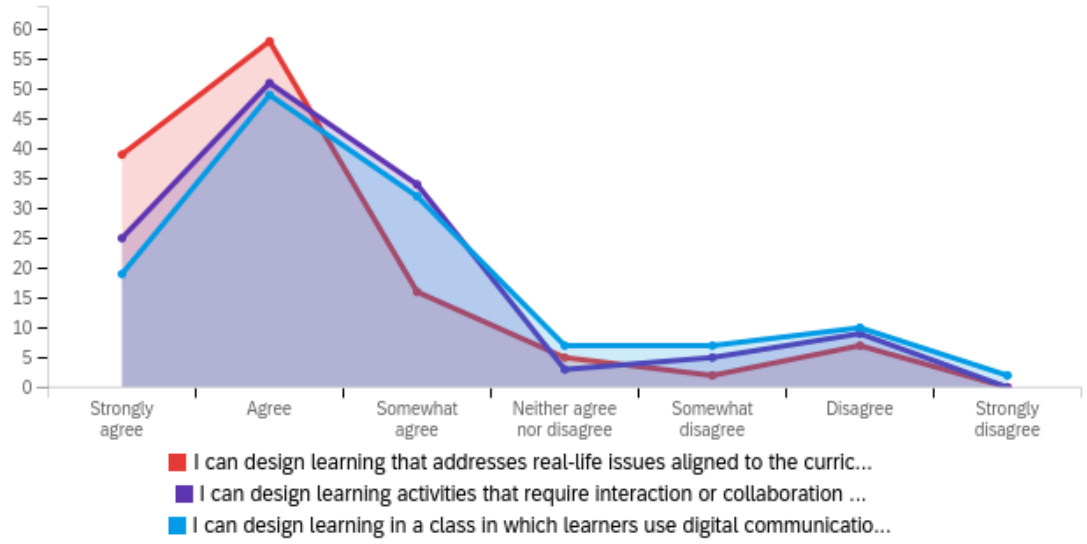

Figure 6: Graphical display of respondents' range of selections related to whether they can develop learners' global awareness and understanding using digital communication and collaboration tools

4.3.3. Digital Learning Competency 8: Transform learning through the innovative use of digital tools and resources.

Digital Learning Competency 8 aims to answer research question 3: Are teachers able to transform learning through the innovative use of digital tools and resources?

For this competency, there are four indicators. The results of each indicator will be presented and discussed separately.

- *Indicator 8.1: I am able to explore new uses for established digital tools and resources.*

  Table 3 shows that 15.20 % of respondents strongly agree that they are competent in this indicator, while 42.40% indicated that they agree and 24.80% indicated that they somewhat agree. 5.60% neither agree nor disagree, 7.20% somewhat disagree, 2.40% disagree, and lastly 2.40% of respondents strongly disagree.

  Over the years, digital modes and mediums have disrupted traditional ways of doing things, including how ICT can create new possibilities for learners and teachers in terms of how they engage in new ways of information selection, gathering, sorting and analysis (Department of Education, 2003). It appears that the majority of respondents, a total of 83% agree that they are able to find new ways to integrate digital methods to facilitate learning in classrooms as

illustrated by figure 7. New uses could include using cell phones to access digital content or using a document camera to tell a story with cut-out shapes (Department of Basic Education, 2017). This indicator is also a clear representation of the SAMR models redefinition phase which represents the pinnacle of how technology can transform a student's experience (H.L., 2017).

- *Indicator 8.2: I am able to explore opportunities offered by new digital tools and resources.*

  Under this indicator, table 3 reflects that 12.90% of respondents strongly agree with this statement, the majority consisting of 49.19% agree, and 20.97% somewhat agree. Whereas, 8.06% neither agree nor disagree, 4.03% somewhat disagree, 3.23% disagree, and lastly 1.61% of respondents strongly disagree with this statement.

  From figure 7, it is clear that 83% of respondents feel that they are capable of finding new ways to integrate digital tools and resources in classrooms. Some of the opportunities identified by the Department of Basic Education (2017) include using Xbox games to develop literacy skills and operating digital eyeglasses to record a museum visit. Theoretically, the SAMR model classifies the attributes of this indicator under the "redefinition" classification. It has also been noted that through the ongoing introduction and integration of new digital competencies, are changes which are inherently part of a progressive life and economy. The teaching landscape in South African schools is being shifted to move in line with the digital era where technology and electronic media are used as tools to teach across all spectrums while enhancing the digital literacy

and learning competence of students (Kajee & Balfour, 2011). Digital literacy and digital learning are changing the legacy approaches within learning environments; from reading books to reading from electronic devices, and from writing in books to writing on electronic devices or typing. This is also a good example of teachers activating their TK and TPK as defined by the TPACK Framework.

- *Indicator 8.3: I am able to facilitate learning that was not possible before the introduction of digital tools and resources.*

  As presented in table 3, 17.60% of respondents strongly agree that they can facilitate learning that was not possible before the introduction of digital tools and resources. A large majority 46.40% just agree, 19.20% somewhat agree, while 6.40% neither agree nor disagree, 4% somewhat disagree, 5.60% disagree, and lastly 0.80% of respondents strongly disagree.

  It's evident from this graphical representation in figure 7 that 83% of teachers agree to some gradation that they now have more opportunities to facilitate learning through the introduction of digital modes in education. The SAMR model classifies the attributes of this indicator under the "modification" classification where transformation takes place (H.L., 2017). There is a complete change to how the lesson is usually delivered (H.L., 2017). Additional activities include learners creating videos and sharing them online, and learners using video to analyse a music or drama performance (Department of Basic Education, 2017).

- *Indicator 8.4: I understand the impact of digital tools and resources on the nature of learning.*

  Table 3 reflects that 38.10% of respondents strongly agree that they understand the impact of digital tools and resources on the nature of learning, while a large majority of 42.86% agree, 12.70% somewhat agree, 4.76% neither agree nor disagree, 0.79% somewhat disagree, 0.79% disagree, and none of the respondents strongly disagree.

  In figure 7, statistics reflecting whether teachers understand the impact of digital tools and resources on the nature of learning shows that 94% of the respondents agree in different ranges that they do understand. Some activities that fall under this indicator, as stated by the Department of Basic Education (2017), include a teacher's use of diagnostic self-assessment tools to analyse the impact on learning of a lesson idea that he/she may have and questioning whether learners are doing anything differently, or if learners are learning more effectively. This indicator also taps into teachers' Technological Information (TK) where teachers are mindful of the various education technologies available to them, as well as their ability to use it in a classroom for enhanced teaching and learning practices (Kurt, 2018). TK also refers to the teacher's ability to recognise when education technology can assist or impede learning (Kurt, 2018).

Table 3: Descriptive statistics reflecting respondents' ability to transform learning through the innovative use of digital tools and resources.

