



Exploring integration of Information Communications Technology (ICT) in curriculum of pre-service teacher education and training in South Africa

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TABLE OF CONTENTS

TABLE OF CONTENTS	i
DECLARATION	vii
ABSTRACT	viii
ACKNOWLEDGEMENTS	ix
DEDICATION	x
LIST OF ACRONYMS AND ABBREVIATIONS	xi
LIST OF ANNEXURES	xiii
LIST OF PICTURES	xiv
LIST OF TABLES	xv
CHAPTER 1: AN OVERVIEW OF THE STUDY	
1.1 INTRODUCTION	1
1.2 BACKGROUND OF THE STUDY	1
1.3 PROBLEM STATEMENT	4
1.4 PURPOSE OF THE STUDY	6
1.5 RESEARCH QUESTIONS	7
1.6 OBJECTIVES	7
1.7 PROPOSITIONS	8
1.8 THEORETICAL FRAMEWORK	8
1.8.1 Basil Bernstein's theories on curriculum structure	8
1.8.2 Social constructivism	9

1.8.3	Connectivism	10
1.9	RESEARCH PARADIGM	11
1.10	METHODOLOGY	11
1.11	RESEARCH DESIGN	11
1.11.1	Sampling	12
1.11.2	Instrumentation	12
1.11.3	Sources of data	13
1.12	DATA REDUCTION AND ANALYSIS	14
1.13	DEALING WITH DATA	14
1.13.1	Credibility	14
1.13.2	Dependability	15
1.13.3	Confirmability	15
1.13.4	Transferability	16
1.13.5	Strategies to ensure rigour	16
1.14	LIMITATIONS OF STUDY AND FUTURE RESEARCH	17
1.15	LAYOUT OF REMAINING CHAPTERS	17
1.16	CONCLUSION	18

CHAPTER 2: EDUCATION AND INFORMATION COMMUNICATIONS TECHNOLOGY (ICT) FOR THE PROMOTION OF QUALITY EDUCATION AND SOCIAL JUSTICE

2.1	INTRODUCTION	19
2.2	QUALITY EDUCATION	19
2.2.1	Human capital approaches	21
2.2.2	Human rights approach	22
2.3	UNDERSTANDING SOCIAL JUSTICE	22
2.3.1	The inclusive dimension of social justice	25
2.3.2	The relevance dimension of social justice	30
2.3.3	The democratic dimension of social justice	32
2.4	UNDERSTANDING ICT IN EDUCATION	33
2.4.1	ICT in higher education	34

2.5 RECENT ICT DEVELOPMENT IN EDUCATION	35
2.5.1 Web 2.0 Technologies	36
2.5.2 Mobile learning (m-learning)	37
2.5.3 Open Educational Resources (OER)	38
2.5.4 Massive Online Open Course (MOOCS)	40
2.5.5 Flipped classrooms model	41
2.5.6 Gamification	42
2.6 ICT IN THE PRACTICE OF 21ST CENTURY TEACHING AND LEARNING	44
2.6.1 The changing role of teachers in the classroom	44
2.6.2 Advantages for teachers	46
2.7 BARRIERS ASSOCIATED WITH ICT INTEGRATION IN SCHOOLS	47
2.7.1 First-order barriers (Extrinsic)	48
2.7.2 Second-order barriers (Intrinsic)	51
2.7.3 The third-order barriers	53
2.8 CONCLUSION	54

CHAPTER 3: KNOWLEDGE, CURRICULUM, AND ICT FOR TEACHER EDUCATION

3.1 INTRODUCTION	55
3.2 WHY KNOWLEDGE	55
3.3 CURRICULUM STRUCTURES	58
3.3.1 An integrated curriculum	60
3.4 ICT INTEGRATION MODEL	61
3.4.1 Content Knowledge (CK)	64
3.4.2 Pedagogical Knowledge (PK)	65
3.4.3 Pedagogical Content Knowledge (PCK)	66
3.4.4 Technological Knowledge (TK)	67
3.4.5 Technological Content Knowledge (TCK)	68
3.4.6 Technological Pedagogical Knowledge (TPK)	69
3.4.7 Technological Pedagogical Content Knowledge (TPACK)	70
3.4.8 Limitation of the TPACK Model	72

3.5 THEORETICAL FRAMEWORK	73
3.5.1 Basil Bernstein's theories on curriculum structure	74
3.5.2 Social constructivism	76
3.5.3 Connectivism	78
3.6 CONCLUSION	81

CHAPTER 4: RESEARCH METHODOLOGY

4.1 INTRODUCTION	82
4.2 RESEARCH PARADIGM	82
4.2.1 Interpretivism	83
4.3 RESEARCH DESIGN	84
4.3.1 Research Approach	84
4.4 RESEARCH METHODS	85
4.4.1 Types of interviews	86
4.5 RESEARCH INSTRUMENTS	88
4.5.1 Other documents consulted	90
4.6 RESEARCH TECHNIQUES	92
4.6.1 Sampling	92
4.6.2 Credibility	94
4.6.3 Dependability	95
4.6.4 Confirmability	95
4.6.5 Transferability	95
4.6.6 Strategies to ensure rigour	96
4.7 DATA REDUCTION AND ANALYSIS	97
4.7.1 Data reduction	97
4.7.2 Data analysis	97
4.7.3 Data display	98
4.8 CONCLUSION	99

CHAPTER 5: FINDINGS OF THE STUDY

5.1 INTRODUCTION	100
5.2 DISCUSSION OF FINDINGS	100
5.2.1 Findings of theme 1: The value of ICT on quality education and social justice	103
5.2.2 Findings of theme 2: ICT for knowledge on content, pedagogy and technology	110
5.2.3 Findings of theme 3: Content Knowledge (CK)	115
5.2.4 Findings of theme 4: Pedagogical Knowledge (PK)	117
5.2.5 Findings of theme 5: Technological Knowledge (TK)	119
5.2.6 Findings of theme 6: Technological Content Knowledge (TCK)	122
5.2.7 Findings of theme 7: Pedagogical Content Knowledge (PCK)	124
5.2.8 Findings of theme 8: Technological Pedagogical Knowledge (TPK)	126
5.2.9 Findings of theme 9: Technological Pedagogical Content Knowledge (TPACK)	128
5.3 CONCLUSION	129