#	Field	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Total
1	I am able to explore new uses for established digital tools and resources	15.20% 19	42.40% 53	24.80% 31	5.60% 7	7.20% 9	2.40% 3	2.40% 3	125
2	I am able to explore opportunities offered by new digital tools and resources	12.90% 16	49.19% 61	20.97% 26	8.06% 10	4.03% 5	3.23% 4	1.61% 2	124
3	I am able to facilitate learning that was not possible before the introduction of digital tools and resources	17.60% 22	46.40% 58	19.20% 24	6.40% 8	4.00% 5	5.60% 7	0.80% 1	125
4	I understand the impact of digital tools and resources on the nature of learning	38.10% 48	42.86% 54	12.70% 16	4.76% 6	0.79% 1	0.79% 1	0.00% 0	126

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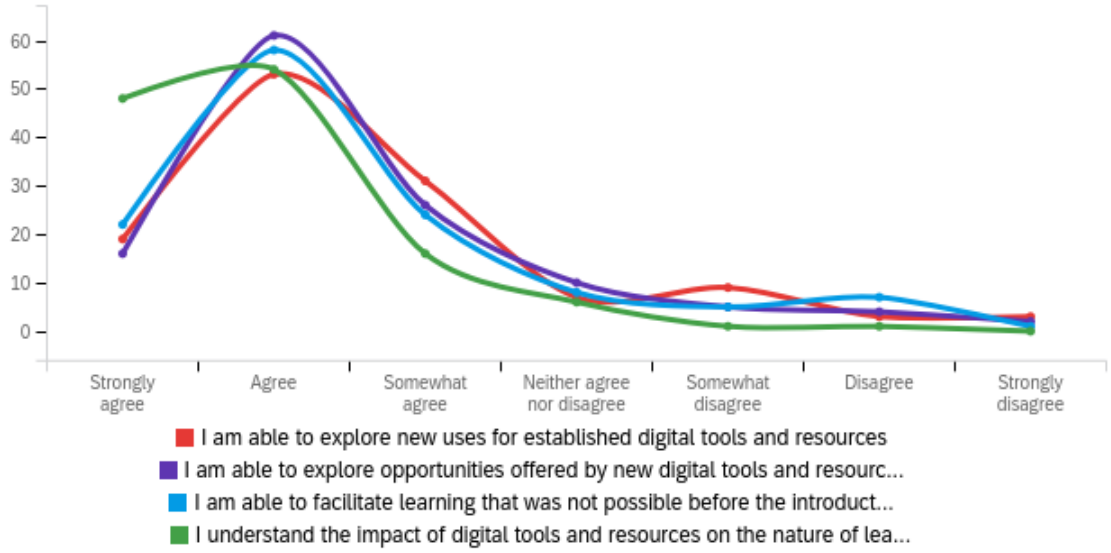

Figure 7: Graphical display of respondents' range of selections related to whether they can transform learning through the innovative use of digital tools and resources.

4.3.4. Digital Learning Competency 9: Enhance class management, assessment and feedback processes through the use of digital resources.

Digital Learning Competency 9 aims to answer research question 4: Can teachers enhance class management, assessment and feedback processes with digital resources?

For this competency, there are four indicators. The results of each indicator will be presented separately.

- Indicator 9.1: I am able to use digital productivity tools to create and administer tests, exams and assessment tools.

  Under this indicator, table 4 depicts that 27.91% of respondents strongly agree that they are competent in this indicator, 36.43% agree, and 14.73% somewhat agree, while 9.30% neither agree nor disagree, 1.55% somewhat disagree, 7.75% disagree, and lastly 2.33% of respondents strongly disagree.

  This indictor also shows strong representation of the augmentation and modification phase of the SAMR model, as it not only enhances processes with the teaching-learning processes but sometimes creates functional improvements or transforms parts of it, creating more time for teachers to explore new possibilities and uses of digital tools and resources (H.L., 2017). A

few activities to mention, as stipulated by the Department of Basic Education (2017) include: designing and administering self-marking quizzes and using Excel to capture, record and calculate averages for the class and individual. Through figure 8, it's apparent that the majority of respondents lean more towards the agree range and therefore are quite confident in executing these or similar activities. Van Dijk's research suggests that certain applications such as bookkeeping, spreadsheets and presentations are used more intensely by people with high levels of education and income in comparison to people with lower levels of education and income (Van Dijk, 2006, p. 182). This cannot be confirmed through the results obtained from participants.

- Indicator 9.2: I am able to use digital communication and collaboration tools, where appropriate, to support dialogue between learners and their teacher.

  Table 4 echoes that 17.83% of respondents strongly agree that they are able to use digital communication and collaboration tools, where appropriate, to support dialogue between learners and their teacher. A further 44.96% agree, 17.83% somewhat agree, and 5.43% neither agree nor disagree. At the same time, 3.10% somewhat disagree, 8.53% disagree, and lastly 2.33% of respondents strongly disagree.

  By combining the different ranges of "agree", for this statement, 81% of respondents confirm that they're able to leverage digital modes to facilitate dialogue between students and themselves as illustrated in figure 8. Supporting dialogues between learner and teacher can take place through several means, of which some include setting up a learning management system to provide

resources and manage submissions by the learner, and sharing an online storage folder on a facility such as DropBox to receive documents from learners, as well as comment using the review functions of the word processor (Department of Basic Education, 2017). These are new and improved ways of engaging students, capitalising on digital resources while creating efficiencies and proper recording controls in the process. Within the parameters of the SAMR model, a teacher's competency to transform learning and collaboration in such ways clearly speaks to the redefinition phase.

- Indicator 9.3: I am able to use digital tools and resources to design diagnostic assessment tools

  Table 4 shows that 12.40% of respondents strongly agree with this statement, 46.51% agree, 17.83% somewhat agree, while 10.08% neither agree nor disagree, 2.33% somewhat disagree, 9.30% disagree, and lastly 1.55% of respondents strongly disagree.

  This competency is measured by a teacher's capability to perform activities such as setting up Google form questionnaires online to replace paper-based copies, having learners complete it, then analysing the responses through the response analysis function in Google forms, and finally creating a self-marking feature when the results are extracted on an excel document (Department of Basic Education, 2017). From the responses, it's indicative from figure 8 that 77% of respondents agree to some extent that they are competent to execute such activities with the minority feeling otherwise. This indicator represents two classifications of the SAMR Model: augmentation and modification. For

example, if a teacher replaces a paper-based questionnaire with a Google form questionnaire, it can be a form of augmentation as it's a direct substitution as well as having the ability to introduce functional improvements such as the usage of images and hyperlinks making the experience for learners more forthcoming. If a teacher is able to export results onto an excel document creating a self-marking function when extracted, this could be classified under the modification phase, as the teacher transforms the process from the traditional way of doing it. Other than the advantages that digital resources provide in the management and administrative capacity function of schools, teachers and learners have new and creative ways to engage in information selection, gathering, sorting and analysis (White Paper on e-Education, 2004).

- Indictor 9.4: I am able to organise and monitor learning activities using online resources similar to a blog or learning management system.

  As seen in table 4 below, 11.63% of respondents strongly agree that they are competent in this indicator, 36.43% agree, 19.38% somewhat agree, while 10.85% neither agree nor disagree, 5.43% somewhat disagree, 10.85% disagree, and lastly 5.43% of respondents strongly disagree.

  It's interesting to note that this indicator has received the lowest percentage across the range of 'agrees' when combined. It can be observed from figure 8, that only 67% agree that they are able to conduct activities such as publishing work outlines, lesson instructions and support materials on a blog or a learning management system such as Obami or Moodle, and/or communicate with individuals and groups of learners regarding work progress (Department of

Basic Education, 2017). 11% of respondents neither agree nor disagree, while 21% disagree to different extents. One key reason for respondents not agreeing could relate to the lack of knowledge of these systems as well as the existence of such functionality to enable them to organise and monitor learning activities. An additional reason could also be the lack of investment in obtaining a learning management system to support teachers.

Table 4: Descriptive statistics reflecting respondents' ability to enhance class management, assessment and feedback processes through the use of digital resources.

#	Field	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree	Total
1	I am able to use digital productivity tools to create and administer tests, exams and assessment tools	27.91% 36	36.43% 47	14.73% 19	9.30% 12	1.55% 2	7.75% 10	2.33% 3	129
2	I am able to use digital communication and collaboration tools, where appropriate, to support dialogue between learners and their teacher	17.83% 23	44.96% 58	17.83% 23	5.43% 7	3.10% 4	8.53% 11	2.33% 3	129
3	I am able to use digital tools and resources to design diagnostic assessment tools	12.40% 16	46.51% 60	17.83% 23	10.08% 13	2.33% 3	9.30% 12	1.55% 2	129
4	I am able to organise and monitor learning activities using online resources similar to a blog or learning management system	11.63% 15	36.43% 47	19.38% 25	10.85% 14	5.43% 7	10.85% 14	5.43% 7	129

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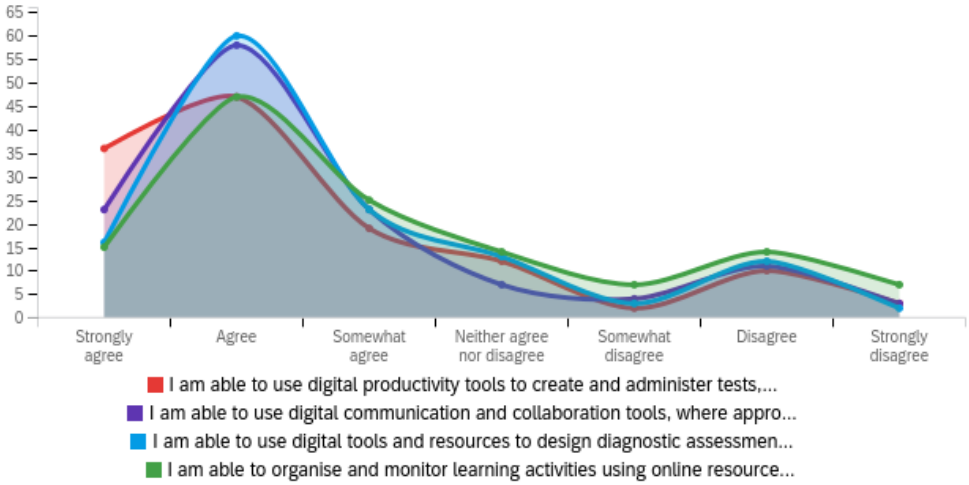


Figure 8: Graphical display of respondents' range of selections related to whether they can enhance class management, assessment and feedback processes through the use of digital resources.

4.3.5. Digital Learning Competency 10: Integrate learners' skills development in terms of digital literacies with curriculum-based learning.

Digital Learning Competency 10 aims to answer research question 5: Are teachers able to integrate learners' skills development in terms of digital literacies with curriculum-based learning?

For this competency, there are four indicators. The results of each indicator will be presented separately.

- Indicator 10.1: I am able to design integrated activities that develop learners' information skills while pursuing curriculum goals.

Table 8 reflects that 14.73% of respondents strongly agree with this statement, 49.61% agree, 18.60% somewhat agree, while 7.75% neither agree nor disagree, 2.33% somewhat disagree, 6.20% disagree, and lastly 0.78% of respondents strongly disagree.

The uses and volumes of information have increased drastically in both developed and developing countries over the last few years, with more and more content available through different channels such as radio, television, internet, books, newspapers, and magazines (Nath, 2017). The wide spreading of information has been enabled through progress in the technology domain (Nath, 2017). The developments in ICT over the years have transformed societies in ways previously unexplored (Nath, 2017). Some examples for developing a learner's information skills include posing a challenging question about global warming (or any other topic) or requiring learners to access real-time data about earthquakes and to draw conclusions about the likelihood of a volcanic eruption or tsunami (Department of Basic Education, 2017). Based on the results from figure 9, we can safely conclude that the vast majority, consisting of 84% agree to some extent that they can develop learners' information skills while still pursuing curriculum goals. The TPACK framework is very relevant to this practice, as it's Technological Information (TK) and Pedagogical Content Knowledge (PCK) elements enable teachers to know and understand when to use technology to promote learning and increase the information base and skill learners (Kurt, 2018).

- Indicator 10.2: I am able to design integrated activities that develop learners' digital literacy skills while pursuing curriculum goals.

As seen in table 5, 11.63% of respondents strongly agree that they can design integrated activities that develop learners' digital literacy skills while pursuing curriculum goals. A further 40.31% agree, 24.03% somewhat agree, while 10.85% neither agree nor disagree, 4.65% somewhat disagree, 7.75% disagree, and 0.78% of respondents strongly disagree.

The value of being digitally literate and developing digital learning competencies is becoming more evident and therefore there is a growing need to monitor the magnitude to which teachers and learners develop skills and knowledge for tomorrow's world. This opinion is confirmed by Chetty et al. (2017), who stated that the possession of digital literacy, in the contemporary digital economy, enables people to attain other esteemed outputs in life. Learners should have the necessary confidence in using ICT where they benefit in a personal and professional context is having ICT competence (Telkom, 2015). Hence the role played by teachers is critical in learners' lives. The study conducted by Fuchs and Horak (2008) stated that Africa is the continent that is most affected by poverty and where the digital divide is more prominent. The digital divide is not only limited to those whom have internet access and those who do not, but a divide is also apparent between those who have digital literacy skills, the ability to produce any form of content online, and the financial independence for optimal internet usage than those whom do not have the same (Violence Prevention Through Urban Upgrading, 2019). Having multiple access routes to digital literacy is a principal lacking factor in South Africa for the less privileged majority as indicated by the research conducted by Kajee & Balfour (2011). Such individuals come from under-resourced cultural backgrounds where digital

technology is almost non-existence, nor is it a focus due to other basic amenities receiving greater priority for survival. Figure 9 reflects that a large number, 76% precisely, of respondents do feel that they are able to develop learners' competencies.

- Indicator 10.3: I am able to design integrated activities that develop learners' media literacy skills while pursuing curriculum goals.