CHAPTER 6: DISCUSSION OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION	130
6.2 SUMMARY OF THE STUDY	130
6.2.1 Purpose of the study	130
6.2.2 Restatement of the research questions	130
6.2.3 Restatement of the objectives	131
6.2.4 Restatement of the propositions	132
6.3 THEORETICAL FRAMEWORK	132
6.3.1 Basil Bernstein's theories on curriculum structure	132
6.3.2 Social constructivism	134
6.3.3 Connectivism	135
6.4 DISCUSSION OF FINDINGS	136
6.4.1 Theme 1: The value of ICT on quality education and social justice	136
6.4.2 Theme 2: ICT for knowledge on content, pedagogy and technology	139
6.4.3 Theme 3: Content Knowledge (CK)	140
6.4.4 Theme 4: Pedagogical Knowledge (PK)	141
6.4.5 Theme 5: Technological Knowledge (TK)	142

6.4.6	Theme 6: Technological Content Knowledge (TCK)	143
6.4.7	Theme 7: Pedagogical Content Knowledge (PCK)	144
6.4.8	Theme 8: Technological Pedagogical Knowledge (TPK)	145
6.4.9	Theme 9: Technological Pedagogical Content Knowledge (TPACK)	146
6.5	RECOMMENDATIONS OF THE STUDY	147
6.5.1	Disciplinary Learning	148
6.5.2	Pedagogical Learning	149
6.5.3	Practical Learning	149
6.5.4	Fundamental Learning	150
6.5.5	Situational Learning	150
6.6	CONCLUSION	151
	LIST OF REFERENCES	152

DECLARATION

I, PASEKA PATRIC MOLLO do hereby declare that apart from the assistance acknowledged, this research project titled,

EXPLORING INTEGRATION OF INFORMATION COMMUNICATIONS TECHNOLOGY (ICT) IN CURRICULUM OF PRE-SERVICE TEACHER EDUCATION AND TRAINING IN SOUTH AFRICA,

submitted to the Central University of Technology, for the degree of Doctor of Education: Faculty of Humanities, Bloemfontein, is my own independent work. It has not been submitted before for any degree or examination at any other university.

Signed in Bloemfontein on the 14th day of September 2019



P.P. Mollo

ABSTRACT

Changes in technology, the advent of computers, mobile technology and innovations in telecommunications technology have affected the way people live around the world. Various sectors such as commerce, medicine, law, education and so on, have been affected by the changes brought by Information Communications Technology (ICT). Countries across the globe have positioned education as an apex priority. South Africa, like most countries, participates in the global *'Education for All'* movement, as initiated by UNESCO, a movement geared towards the advancement of social justice. Based on these changes, teacher education and training at universities should prepare prospective teachers to be able to function within the 21st century classroom. This means that after qualifying, student teachers should possess knowledge that will enable them to teach the millennial learners, to teach with technology, and to teach towards the advancement of quality education and social justice. The purpose of this study is to explore the integration of ICT in pre-service teacher training at universities in South Africa. The study investigates the level to which student teachers are exposed to the Technological Pedagogical Content Knowledge (TPACK) needed by them to deal with the demands of 21st century teaching. The study used the qualitative research approach using both group and individual interviews as research methods. The study found that prospective teachers still lack the required knowledge for them to integrate content, pedagogy and technology. It also found that the present B.Ed curriculum as prescribed in the revised Minimum Requirements for Teacher Education Qualifications (MRTEQ) policy document stifles the flexibility of universities in their efforts to provide student teachers with the required TPACK. Also, the ICT competencies of some lecturers at universities still need to be improved for them to adequately train student teachers to integrate ICT in their teaching. This study recommends practical steps that universities can employ to complement the prescripts of the revised MRTEQ to provide prospective teachers with the required TPACK.

Keywords: Information communications technology (ICT), quality education, social justice, curriculum, teacher education, Technological Pedagogical Content Knowledge (TPACK), research, university, learners, 21st century education, social constructivism, connectivism.

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DEDICATION

This study is dedicated to my son Tshepo Samuel Mollo born with albinism on the 28th of August 2016. Your birth reignited my passion for ICT in education and further convinced me that it is through ICT that we can adhere to the precepts of social justice.



LIST OF ACRONYMS AND ABBREVIATIONS

4IR	Fourth industrial revolution
B. Ed	Bachelor of Education
CAPS	Curriculum and Assessment Policy Statement
CAST	Centre for Applied Special Technology
CHE	Council of Higher Education
CK	Content Knowledge
CPD	Continuous Professional Development
DBE	Department of Basic Education
DBSA	Development Bank of South Africa
DHET	Department of Higher Education and Training
EENET	Enabling Education Network
ELRC	Education Labour Relations Council
FET	Further education and training
FITness	Fluency of Information Technology
FS	Free State
GDP	Gross Domestic Product
ICT	Information Communications Technology
LoTi	Levels of Technology Integration
MOOCS	Massive Online Open Courses
MRTEQ	Minimum Requirements for Teacher Education Qualifications
NCS	National Curriculum Statement
OER	Open Educational Resources
PCK	Pedagogical Content Knowledge
PICRAT	Passive, Interactive, Creative, Replacement, Amplification, Transformation
PK	Pedagogical Knowledge
TAM	Technology Acceptance Model

TCK	Technological Content Knowledge
TIM	Technology Integration Matrix
TIP	Technology Integration Planning
TK	Technological Knowledge
TPACK	Technological Pedagogical Content Knowledge
TPK	Technological Pedagogical Knowledge
RAT	Replacement – Amplification – Transformation
RSA	Republic of South Africa
SA	South Africa
SA-SAMS	South African Schools Administration management System
SAMR	Substitution – Augmentation – Modification – Redefinition
SES	Senior Education Specialists
UDL	Universal Design for Learning
UN	United Nations
UNESCO	United Nations Educational, Scientific, and Cultural Organisation
UNICEF	United Nations Children’s Emergency Fund
WWW	World Wide Web

LIST OF ANNEXURES

Annexure A:	Proposed Continuous Professional Development in ICT Integration
Annexure B:	Group interviews questions
Annexure C:	Individual interviews questions for ICT lecturers
Annexure D:	Individual interviews questions for subject methodology lecturers
Annexure E:	Ethical clearance from the FRIC of CUT
Annexure F:	Permission by the Free State Department of Basic Education
Annexure G:	Letter to District Directors in the Free State DBE
Annexure H:	Permission letter from the supervisor to collect data at the sites
Annexure I:	Transcriber's Certificate