  It can be confirmed from table 5 that 10.08% of respondents strongly agree that they are competent in this indicator, 41.86% agree, 23.26% somewhat agree, 11.63% neither agree nor disagree, 5.43% somewhat disagree, 7.75% disagree, and lastly 0% of respondents strongly disagree.

  A method to develop the media literacy skills of learners may be to ask learners using a checklist of media literacy questions when analysing the gender bias in a TV advertisement (Department of Basic Education, 2017). 75% of respondents selected that they agree to some extent as shown in figure 9. The highly positive responses for this indicator could be due to the fact that the exercise doesn't necessarily mean that the advert has to be watched at school. This could serve as a form of homework as well, where learners are asked to conduct this study at home if the school is under-resourced and does not have televisions available to facilitate learning. The opposing consequence would be if a student does not have a television at home as well. This could be the possible reason for the 12% of responses that are classified under neither agree nor disagree. There could be additional reasons for the negative

responses which relate to the teacher not understanding the value of media literacy skills to students and/or how to integrate it into lessons.

- Indicator 10.4: I am comfortable to promote and model safe, legal and ethical use of digital information resources.

  As presented by table 5, 24.81% of respondents strongly agree that they are comfortable to promote and model safe, legal and ethical use of digital information resources. An additional 43.41% agree, 16.28% somewhat agree, 9.30% neither agree nor disagree, whereas 2.33% somewhat disagree, 3.88% disagree, and none of the respondents strongly disagrees with this statement.

  Promoting and modelling safe use of digital information resources includes modelling correct copyright procedures by referencing images used in a class worksheet, and requiring learners to do the same when submitting work, as well posting online safety guidelines and reminding learners of their social responsibility to use information ethically when conducting online research (Department of Basic Education, 2017). Impressively, figure 9 represents that 84% of respondents acknowledge this responsibility and are comfortable to enforce ethical practices related to digital information resources. Only 6% of respondents disagree, and this could relate to them not understanding the importance or implications of using digital information ethically.

Table 5: Descriptive statistics reflecting respondents' ability to integrate learners' skills development in terms of digital literacies with curriculum-based learning.

#	Field	Strongly agree		Agree		Somewhat agree		Neither agree nor disagree		Somewhat disagree		Disagree		Strongly disagree		Total
1	I am able to design integrated activities that develop learners' information skills while pursuing curriculum goals	14.73%	19	49.61%	64	18.60%	24	7.75%	10	2.33%	3	6.20%	8	0.78%	1	129
2	I am able to design integrated activities that develop learners' digital literacy skills while pursuing curriculum goals	11.63%	15	40.31%	52	24.03%	31	10.85%	14	4.65%	6	7.75%	10	0.78%	1	129
3	I am able to design integrated activities that develop learners' media literacy skills while pursuing curriculum goals	10.08%	13	41.86%	54	23.26%	30	11.63%	15	5.43%	7	7.75%	10	0.00%	0	129
4	I am comfortable to promote and model safe, legal and ethical use of digital information resources	24.81%	32	43.41%	56	16.28%	21	9.30%	12	2.33%	3	3.88%	5	0.00%	0	129

Showing rows 1 - 4 of 4

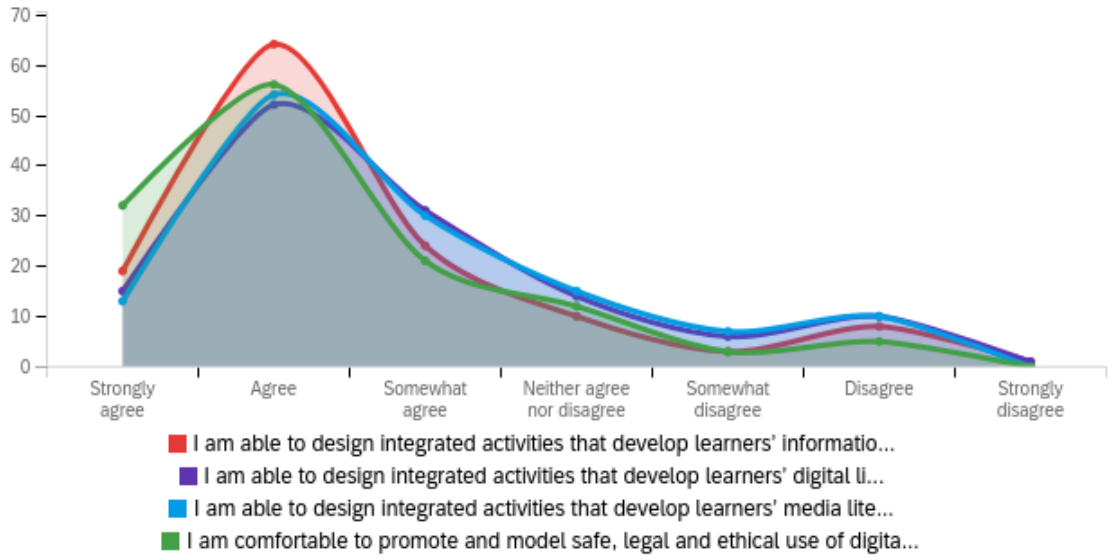


Figure 9: Graphical display of respondents' range of selections related to whether they can integrate learners' skills development in terms of digital literacies with curriculum-based learning.

4.4 Summary of the Results

In the International Telecommunication Union Report (2003), it was recognised that education is the key component of a country's digital transformation journey and enabling an information society. It is therefore remarkable to note that most respondents provided answers that leaned more towards a positive sentiment, suggesting that they understand or are beginning to understand how their role as educators are transforming and how through the use of digital tools and resources, they are the catalyst of change for the teaching-learning process. The policies, frameworks and initiatives carefully orchestrated and implemented by the South African DBE cannot go unnoticed.

Based on the results and most respondents agreeing that they are competent to some degree in all 19 indictors, we can conclude the following:

- The results of the study confirm that HP1 is supported by the outcomes of the survey the Professional Development Framework for Digital Learning is presumably effective in developing the digital learning competencies in teachers.

- The results obtained from the respondents further advocates that the Professional Development Framework for Digital Learning is a solid methodology that has given teachers a good understanding and mindfulness of when and how to integrate technology-supported materials into the curriculum to facilitate enhanced learning, thus creating an improved teacher-learner experience. HP2 is therefore also supported by the results.

- The results of the test also support HP3 despite previous research confirming the opposite, discussed in earlier sections. This could be as a result of the swift implementation and execution of the Professional Development Framework for Digital Learning through universities curriculum, as well in-house training provided for in-service teachers. The results of the study verify that most teachers no longer have fearful emotions or feel a lack of skill to integrate and promote the usage of digital tools and resources in order to facilitate enriched classroom learning.

For the minority that selected “neither agree or disagree” and the various gradations of “disagree”, there are various challenges that they may have experienced or that still pose as a problem, and that’s either related or unrelated to their competency levels. It could be that a teacher can activate an indicator however, they lack the necessary support or resources to do so. Some challenges to mention include: the lack of infrastructure, lack of IT coordinator support, lack of senior management support, and the teacher’s digital literacy levels. Some of the challenges encountered by the government in enabling this, includes the cost of using ICT as an effective tool in education on a limited budget and maintaining sustainability in implementing ICT.

CHAPTER 5. CONCLUSIONS & RECOMMENDATIONS

5.1 Introduction

The concluding observations on the study are presented in this chapter, providing a synopsis and denouement of the research intention. The study is examined in terms of both its contribution and impediments to the education arena. Recommendations are made regarding aspects that could be discovered in prospective studies, especially within the context of evaluating whether teachers are successfully integrating digital instruments in the classroom and if there is a subsequent impact on learning outcomes.

5.2 Conclusions for Research Question

In this section, a conclusion on the results of the research will be providing for the research questions. The conclusion will be wholistic, capturing sentiments from all five research questions (RQ).

- RQ1: Are teachers able to integrate digital tools and resources to enhance learning objectives in various learning environments?
- RQ2: Are teachers able to develop learners' global awareness and understanding using digital communication and collaboration tools?
- RQ3: Are teachers able to transform learning through the innovative use of digital tools and resources?
- RQ4: Can teachers enhance class management, assessment and feedback processes with digital resources?

- RQ5: Are teachers able to integrate learners' skills development in terms of digital literacies with curriculum-based learning?

The results suggest that majority of participants feel that they are able to integrate digital tools and resources in the teaching curriculum in order to facilitate enhanced teaching practices and expand the information base of learners. These results are contradictory to some previous studies which indicated sentiments such as:

- One of the main limitations to successfully integrating ICT in classroom learning are teachers themselves, and this is due to their attitudes and knowledge related to computers which mostly relates to fear and feelings of skill deficiencies (Lawson & Comber, 2006).

- Teachers also fail to understand and recognise the value and benefit of such integration to the students' learning experience (Lawson & Comber, 2006).

- Basargekar and Singhavi (2017) stipulate that teachers' reluctance and lack of confidence to leverage off digital tools and resources in classrooms, to enable enhanced learning, is one of the major barriers in any attempt by government to improve the quality to education.

The results of this study indicate that teachers are not a limitation; they understand and recognise the value and impact of such integration within the teaching-learning process. The results of the study further indicate that teachers are well equipped in leading the digital transformation expected in the educational sector. This coincides with the comments made in the study of Kajee and Balfour (2011) which mentions that the teaching landscape in South African schools is being shifted to move in line with

the digital era where technology and electronic media are used as tools to teach across all spectrums, while enhancing the digital literacy and learning competence of students. The forefront of this transformation is led by teachers.

5.3 Recommendations

In this section, recommendations are being explored. In a research report by Hutchison and Reinking (2011), it was acknowledged that literacy teachers are not the only parties that should be accountable for digital tools and resources implementation in classrooms.

It's imperative for the following activities to coincide with teacher development:

- Assessing Learning Outcomes: It's important to assess if the integration of digital modes in lessons is improving learning outcomes or not and if not, understand why. This will also indicate if teachers know when such integration is most beneficial and the reverse.

- Sharing of best practices and positive results: Some teachers or schools may find the best mechanisms to leverage digital integration in lessons which positively impact learning outcomes. Digital traction and progress in schools or classrooms should be reported back to districts and provincial governments for them to deploy the same practices in schools where integration is low or inefficient.

- Top Management Support: In order to ensure that there is a 100% integration where possible, there has to be managerial support. Teachers need to be given

time to strategically plan lessons integrating digital tools and resources. While there is a great need to ensure that the curriculum is delivered on time, giving teachers the time to explore the uses of technology may provide long-term benefits such as time savings and positive learning outcomes.

- Provide online training material and assessments for teachers: Teachers can be given exercises through online forms to help them understand new digital tools and how they can deploy them in a classroom setting. Teachers can also be given assessments to creatively find ways of integrating new technology in classrooms, and the best suggestions can be shared amongst the national teacher base. Such training can also be listed as a school's compliance requirement.

- Digital technology integration should be a topic of conversation in performance discussions: Principals should ensure that their teachers understand their roles in digitally transforming the education landscape while receiving support in doing so.

- Government support in prioritising education needs: The government's capital challenges are known. However, this sector can secure and promise a brighter future economically by producing learners of a higher quality into the employment market and industries, as some learners leave school with a strong entrepreneurial acumen, hence investment in this sector today will ensure that the country reaps the rewards in various forms in future years.

5.4 Suggestions for Further Research

The following aspects could be considered for future studies:

- Does the integration of digital technologies in classroom learning impact learning outcomes?
- Do higher levels of digital literacy and media literacy mean that an individual is more likely to be employed?
- Is the content in schools' education curriculums still relevant in the digital age?
- What is the gap between teacher's perceived or self-assessed competence on the curriculum focus indicators stipulated in the Professional Development Framework to their actual performance of those indicators?

REFERENCES

Aitchison J & Rule P. (2005). A quick survey of SADC literacy statistics and projections. Background paper prepared for the Education for All Global Monitoring Report 2006. Literacy for Life. Centre for Adult Education, University of KwaZulu-Natal.

Barratt, H. (2009) & Shantikumar S. (2018). Methods of sampling from a population. *Health Knowledge.* Retrieved from https://www.healthknowledge.org.uk/public-health-textbook/research-methods/1a-epidemiology/methods-of-sampling-population (Accessed 12 October 2019).

Barzilai-Nahon, K. (2006). Gaps and Bits: Conceptualizing Measurements for Digital Divide/s. *The Information Society*, *22*(5), 269-278. https://doi.org/10.1080/01972240600903953

Basargekar, P. & Singhavi, C. (2017). Factors Affecting Teachers' Perceived Proficiency in Using ICT in the Classroom. *IAFOR Journal of Education*, *5*(2). https://doi.org/10.22492/ije.5.2.03

Baskaran, A. & Muchie, M. (2007). Bridging the Digital Divide: Innovation Systems for ICT in Brazil, China, India, Thailand, and Southern Africa. London: Adonis & Abbey Publishers Ltd.

Bornman, E. (2015). Information society and digital divide in South Africa: results of longitudinal surveys. Information, Communication & Society, 19(2), 264-278. https://doi.org/10.1080/1369118X.2015.1065285 (Accessed 11 August 2019).

Bulfin, S. & North, S. (2007). Negotiating Digital Literacy Practices Across School and Home: Case Studies of Young People in Australia. Language and Education, 21(3), 247-263. https://doi.org/10.2167/le750.0

Castells, M. (2002). The Internet Galaxy: Reflections on the Internet, Business, and Society. New York: Oxford University Press, Oxford.

Center for Innovation in Research and Teaching. (2019). Sampling Methods in Quantitative Research. Retrieved from https://cirt.gcu.edu/research/developmentresources/research_ready/quantresearch/sample_meth (Accessed 6 September 2019).

Chetty, K., Qigui, L., Gcora, N., Josie, J., Wenwei, L. & Fang, C. (2018). Bridging the digital divide: measuring digital literacy. Economics: The Open-Access, Open-Assessment E-Journal, 12(23): 1-20. http://dx.doi.org/10.5018/economics-ejournal.ja.2018-23 (Accessed 16 January 2020).