LIST OF PICTURES

- Picture 1 BRAILLENOTE TOUCH
- Picture 2 CLICKER 7 LITERACY SOFTWARE

LIST OF TABLES

Table 4.1:	Basic competencies of a beginner teacher
Table 4.2:	Educator digital learning competencies
Table 5.1:	Presentation of participants in the focus group interview
Table 5.2:	Presentation of participants for individual interviews
Table 5.3:	The importance of ICT towards quality education and social justice
Table 5.4:	ICT for knowledge on content, pedagogy, and technology
Table 5.5:	Acquisition of Content Knowledge
Table 5.6:	Acquisition of Pedagogical Knowledge
Table 5.7:	Acquisition of Technological Knowledge
Table 5.8:	Acquisition of Technological Content Knowledge
Table 5.9:	Acquisition of Pedagogical Content Knowledge
Table 5.10:	Acquisition of Technological Pedagogical Knowledge
Table 5.11:	Acquisition of Technological Pedagogical Content Knowledge

CHAPTER 1

AN OVERVIEW OF THE STUDY

1.1 INTRODUCTION

This chapter provides the general overview of this research project. It describes the background to the study and states the purpose and objectives of the study. The chapter also outlines the research questions, statement of the problem, the theoretical framework, literature review and the research design of the study.

1.2 BACKGROUND OF THE STUDY

Countries across the world have put education as a top priority. Most international communities have the provision of education as a high-ranking right (Tikly & Barrett, 2011). The right to education is universal and unchallengeable like all human rights (Tikly & Barrett, 2011). This right has been enshrined in international laws and placed as binding by several governments (United Nations Children's Emergency Fund, 2007). Several treaties have been signed to ensure that education is a top priority. These include the United Nations Education, Scientific and Cultural Organisation's (UNESCO) Convention Against Discrimination in Education of 1960, the International Covenant on Economic, Social and Cultural Rights of 1966, and the United Nations Convention on the Rights of the Child of 1989 (UNICEF, 2007; Tikly & Barrett, 2011).

In adhering to the above-mentioned treaties and many more, the United Nations (UN) ratified an “*Education for All*” goal. “*Education for All*” was agreed upon at an international convention in Thailand in 1990 and was reaffirmed at the World Education Forum in Dakar (Senegal) in 2000

(UNICEF, 2007). This goal intended to ensure that all UN member states would provide access to quality education to all children, including traditionally marginalised groups. The marginalised groups include girls and women, indigenous populations and rural communities, disabled people, and linguistic and cultural minorities (UNICEF, 2007; Miles & Singal, 2010; Tikly & Barrett, 2011). The aim of the “*Education for All*” goal is to ensure that UN member states use education as a means for liberty and justice for all. As a result of this, education must be used to achieve social justice.

Recently, in September 2015, the UN further adopted Sustainable Development Goals (SDG). These goals were agreed upon to improve the living conditions of people, especially people from poorer countries (UN, 2015). Goal 4 of the SDGs commits the UN member states to “Ensure inclusive and quality education for all and promote lifelong learning” (UN, 2015; Department of Basic Education, 2018). This goal is in line with the prescript of social justice in the sense that education in this instance is seen as a means to achieve redistribution as well as ensure the recognition and participation of all people. These, are the three dimensions of social justice, according to Fraser (2003).

With the aim to adhere to the commitment to social justice, the use of Information Communications technology (ICT) in education ensures that education, particularly teachers, can easily achieve Goal 4 of the SDG. Teachers use ICT to ensure that people are not discriminated against, nor their welfare and well-being prejudiced or disadvantaged based on gender, religion, political affiliation, race, age, disability, and location (Republic of South Africa, 1996; DBE, 2011). Therefore, ICT has become an indispensable element of education as it seeks to achieve social justice in all educational institutions.

The advent of computers and the Internet have made the dissemination of information easy. Peoples’ knowledge has greatly grown. Never in history has so much knowledge been available to people (Education Labour Relations Council, 2005; Mbodila, Jones & Muhandji, 2013; Tunjera, N. & Chigona, A. 2020).

Studies have shown that technological inventions of the 21st century have completely changed the way people live their lives (Koc, 2005; Mbodila, Jones & Muhandji, 2013). Technology usage, in all its forms, has also become part and parcel of people’s lives (Koc, 2005; Mbodila,

Jones & Muhandji, 2013; Tunjera, N. & Chigona, A. 2020). ICT has become an indispensable part of the operations of various fields, including education (ELRC, 2005).

The changes in ICTs have affected the behaviours of both teachers and learners. Again, ICT has become an integral part of schooling because people in general as well as teachers and learners are using computer technology (Salehi & Salehi, 2012; Voogt, & McKenney, 2017). The developments brought about by ICT can improve and vary teaching and learning considerably. Teaching and learning have been greatly influenced by developments in computer technology, mobile technology, and the Internet (Salehi & Salehi, 2012). Educational technology, specifically, has greatly influenced teaching and learning. The advent of ICT has provided opportunities for teachers and learners to better interact during their class activities. So, because of these ICT developments, teachers and learners, in the 21st century classrooms, are confronted with different electronic media and these have changed the way teachers should teach and the way learners learn (Koc, 2005; Salehi & Salehi, 2012; Voogt, & McKenney, 2017).

Consequently, teachers, especially newly qualified teachers, are supposed to possess 21st century teaching skills for them to be relevant to their learners and be able to cope with demands of the 21st century classrooms (Koc, 2005; Hepp, Welling, & Aksen, 2009; Salehi & Salehi, 2012). The newly qualified teachers are expected to act as agents of change towards the infusion of ICT within the schooling system (Teo & Koh, 2010; Voogt, & McKenney, 2017). Also, teachers should be agents of social justice and this should be promoted throughout their professional career, beginning from their initial teacher education (DBE, 2018)

Therefore, in this era of the information age, pre-service teachers are supposed to demonstrate the ability to use different technological resources. They should be trained to become reflective practitioners who are able to monitor and measure learners' understanding of the content using ICT (DBE, 2018). Also, they should demonstrate an ability to assist and be comfortable with learners' exploration of a variety of ICT resources in the learning process (Hepp, Welling, & Aksen, 2009; Salehi & Salehi, 2012). Again, newly qualified teachers must be able to use ICT to enhance the dissemination of information and use it to help learners to meet the education challenges in the classroom (Goktas, Yildirim & Yildirim, 2009; DBE, 2018). Their teaching knowledge should be composed of satisfactory 21st century teaching skills, enough content knowledge and advanced pedagogical content knowledge (Shulman, 1987; Salehi & Salehi,

2012). It is thus, the teacher's role to cultivate classrooms that are inclusive and an education system that encourages lifelong learning.

What stands out from the above background are the concepts of quality education, social justice, ICT integration and teachers becoming global players. With this background in mind, quality education is a social justice mandate. So globally, ICT has been embraced as a medium that enables quality education and advances social justice. Literature has shown that in the 21st century, to a large extent, ICT ensures quality and in turn, advances social justice (Tikly & Barrett, 2011; Voogt, & McKenney, 2017).

1.3 PROBLEM STATEMENT

The supply of teachers in South Africa (SA) has become a matter of national concern and this can be attributed to, among other reasons, the shutting down of Colleges of Education, an increase in the number of schools, and a decrease in the number of students taking up teaching as a career (DBE, 2011). Furthermore, an increasing number of teachers are leaving the teaching profession for several reasons. One reason is the inability of teachers to cope with the demands of the 21st century classrooms, which are characterised using ICT (ELRC, 2005; DBE, 2011; DBE, 2015).

The UN has requested its member states to provide “*Education for All*” to its citizen. “*Education for All*” is a social justice mandate that has been determined by the UN (UNICEF, 2007). Teachers are supposed to be the champions of this social justice mandate. A way in which this mandate can be achieved is for teachers to introduce inclusive education in schools (Tikly & Barrett, 2011; Goodwin & Darity, 2019). Inclusive education can easily be achieved by infusing ICT in teaching. This will enable teachers to practice “*Education for All*” and hence adhere to the prescripts of social justice (UNICEF, 2007; Tikly & Barrett, 2011; Goodwin & Darity, 2019).

This country seems to have a problem producing teachers who can infuse ICT in their teaching. Hence the problem with inclusive education and broadly the problem of adhering to social justice. The problem can be traced to the curriculum at universities in SA, which seem not to equip pre-

service teachers with knowledge and skills to integrate ICT in their classrooms (ELRC, 2005; DBE, 2015). Hence, if teachers are neither taught nor developed to be ICT competent at teacher education institutions, this becomes a barrier towards the integration of educational technology in the classroom (Goktas, Yildirim & Yildirim, 2009). The problem of not being able to integrate technology in education can be attributed to the inadequate training that teachers receive in their pre-service education (Nyambane & Nzuki, 2014).

The Council on Higher Education (2010) has approved the Bachelor of Education (B.Ed.) degree offered by universities as an initial teacher education qualification in SA. The prescripts of the B.Ed. programme are contained in a document entitled Revised Policy on the Minimum Requirements for Teacher Education Qualifications (MRTEQ) (Department of Higher Education and Training, 2015). As a compliance requirement, the curriculum of various universities in SA goes through various accreditation processes before the universities receive approval to offer degrees in teacher education. However, the approved curricula still produce teachers that are experiencing problems with ICT integration (CHE, 2010; DHET, 2015).

Research has shown that successful ICT integration requires teachers to possess among others the seven knowledge bases as proposed by the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006; Voogt, & McKenney, 2017). This study aligns itself to the TPACK framework because it seems to be the model that can provide student teachers with the required knowledge for ICT integration.

The TPACK framework proposes that teachers should possess Content Knowledge (CK), Technological Knowledge (TK), Pedagogic Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006; Koehler & Mishra, 2009; Mishra & Koehler, 2008). The problem seems to be the lack of similarity and balance between the TPACK framework and the revised MRTEQ. This is because the revised MRTEQ seems not to give universities enough minimum requirements to meet the knowledge bases needed for ICT integration (Mishra & Koehler, 2006; Mishra & Koehler, 2008; DBE, 2011; Koehler, Mishra & Cain, 2013; DBE, 2015; DHET, 2015).

Apart from the curriculum as the source of the problem, the way in which the curriculum is presented is also a problem. Most lecturers still concentrate too much on content knowledge over other knowledge bases that student teachers should have (Koc, 2005). Newly qualified teachers seem to have a great deal of content knowledge without other knowledge bases that are needed in the 21st century classrooms. There seems to be an imbalance between theory and practice; as a result, the connection between theory and practice becomes unhealthy.

Vreugdenhil (2005:1) indicated that the problem is threefold in the sense that “theory does not always facilitate an adequate performance in the school practicum. Student teachers are not always able to restructure the theory received into meaningful knowledge for their practical activities in the classroom. The everyday practice in schools is not always the right field of action for elaborated theory, as instructed in teacher education”. Hence there will always be the problem of a digital divide between teachers and learners (Koc, 2005; DBE, 2011; DBE, 2015).

Central to teacher knowledge is the ability to provide quality education that can accommodate every learner in the classroom regardless of the learner’s abilities and capabilities. If ICT is properly integrated, it helps teachers to adhere to the United Nations (UN) call for “*Education for All*” (UNICEF, 2007; Tikly & Barrett, 2011). Another problem that most teachers are faced with is to use ICT to help them to plan, design and produce quality teaching resources and to use them to meet all the requirements of social justice (Tikly & Barrett, 2011; Goodwin & Darity, 2019).

1.4 PURPOSE OF THE STUDY

The purpose of this study is to explore the integration of ICT in pre-service teacher training at universities in South Africa. The study tries to align social justice with ICT integration and the teacher education curriculum. The study investigates the level to which student teachers are exposed to the Technological Pedagogical Content Knowledge (TPACK) that they need to deal with the demands of 21st century teaching. The investigation focuses on the student teachers’

ability to teach in an inclusive education environment that will enable them to adhere to the precepts of social justice.

1.5 RESEARCH QUESTIONS

The following research questions from the statement of the problem guided the inquiry:

What knowledge is needed by prospective teachers studying for a B.Ed. degree so they can integrate ICT in their teaching, and enable them to provide quality education that is geared towards the promotion of social justice?

The following are subsidiary questions:

- How does ICT promote the advancement of quality education and social justice in education?
- How are student teachers trained to acquire TPACK critical in the integration of ICT in undergraduate courses?
- To what extent have universities in SA incorporated TPACK in their B.Ed. curriculum to ensure that prospective teachers are trained to integrate ICT into their teaching?
- Do teacher education qualification policies in SA provide adequate guidelines for universities to develop a curriculum that trains prospective teachers to infuse ICT into their teaching?

1.6 OBJECTIVES

The objectives of this study are to:

- Examine the importance of ICT in advancing quality education and social justice.
- Establish how student teachers are trained to acquire TPACK.

- Determine the level to which universities in South Africa have incorporated TPACK in the curriculum of their teacher education and training programmes.
- Establish the adequacy of the guidelines provided by teacher education qualification policies in determining the teacher education curriculum at universities.