Chetty, K., Wenwei, L., Josie, J., Gcora, N. & Shenglin, B. (2017). Bridging the digital divide: measuring digital literacy. G20-Insights Policy Brief, March. http://hdl.handle.net/20.500.11910/10840 (Accessed 15 January 2020).

Chung, J., & Monroe, G. S. (2003). Exploring Social Desirability Bias. Journal of Business Ethics, 44(4), 291-302. https://doi.org/10.1023/A:1023648703356

Crenshaw, E. M. & Robison, K. K. (2006). Globalization and the Digital Divide: The Roles of Structural Conduciveness and Global Connection in Internet Diffusion*. Social Science Quarterly, 87(1), 190-207. https://doi.org/10.1111/j.0038-4941.2006.00376.x

Creswell, J. W. (2014). Research Designs: Qualitative, Quantitative and Mixed Methods Approaches. (4th ed). California: SAGE Publications Ltd.

De Lange N., Bhana D., Mitchell C., Moletsane L., Balfour R., Wedekind W, Pillay D. & Buthelezi T. (2010). Every voice counts: A research niche area on teacher education and community development in the age of AIDS. Education as Change,14(sup:1), S45-S55. https://doi.org/10.1080/16823206.2010.517916

Debois, S. (2019, March 8). 10 Advantages and Disadvantages of Questionnaires. Survey Anyplace. Retrieved from https://surveyanyplace.com/questionnaire-pros-and-cons (Accessed 11 August 2019).

Department of Education. (2003). Draft White Paper on e-Education. Transforming Learning and Teaching through ICT. South Africa. https://www.gov.za/sites/default/files/gcis_document/201409/e-education1.pdf (Accessed 4 August 2019).

Department of Basic Education. (2017). Professional Development Framework for Digital Learning. South Africa. https://www.education.gov.za/Portals/0/Documents/Publications/Digital%20Learning%20Framework.pdf?ver=2018-07-09-101748-953 (Accessed 28 November 2019).

Department of Education. (2004). White Paper on e-Education. Transforming Learning and Teaching through Information and Communication Technologies (ICTs). Government Gazette No. 26734. South Africa.

https://www.sahistory.org.za/sites/default/files/white%20_paper_on_e-education_2004.pdf (Accessed 18 October 2019).

Ferrari, A. (2012). Digital Competence in Practice: An Analysis of Frameworks. JRC Technical Reports. Luxembourg: Publications Office of the European Union.

Formplus. (2020). The 4,5, And 7 Point Likert Scale + [Questionnaire Examples]. Retrieved from https://www.formpl.us/blog/point-likert-scale (Accessed 26 March 2020).

Frost & Sullivan. (2017). Digital Education: South Africa's Economic Imperative. Frost & Sullivan. https://ww2.frost.com/files/6014/9873/0945/e-Education_LM_Final.pdf

Fuchs, C. & Horak, E. (2008). Africa and the digital divide. Telematics and Informatics, 25(2), 99-116. https://doi.org/10.1016/j.tele.2006.06.004

Gartner. (n.d.). Digital Disruption. In Garner.com glossary. Retrieved from https://www.gartner.com/en/information-technology/glossary/digital-disruption (Accessed 18 October 2020)

Ghavifekr, S., Razak, A. Z., Ghani, M. F., Ran, N. Y., Meixi, Y. & Tengyue, Z. (2014). ICT Integration In Education: Incorporation for Teaching & Learning Improvement. Malaysian Online Journal of Educational Technology, 2(2) 24-45. https://files.eric.ed.gov/fulltext/EJ1086419.pdf (Accessed 6 March 2020).

Gilster, P. (1997). An excerpt from *Digital Literacy*. Excerpt obtained from Meridian: A Middle School Computer Technologies Journal, 2(2), 1999, July 27. Originally published by John Wiley & Sons, Inc., New York.

https://www.academia.edu/1354072/Digital_Literacy (Accessed 25 August 2019).

Global Commission of Future Work. (2019). Work for a brighter future. International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_662410.pdf (Accessed 18 October 2019).

Government Office for Science. (2017). Evidence From the Lifetime Learning In The Digital Age Summit. Future of Skills & Lifelong Learning: Workshop Report. *Foresight.* London. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627690/Skills_and_lifelong_learning_-_learning_in_the_digital_age_-_CLEAN.pdf (Accessed 7 January 2020).

Gudmundsdottir, G.B. (2010). From digital divide to digital equity: Learners' ICT competence in four primary schools in Cape Town, South Africa. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 6*(2), 84-105. https://files.eric.ed.gov/fulltext/EJ1084980.pdf

H.L. (2017, October 30). SAMR Model: A Practical Guide for EdTech Integration. Schoology Exchange. Retrieved from https://www.schoology.com/blog/samr-model-practical-guide-edtech-integration (Accessed 16 October 2019).

Heale, R. & Twycross, A. (2015). Validity and reliability in quantitative studies. Evidence-Based Nursing, 18(3), 66-67. http://dx.doi.org/10.1136/eb-2015-102129

Hutchison, A. & Reinking, D. (2011). Teachers' Perceptions of Integrating Information and Communication Technologies Into Literacy Instruction: A National Survey in the United States. *Reading Research Quarterly*, 46(4), 312-333. https://doi.org/10.1002/RRQ.002

IGI Global. (2019). What is Pre-Service Teachers. https://www.igi-global.com/dictionary/critical-thinking-and-mathematics-teaching-and-learning/23201 (Accessed 18 October 2019).

Ikamva National eSkills Institute. (n.d.). What is an e-Skill? https://www.inesi.org.za/pages/what-is.php (Accessed 18 October 2019).

International Telecommunication Union. (2003). World Telecommunication Development Report 2003. Access Indicators for the Information Society. https://www.itu.int/ITUD/ict/publications/wtdr_03/material/WTDR2003Sum_e.pdf (Accessed 9 March 2020).

Jovancic, N. (2019, April 2). 5 Data Collection Methods for Obtaining Quantitative And Qualitative Data. LeadQuizzes. Retrieved from https://www.leadquizzes.com/blog/data-collection-methods/ (Accessed 26 March 2020).

Kajee, L. & Balfour, R. J. (2011). Students' access to digital literacy at a South African university: Privilege and marginalisation. Southern African Linguistics and Applied Language Studies, 29(2), 187-196. https://doi.org/10.2989/16073614.2011.633365

Kurt, S. (2018, May 12). TPACK: Technological Pedagogical Content Knowledge Framework - Educational Technology. Educational Technology. Retrieved from https://educationaltechnology.net/technological-pedagogical-content-knowledge-tpack-framework/ (Accessed 15 October 2019)

Lawson, T. & Comber, C. (2006). Superhighways technology: personnel factors leading to successful integration of information and communications technology in schools and colleges. Journal of Information Technology for Teacher Education, 8(1), 41-53. https://doi.org/10.1080/14759399900200054

Maree, K. (2007). First Steps in Research (1st ed.). Pretoria: Van Schaik.