1.7 PROPOSITIONS

- ICT is indispensable to the realisation of quality education that ensures social justice.
- The current B.Ed. curriculum at universities in South Africa does not adequately infuse ICT in the training to equip student teachers with the required knowledge and skills to integrate ICT in their own teaching.
- The current curriculum of B.Ed. programmes provided by universities has not sufficiently incorporated TPACK that prospective teachers need to integrate ICT in their teaching.
- Teacher education qualification policies in SA should provide universities with adequate guidelines to infuse ICT in their curriculum.

1.8 THEORETICAL FRAMEWORK

This study is shaped by three theoretical strands that contribute to determining the knowledge that pre-service teachers need in the teaching environment. The rationale for choosing these theories is because of their allegiance to transformative pedagogies. The theoretical strands are Basil Bernstein's concept of curriculum; social constructivism; and connectivism.

1.8.1 Basil Bernstein's theories on curriculum structure

Bernstein's structure of the curriculum focuses on knowledge. His investigation on how knowledge and pedagogic practice are organised is captured in his notion of the pedagogic device (Bernstein, 1973a; Wheelahan, 2010). The pedagogic device entails the code and rules

that facilitate the image of a curriculum. The pedagogic device resembles an orderly arrangement in which acquired facts are classified and framed (Wheelahlan, 2010). Bernstein (1973a) introduced the concepts classification and framing to determine how a curriculum at an education institution is structured. The two concepts indicate whether the curriculum is a collection-type of curriculum or an integrated-type of curriculum (Bernstein, 1973a, 1973b; Sadovnik, 2001).

Classification refers to the levels that determine boundaries between groupings of subjects, agents, spaces, discourses and structures or practices (Bernstein, 1973a, 1973b; Sadovnik, 2001). It also deals with the way in which knowledge is articulated within different fields of study and how the fields are differentiated from one another (Bernstein, 2000).

Framing is concerned with how knowledge differs and represents the way in which it is controlled. It is about how knowledge is selected, sequenced, paced and evaluated (Bernstein, 2000). The framing of knowledge can either be strong or weak (Bernstein, 2000). *Classification* and *Framing* of knowledge are facilitated by three rules, namely, distributive rules, recontextualization rules, and evaluation rules (Bernstein, 2000).

1.8.2 Social constructivism

Social constructivist theory is considered a relevant theory in shaping the pedagogy in SA schools in recent times (Amineh & Asl, 2015). It revolves around the learner being central to the learning experience rather than the teacher (Vygotsky, 1978a, b; Amineh & Asl, 2015). This theory views learners as active participants in their learning (Amineh & Asl, 2015). Social constructivist pedagogy sees knowledge being built and applied according to individuals' experiences and sees learning as social experience (Brooks & Brooks, 1999).

This study looked at social constructivism in the learning theories of Lev Vygotsky (1978b), with the intention to use this to unpack the learning environment of the 21st century and to guide the TPACK that prospective teachers must have. This theory helped to understand how to bridge the digital divide between teachers and the millennials, how to meet the educational needs of

millennial learners, and how teachers can cope with the demands of the 21st century classrooms (Roberts, Newman & Schwartzstein, 2012; Mokoena, 2015).

The ontological notion of social constructivism stipulates that reality is created through shared human social actions (Vygotsky, 1978b). This means that members of a society or a group create a view of the world and its properties based on common understanding (Vygotsky, 1978a, b; Amineh & Asl, 2015). On the other hand, the epistemological stance of social constructivism is that knowledge is created by human beings and it is constructed through social and cultural interactions (Vygotsky, 1978a, b).

Social constructivism advocates for teaching modes that highlight the need for collaboration between teachers and learners (Woo & Reeves, 2007; Amineh & Asl, 2015). Some of the teaching approaches this theory emphasises are, among others, reciprocal teaching, peer teaching, collaborative learning, problem-based teaching, flipped classroom, web quest and other methods that involve learning with others (Amineh & Asl, 2015). The mentioned approaches are dependent on the use of ICT; hence this study investigated social constructivism to guide the knowledge that teachers must have to be relevant to 21st century learners.

1.8.3 Connectivism

This theory was introduced by George Siemens (2005) who identified the limitations of behaviourism, cognitivism and constructivism in addressing the demands of 21st century classrooms. Siemens (2005:2) stated that “these theories had limitations because of their intrapersonal view of learning, their inability to address the learning that is positioned within technology, and their incapacity to contribute towards the value judgements that need to be made in knowledge-rich learning environments” (Siemens, 2005; Kop & Hill, 2008; Bell, 2011).

This learning theory perceives learning as a process of coming up with new knowledge after consulting with different information sources (Boitshwarelo, 2011). Its view is that for one to know more is more important than what is presently known (Siemens, 2005). Connectivism requires the nurturing and maintenance of connections to facilitate lifelong learning. The

essential skills as proposed by this theory revolve around the ability to determine networks of fields, ideas, and concepts (Downes, 2005; Siemens, 2005; Bell, 2011; Boitshwarelo, 2011; Siemens, 2014). This theory is relevant because this study is about the ability to teach in an ICT infused curriculum, it is about the teachers' knowledge of using the Internet in the classroom and the ability of teachers in teaching the millennials. The study used this to determine the correct way of training prospective teachers, so they can operate in knowledge-rich teaching and learning environments – teaching and learning environments that use the Internet to form networks or communities of practice and teaching and learning that use ICTs in all its forms.

1.9 RESEARCH PARADIGM

This study is grounded on an interpretive paradigm. This paradigm supports the view that peoples' subjective interaction with the external world constitutes reality (Denzin & Lincoln, 2011). Hence people construct the social world by sharing meanings, interacting with, and/or relating to each other (Maree, 2007). An interpretive paradigm was considered suitable for this study since it emphasises the world of experience as it is lived, felt and undertaken by social actors (Maree, 2007; Denzin & Lincoln, 2011; Creswell, 2013).

1.10 METHODOLOGY

In line with the chosen paradigm, qualitative methods were used for this research study. A qualitative methodology was chosen because it uses words rather than numerical data (quantitative methods) and flows predominantly from concreteness to abstractness (Joubish, Khurram, Ahmed, Fatima & Haider, 2011).

1.11 RESEARCH DESIGN

1.11.1 Sampling

This study used a purposive sample because purposive sampling allows a researcher to choose a representative sample group based on the knowledge of the researcher (Creswell, 2007; Denzin & Lincoln, 2011). The first sample category is comprised of Senior Education Specialists (SES) that are responsible for E-Learning in the Free State (FS) Department of Basic Education (DBE) together with IT Coordinators in the FS DBE. The two formed a focus group because of their involvement in facilitating ICT in-service training to teachers. This group of education specialists was included to gain insight about their observations on the ICT knowledge of newly qualified teachers in schools. Lastly, they were used to determine whether there is a noticeable difference in the ICT knowledge between teachers that have been in service for a long time and newly qualified teachers.