Merkofer P. & Murphy A. (2009). The e-skills landscape in South Africa. The issues of demand and supply and the use of international benchmarks to inform the South African e-skills development context. Z Politikberat, 2: 685–695. https://doi.org/10.1007/s12392-010-0219-y

Mishra, P. & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. Teachers College Record, 108(6), 1017-1054. https://www.learntechlib.org/p/99246/

Nath, H. K. (2017). The Information Society. Space and Culture, India. SIBCOLTEJO – A Journal of the SCTU, 4(3), 19-29. http://doi/10.20896/saci.v4i3.248

Porat, M. U., & Rubin, M.R. (1977). The Information Economy (9 volumes). Office of Telecommunications. Special Publication 77-12. Washington D.C.: US Department of Commerce.

Ritzhaupt, A., Liu, F., Dawson, K. and Barron, A. E. (2013). Differences in Student Information and Communication Technology Literacy Based on Socio-Economic Status, Ethnicity, and Gender. Journal of Research on Technology in Education, 45(4), 291-307. https://doi.org/10.1080/15391523.2013.10782607

Saylor Academy (n.d.). Sampling in Quantitative Research (7.3). *GitHub.* Retrieved from https://saylordotorg.github.io/text_principles-of-sociological-inquiry-qualitative-and-quantitative-methods/s10-03-sampling-in-quantitative-resea.html (Accessed 29 March 2020).

Schoeman, M. (2000). South Africa as an emerging middle power. African Security Review, 9(3), 47-58. https://doi.org/10.1080/10246029.2000.9628050

SmartSurvey. (n.d.). 10 Advantages of Online Surveys. SmartSurvey. Retrieved from https://www.smartsurvey.co.uk/articles/10-advantages-of-online-surveys (Accessed 16 October 2019).

Telkom. (2015). Technology in Education. Considerations and Trends for the Education Sector. Retrieved from https://media.telkom.co.za/today/media/downloads/Education.pdf (Accessed 5 November 2019).

Tondeur, J., Aesaert, K., Pynoo, B., van Braak, J., Fraeyman, N. & Erstad, O. (2015). Developing a validated instrument to measure preservice teachers' ICT competencies: Meeting the demands of the 21st century. British Journal of Educational Technology, 48(2), 462-472. https://doi.org/10.1111/bjet.12380

United Nations Educational, Scientific and Cultural Organization. (2003, July 7). Towards Knowledge Societies. An Interview with Abdul Waheed Khan. UNESCO. Retrieved from http://www.unesco.org/new/en/communication-and-information/resources/news-and-in-focus-articles/all-news/news/towards_knowledge_societies_an_interview_with_abdul_waheed/ (Accessed 18 October 2019).

United Nations Educational, Scientific and Cultural Organization. (2016). Global Education Monitoring Report 2016. Education for people and planet: Creating sustainable futures for all. UNESCO Digital Library. https://unesdoc.unesco.org/ark:/48223/pf0000245752 (Accessed 11 Nov 2019).

United Nations Educational, Scientific and Cultural Organization. (2019). ICT Competency Framework For Teachers Harnessing Open Educational Resources. UNESCO. Retrieved from https://en.unesco.org/themes/ict-eduction/competency-framework-teachers-oer (Accessed 31 March 2020).

University of Southern California LibGuides. (2019). Research Guides: Organizing Your Social Sciences Research Paper: Quantitative Methods. USC Libraries. Retrieved from https://libguides.usc.edu/writingguide/quantitative (Accessed 6 September 2019).

Van Dijk, J. (2006). The Network Society. Social Aspects of New Media (2nd ed.). London: SAGE Publications Ltd.

Van Dijk, J. & Hacker, K. (2003). The Digital Divide as a Complex, Dynamic Phenomenon. The Information Society, 19(4), 315–326. https://doi.org/10.1080/01972240309487

Violence Prevention Through Urban Upgrading. (2019, May 20). Bridging The New Digital Divide. VPUU. Retrieved from http://vpuu.org.za/ict4d/digital-divide-south-africa/ (Accessed 17 October 2019).

Walliman, N. (2011). Research Methods: The Basics (1st ed.). Abingdon: Routledge, Taylor & Francis.

Walsh, K. (2017, September 12). 5 Selected Frameworks for Teaching and Promoting Digital Literacy. *EmergingEdTech.* Retrieved from https://www.emergingedtech.com/2017/09/selected-frameworks-for-teaching-digital-literacy/ (Accessed 18 October 2019).

West, J. (2019). Data Collection. Childcare and Early Education. Research Connections. Retrieved from https://www.researchconnections.org/childcare/datamethods/survey.jsp (Accessed 6 September 2019)

WhatIs. (2019). Secondary data. In WhatIs.com definitions. Retrieved from https://whatis.techtarget.com/definition/secondary-data (Accessed 12 Oct 2019)

World Economic Forum. (2016, January). World Economic Forum White Paper Digital Transformation of Industries: In collaboration with Accenture. http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/digital-enterprise-narrative-final-january-2016.pdf (Accessed 22 August 2019).

APPENDIX A – The participant information sheet

Dear Participant,

My name is Tashlynne Naidoo, and I am a student at the Wits Business School, completing a master's degree in digital business. For completion of my degree, I am expected to complete a research project. My selected project relates to an evaluation of South African universities education curricula to effectively develop digital learning competencies in teachers.

The study aims to provide an understanding of the content and context of the university curriculum for education programmes in SA and its alignment to the Department of Basic Education framework for digital learning.

As part of this project, I'd like to invite you to participate in a survey. This activity will involve answering a web-based survey type questionnaire and will take no longer than 15minutes of your time.

You will not receive any direct benefits from participating in this research, and there is no disadvantages or penalties for not participating.
You may withdraw at anytime and not answer any question should you not want to.
The data collected in this survey will remain confidential and anonymous as I will not ask for your name or any other identifying information.
The information you give me will be held securely and not disclosed to anyone else.
If you experience any distress or discomfort at any point in this process, you can stop the survey participation completely or resume at another time convenient to you.

If you have any questions during or afterwards, please get in touch with me.

This study will be written up as a research report which will be available online through the university library website. If you have any concerns or complaints regarding ethical procedures of this study, you are welcome to contact the university: Human Research Ethics on 011 717 1408.

Your Sincerely,
Tashlynne Naidoo
2286626@students.wits.ac.za
084 255 0553

APPENDIX B – The participant agreement form

Q2 As a selected participant, I agree to participate in this research project?