The second sample comprised university lecturers. Out of the 24 universities in South Africa, this study drew a sample of six universities. The six universities include two universities of technology, two traditional academic universities and two newly built universities in South Africa (SA). The researcher chose universities that offer a Bachelor of Education (B.Ed.) degree.

At each university, two lecturers were identified from each faculty or school of education. From the two identified lecturers, one had to be a lecturer responsible for lecturing computer/digital literacy to B.Ed. (SP & FET) student teachers. The other one had to be a lecturer offering any B.Ed. subject specialisation. These lecturers were interviewed to learn their personal experience regarding the preparation of prospective teachers.

1.11.2 Instrumentation

Following the chosen methodology and paradigm, instruments for data collection for this study included interviews and document analysis. Qualitative research prefers the use of interviews as an instrument for the collection of data (Cohan, Manion & Morrison, 2011; King & Horrocks,

2011; Silverman, 2013). Interviews were chosen because they helped the researcher identify patterns and relationships. Group interviews were conducted with SESs to determine how knowledgeable newly qualified teachers are with ICT integration. Individual interviews were conducted with lecturers to determine to what level they train pre-service teachers to acquire TPACK at the different universities.

Books and journals formed part of the primary sources that the researcher used to gain more knowledge on the concepts of curriculum, social justice, ICT, and ICT integration in education. Policy documents that provide guidelines about the teacher education curriculum and ICT integration were analyzed. This informed the researcher on the level of guidance provided by the policies.

1.11.3 Sources of data

Data for this study was sourced from primary sources such as books, and secondary sources, such as articles, policy documents, transcripts and so on. Policy documents for teacher education qualifications and development consulted for this study include the Revised Policy on *The Minimum Requirements for Teacher Education Qualifications* (DHET, 2015). This policy was consulted because it prescribes the minimum requirements for all teacher education qualifications in SA. The curriculum of every teacher qualification in SA is formulated around the requirements in this policy. Therefore, universities cannot provide a teacher qualification that is not aligned to the prescripts of this policy. This study also consulted *The National Policy Framework for Teacher Education and Development in South Africa* (Department of Education, 2006) and the *Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011 – 2025* (DBE & DHET, 2011).

Other works consulted because they provide guidelines, expectations of the South African government, and strategies that must be employed by teachers to integrate ICT in the classroom were: *The White Paper on e-Education: Transforming Learning and Teaching through Information and Communication Technologies (ICT)* (DoE,2004), referred to in this study as

White Paper 7; *Action Plan 2014: Towards the Realisation of Schooling 2025* (DBE, 2011), referred to in this study as Action Plan 2014; *Action Plan to 2019: Towards the Realisation of Schooling 2030* (DBE, 2015), referred to in this study as Action Plan 2019; *The White Paper on Special Needs Education: Building an Inclusive Education and Training System* (DoE, 2001), referred to in this study as White Paper 6; and *The Professional Development Framework for Digital Learning: Building Educator Competencies in Facilitating Learning with Digital Tools and Resources* (DBE, 2018). All these policies were used by the researcher to determine ICT integration skills that are required for teachers while in pre-service training.

1.12 DATA REDUCTION AND ANALYSIS

The acquired data was reduced and analysed by determining themes, looking at emerging patterns and noting the reflections. Also, codes organized the information drawn from field notes and interviews and information from different sources. Lastly, patterns were identified, noting generalisations, commonalities and differences (Miles & Huberman, 1994).

1.13 DEALING WITH DATA

1.13.1 Credibility

The credibility of this study was ensured by using the triangulation technique. This study used a type of triangulation called triangulation of sources. With this, the qualitative researcher uses different data sources within the same data collection instrument (Cohan, Manion & Morrison, 2011). It involves the use of two different populations at different points in time to compare their divergent views on the matter at hand (Cohan, Manion & Morrison, 2011).

In this study, the researcher used both group interviews and individual interviews. Group interviews were conducted with a group of Senior Education Specialists (SES) who are responsible for the in-service training of teachers. The identified SES's main task is to provide in-service training for continuous professional development of teachers in schools. Individual interviews were conducted with lecturers who are responsible for pre-service training of teachers at universities. Triangulation was done to determine both the process and the product. Group interviews were conducted to determine the product, i.e. the ability of teachers to integrate ICT after they have completed their qualifications, while individual interviews were conducted to determine the process of equipping prospective teachers with adequate TPACK while they are still at university.

1.13.2 Dependability

Dependability in a qualitative study revolves around the researcher's careful handling of the data collected. The researcher must ensure that there were no careless mistakes in collecting the data, interpreting the findings and reporting findings (Cohan, Manion & Morrison, 2011). Hence in this study the researcher used electronic-type recordings to record all interviews conducted, except for one. One individual interview was video recorded because it was done through Skype. The Skype interview was video recorded for the researcher to capture the entire interview.

1.13.3 Confirmability

Confirmability is based on the respondents' exact words rather than researcher's words that might be biased (Cohan, Manion & Morrison, 2011). This study used an audit trail technique to ensure confirmability. All the recordings of the data collected are available both in audio and visual form. The authenticity of both can be proved by the physical recording and the

transcription certificate (Annexure I). Coding was used to identify and match themes. Analysis was done using different themes relating to the topic and the research questions.

1.13.4 Transferability

Transferability refers to the provision of evidence in relation to how the findings of a study can be applicable to other contexts, circumstances, and different time periods (Cohan, Manion & Morrison, 2011). The individual interviews in this study were conducted at the participants' workplaces. Most the lecturers were interviewed in their offices at their respective universities. Only one lecturer was interviewed through Skype, but the location was still at the lecturer's university in the office. The group interviews were conducted at the board room of the DBE offices.

1.13.5 Strategies to ensure rigour

Ethical clearance was obtained from the Central University of Technology, Faculty of Humanities, Research Committee before collecting data (Annexure E). Also, ethical clearance was obtained from the Free State DBE (Annexure F & G) to collect data from the two chosen education districts.

The participants provided the researcher with consent regarding their participation. It explained the purpose of the study and informed the participants that they participate in the study freely and without coercion, and that they can withdraw at any time should they choose to do so. The researcher requested the participants to sign a consent form before the commencement of data collection. This was done to avoid any potential risk to participants and to ensure that the researcher's methods are honest, fair and non-manipulative (Berg, 2001).

1.14 LIMITATIONS AND FUTURE RESEARCH

This study focused only on teacher education as presented by public universities in South Africa (SA). There might be differing views about teacher education as presented by private universities in SA and/or in other countries. Again, because social justice is a broad concept, it can be viewed either as a goal or a process depending on the researcher's paradigm. This study focused on the training of pre-service teachers in how to use ICT to respond to the social justice goal of equalising educational opportunities in SA Schools. The study collected data from a small sample of Senior Education Specialists (SES) responsible for e-learning in the Free State province.

Further research can be conducted for in-service training of teachers on how to use ICT in the classroom and/or to use ICT to respond to social justice processes of teaching to meet the needs of immigrant, refugee and vulnerable school children. Data can also be collected from SES responsible for different subjects to explore the use of ICT in different subjects like mathematics & natural science, technology and IT, languages, economic and management sciences, and so on.

1.15 LAYOUT OF REMAINING CHAPTERS

This research study is comprised of a further five chapters.

Chapter two discusses literature on the importance of ICT in education. This chapter shows how ICT is indispensable to the achievement of quality education. The chapter discusses the dimensions of social justice and shows that it is only through ICT that the dimensions of social justice can be realised.

Chapter three reviews the literature, first, on concepts of knowledge and curriculum structures. Second, the chapter discusses the Technological Pedagogical Content Knowledge (TPACK) framework. Third, it discusses three theoretical frameworks, namely, Basil Bernstein's curriculum structure, social constructivism, and connectivism.

Chapter four focuses on the research design of the study. The chapter discusses the research paradigm, methodology, research design, data reduction and analysis, and dealing with data.

Chapter five presents the findings of the study. This chapter provides the researcher's interpretation and analysis of the collected data. The data is discussed in line with the research questions and is presented in themes.

Chapter six concludes the study. The researcher discusses the findings and from these makes recommendations.

1.16 CONCLUSION

This chapter has provided an overview of this study. It has provided the background of the study, its purpose and the problems that necessitated the study. Other elements of the study discussed include the problem statement, research questions, research design and significance of the study.

CHAPTER 2

EDUCATION AND INFORMATION COMMUNICATIONS TECHNOLOGY (ICT) FOR THE PROMOTION OF QUALITY EDUCATION AND SOCIAL JUSTICE

2.1 INTRODUCTION

This chapter reviews literature on the concepts of quality education, social justice, and ICT. It presents literature on the understanding of the concept of quality education then unpacks the concept of social justice and shows its relationship to education. The chapter also discusses the dimensions of social justice as articulated by Sociologist Nancy Fraser (2007).

In addition to the above, this chapter reviews literature on the relationship between ICT, quality education and social justice. This is done to show how indispensable ICT is to quality education and the advancement of social justice. This chapter draws on the literature to show it is unlikely that quality education can be provided, and social justice advanced without the use of ICT. The chapter looks at recent ICT and educational technological trends that have become prominent in 21st century education. Lastly, the literature review shows the importance of integrating ICT in the teacher education curriculum so that universities can produce teachers that meet needs of 21st century classrooms.

2.2 QUALITY EDUCATION

Several authors and researchers have defined quality of education differently. However, most of the adopted definitions have features agreed upon in UNICEF's definition. According to

UNICEF (2007: 32), “quality education comprises, first, quality learners. This refers to learners who are healthy, well looked after, and are assisted to be able to participate within the learning environment”.

Second, quality education comprises of safe education settings. These safe educational settings need to have enough teaching and learning facilities and resources that are up-to-date and sensitive to race and gender, and can respond to the marginalised (UNICEF, 2007; DBE, 2008).

Third, quality education should provide quality content that adheres to the curriculum standards, does not discriminate in any form, and is relevant to the learner-centered curriculum. This content should meet the basic knowledge requirements, such as literacy, life skills and basic mathematics (UNICEF, 2007; DBE, 2008).

Fourth, quality education should be characterized by quality processes. This means that quality education requires trained professional teachers who can use different learner-centered teaching approaches, can use different teaching and learning resources, and have good classroom management skills. Other teacher capabilities should include the ability to administer different assessment methods, facilitate learning to accommodate different learners including the disabled, and the ability to use technology to decrease rather to increase disparities (UNICEF, 2007; DBE, 2008).

Lastly, quality education requires the development of quality educational outcomes. This simply means that a prescribed education curriculum must be composed of objectives that include skills, attitudes and knowledge that are linked to national priorities and encourage learners and teachers to be participants in global communities of practice (UNICEF, 2007; DBE, 2008).

To achieve the above-mentioned characteristics of quality education, two approaches to education have become prominent. The two are the human capital approach and the human rights approach (Tikly, 2011). These approaches have been adopted by many countries, including South Africa (SA), when setting up their education policies.

In SA, some of the education policies that have used the two approaches, among others, are the Education Roadmap (DBE, 2008), Action Plan 2014 (DBE, 2011), Action Plan 2019 (DBE, 2015), White Paper 7 (Department of Education, 2004), and White Paper 6 (DoE, 2001). The

two approaches are briefly discussed below to show how relevant they are to the quality of the education system in SA.

2.2.1. Human capital approaches

The central rationale for this approach is investing in quality education for it to advance the economic growth of a country. According to this approach, the Gross Domestic Product (GDP) is a revealing indicator of development (Tikly & Barrett, 2011). The argument supporting this approach is that a country that invests in quality of education is likely to experience growth in its economy and its GDP will also be high.

This approach emphasises the importance of eradicating inequalities in education. The human capital approach calls for education to address gender inequality, urban / rural inequality, and inequalities because of socio-economic background (Tikly & Barrett, 2011).

There are three areas this approach emphasises (Tikly, 2011). The first approach is that schools should compete amongst each other and they should have choices of the education systems they employ. Second, schools should involve parents so that the schools can become productive and self-sustainable, especially in terms of finances, meeting educational goals, and making decisions that enable them to function properly. Third, schools should be able to publish their results and benchmark these results internationally (Tikly, 2011).

The human capital approach is also characterized by investing in learners, resources, teacher development and educational processes that produce outcomes. An example of this approach, according to Tikly (2011: 6), “can be seen in the influence brought by the Development Bank of South Africa (DBSA), headed by Mr. Jay Naidoo, on the development of the Education Roadmap”. The DBSA influenced the Education Roadmap by indicating that the quality of SA education should address the shortage of skilled manpower and contribute to the economy and the country’s GDP (Tikly, 2011). Upon scrutiny, one realizes that most SA education policies have elements of the human capital approach.