- Yes
- No

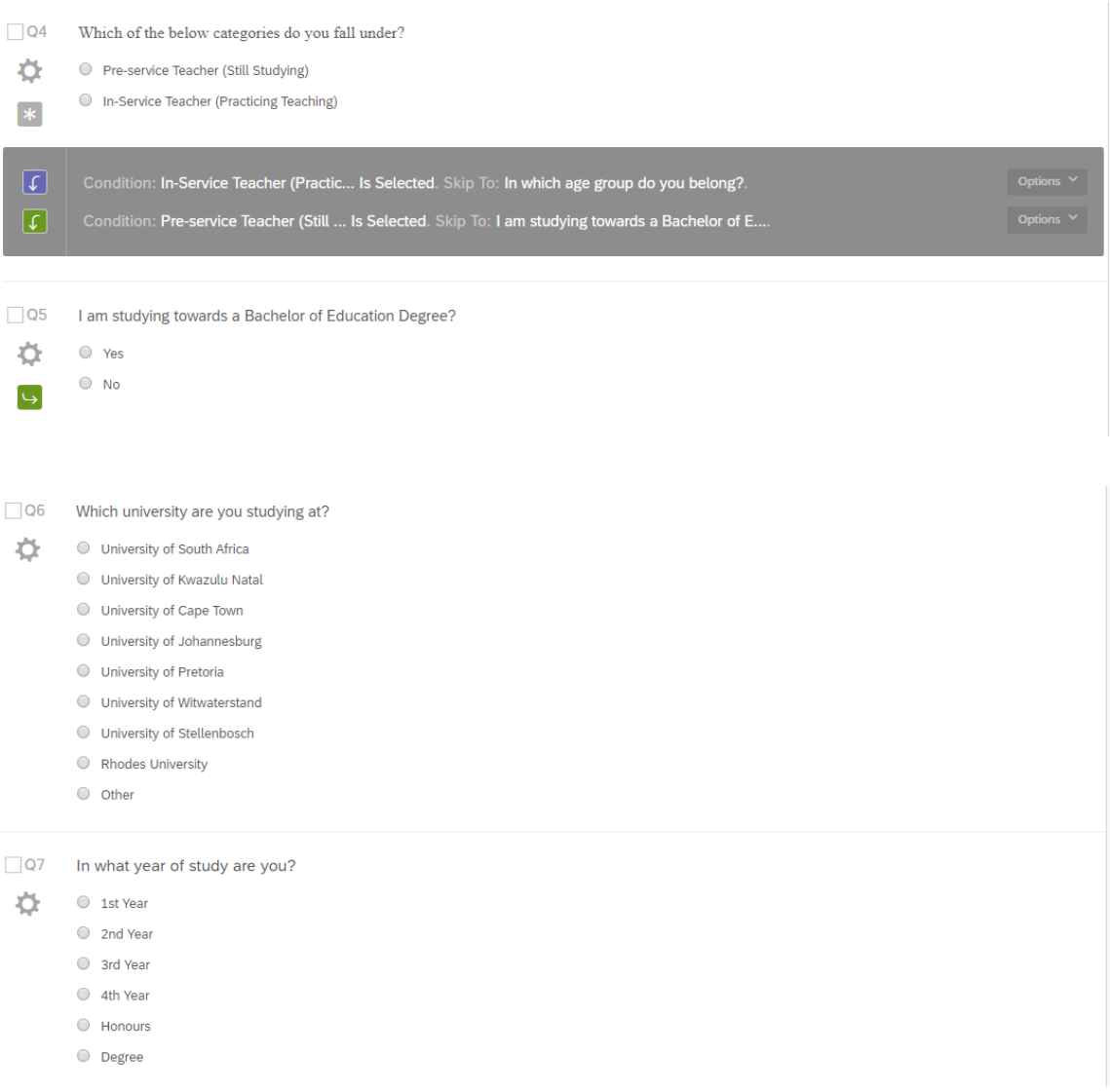
Q3 I agree that my participation will remain anonymous?

- Yes
- No

Q4 Which of the below categories do you fall under?

- Pre-service Teacher (Still Studying)
- In-Service Teacher (Practicing Teaching)

APPENDIX C – Instrument



Q8 In which age group do you belong?

- 17 – 25 Years Old
- 25 – 35 Years Old
- 35 – 45 Years Old
- 45 – 55 Years Old
- + 55 Years Old

Q9 I am specialising/a specialist in the following phase?

- Foundation Phase
- Intermediate Phase
- Senior Phase
- Further Education and Training (FET) Phase

Q10 There are 5 competencies that are included in this survey, starting from competency 6 and ending at competency 10. Each competency is described.

Each competency has between 3-4 questions for you to answer.

To help you understand the questions, a key definition to note:
Digital tools and resources refers to any devices and accompanying resources that may be used to support teaching and learning. This includes computers, laptops, tablets, cell phones, document cameras, interactive-whiteboards, digital cameras, gaming consoles, response systems and digital microscopes. "Resources" refers to all digital content and information sources.

Q11 Digital Learning Competency 6: Integrate digital tools and resources to enhance learning objectives in v

I am able to plan the strategic use of digital content resources before, during and/or after the lesson.	
I am able to plan learner-centered access to digital tools and resources as and when appropriate.	
I am able to address the diverse needs of all learners and providing equitable access to appropriate digital tools and resources.	
I am able to afford learners the opportunity to share knowledge and skills using digital platforms	

Q12 Digital Learning Competency 7: Develop learners' global awareness and understanding using digital con

I can design learning that addresses real-life issues aligned to the curriculum	
I can design learning activities that require interaction or collaboration between my learners and a local or global community	
I can design learning in a class in which learners use digital communication and collaboration tools.	

Q13

Digital Learning Competency 8: Transform learning through the innovative use of digital tools and resou

I am able to explore new uses for established digital tools and resources	
I am able to explore opportunities offered by new digital tools and resources	
I am able to facilitate learning that was not possible before the introduction of digital tools and resources	
I understand the impact of digital tools and resources on the nature of learning	

Q14

Digital Learning Competency 9: Enhance class management, assessment and feedback processes throu

I am able to use digital productivity tools to create and administer tests, exams and assessment tools	
I am able to use digital communication and collaboration tools, where appropriate, to support dialogue between learners and their teacher	
I am able to use digital tools and resources to design diagnostic assessment tools	
I am able to organise and monitor learning activities using online resources similar to a blog or learning management system	

Q15

Digital Learning Competency 10: Integrate learners' skills development in terms of digital literacies with

I am able to design integrated activities that develop learners' information skills while pursuing curriculum goals	
I am able to design integrated activities that develop learners' digital literacy skills while pursuing curriculum goals	
I am able to design integrated activities that develop learners' media literacy skills while pursuing curriculum goals	
I am comfortable to promote and model safe, legal and ethical use of digital information resources	

Q16

Thank you for completing the survey :)

APPENDIX D – Ethics Clearance

Note: The title has been changed and approved by the WBS Ethics Committee.

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

SCHOOL OF GRADUATE SCHOOL OF BUSINESS ADMINISTRATION ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: WBS/BA2286636/842**
PROJECT TITLE	An evaluation of South African Universities ICT curriculum
INVESTIGATOR	Mrs Tashlynne Naidoo
SCHOOL/DEPARTMENT OF INVESTIGATOR	MM (Digital Business)
DATE CONSIDERED	31 October 2019
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	LOW RISK
EXPIRY DATE	Date of submission of the project Research Report

ISSUE DATE OF CERTIFICATE 17 February 2020

CHAIRPERSON _____
(Dr MDJ Matshabaphala)