2.2.2 Human rights approaches

The human rights approach involves the economic, political, and cultural dimensions of human development with the purpose of realising peace, security, and sustainability (Tikly & Barrett, 2011). The role of education according to this approach is to ensure that citizens have access to education. People must be given opportunities to operate within the educational environment and they have rights to do things through education for sustaining their livelihoods. It further promotes democratically run schools that are learner centered. The schools should ensure that learners have freedom of expression and they are engaged in robust debates on educationally relevant topics (UNICEF, 2007; Tikly & Barrett, 2011).

Furthermore, the human rights approach to quality of education focusses on five (5) dimensions of education. These are: what the learners do when they learn; the nature of content learned; the learning environments; learning processes; and outcomes (UNICEF, 2007; Tikly & Barrett, 2011). This approach requires schools to be child friendly. This means that schools must help children to learn what they need to learn. The schools must enhance children's health, guarantee them safety, and provide them with protection from any harm. There should not be any form of violence at schools and children should not be exposed to any physical, verbal, and emotional abuse. The schooling environment must motivate teachers to teach, and their morale should be raised by these environments (UNICEF, 2007; Tikly & Barrett, 2011).

This approach, in a nutshell, emphasises that education should ensure peoples' health and safety. Education should be inclusive and democratic to benefit all members of the society (Tikly & Barrett, 2011). The above two approaches both advances the prescripts of social justice. Now the question is, what is social justice?

2.3 UNDERSTANDING SOCIAL JUSTICE

Quality education is both a political and human resource mandate, hence it must advance social justice. According to Goodwin & Darity (2019:64) social justice can either be viewed as a goal or a process in schools. For education to respond to the prescripts of social justice, Amartya Sen

(2005) and Martha Nussbaum (2006) developed the capabilities approaches (Sen, 2005; Nussbaum, 2006). For the same purpose, Nancy Fraser (2007) developed a three-dimensional theory (Fraser, 2007). As the two approaches are relevant to the advancement of social justice, different governments, depending on their needs, have chosen one of the two for their education system to advance social justice.

Over and above the provision of free, equal, and independent education, Nussbaum's (2006) capability approach requires all governments to give people entitlements to human dignity and respect (Nussbaum, 2006). This capabilities approach claims that people are not the same; as a result, the rights of the disabled should also be taken into consideration when quality education is provided (Nussbaum, 2006).

The capability approach proposed by Sen (2005) on the other hand, shares much with that of Nussbaum (2006), but also differs in important ways. The work of Sen (2005) focuses on comparative decisions on social justice in a world with limited choices. It means that sometimes people are not presented with the same resources or different countries do not have the same resources and this impacts on social justice (Sen, 2005).

Combining the work of the two researchers above, Polat (2011) identified ten entitlements which together work to restore equality and human dignity. The ten entitlements begin with a person having a right to life. Then each person must be afforded health care and integrity concerning their bodies (Polat, 2011). They must be afforded the opportunity to use all their senses, mind, thoughts, and sentiments, they should reason out issues, and being part of the natural environment, they should be free to associate themselves with other species of nature. They also need to enjoy and exercise control over their own environments (Polat, 2011).

The capability approach to social justice entitles people to life which means that everyone must live fully and normally like any other human being. Regarding bodily health, this approach requires that people be sufficiently nourished, and provided with shelter (Sen, 2005; Polat, 2011). The bodily integrity of people should be ensured so that they can move freely without any fear of attack (Sen, 2005; Polat, 2011). Their sexual preferences and reproductive choices should not be oppressed. Again, they must have the ability to use all their senses regardless of their disabilities, impairments, and limitations (Sen, 2005; Polat, 2011).

This approach also entitles people to their own emotions. It advocates for people to have freedom of attachment and association (Sen, 2005; Polat, 2011). People within socially just environments should be able to reason out issues and to plan their lives (Sen, 2005; Polat, 2011). Regarding affiliation to different groupings, this social justice approach entitles people to live with others no matter their social, political and religious affiliation (Sen, 2005; Polat, 2011). Again, people are entitled to live with other species, and they should take care of animals, plants and/or any other species that nature can present (Sen, 2005; Polat, 2011).

Furthermore, this approach encourages people to enjoy themselves by playing and laughing. It requires societies to have recreational activities. Last, this approach entitles people to be controllers of their immediate environments. This entails having places of work, their own land, freedom of speech and the liberty to freely participate in politics (Sen, 2005; Polat, 2011).

The capability approach to social justice perceives education as a vehicle to afford people decent livelihoods, to ensure that they get living wages, and to provide them with human dignity. This approach sees education as a means for people to know how to share in the wealth of their countries and to provide them with democratic freedom (Sen, 2005; Polat, 2011; Tikly & Barrett, 2011; Goodwin & Darity, 2019).

Nancy Fraser's (2003) approach, on the other hand, proposes three dimensions that contribute to social justice. These are redistribution, recognition and participation (Fraser, 2003; Tikly & Barrett, 2011). Fraser's theory started with only two dimensions of social justice, namely redistribution and recognition (Fraser, 2003). The advent of technology and the context of globalization brought about by the Internet influenced Fraser to come up with the third dimension called participation. This addition influenced the adoption of the concept of participatory parity (Fraser, 2007).

In the context of this study, redistribution relates to easy entry into education and access to resources that will ensure quality education. The recognition dimension refers to the identification and then acknowledgement of historically marginalised groups, including rural communities, the disabled, vulnerable children, orphans of the victims of HIV and AIDS, and others. Recognition also refers to the use of education as an emancipator mechanism for the marginalised groups. Participation means the rights of individuals to have their voices heard

irrespective of their geographic location, minority status, disability, etc. Participation encourages people to become global citizens (Fraser, 2007; UNICEF, 2007; Tikly & Barrett, 2011).

With the above discussion in mind, the section below identifies possible applications of the social justice approach towards good quality education. Tikly & Barrett (2011), after looking at both the human capability and the human rights approaches to social justice, proposed three dimensions through which quality education can be achieved. According to them, from a social justice perspective, good quality education is characterized by inclusion, relevance and democratic dimensions (Tikly & Barrett, 2011). This study will align itself with these three dimensions and will show how ICT will provide quality education that improves all learners' rights and capabilities required within 21st century classrooms.

2.3.1 The inclusive dimension of social justice

The right of access to education is the first important goal adopted by governments globally (UNICEF, 2007). This goal provides every child with the right to an education that is characterised by equality of opportunities and non-discrimination of any groups of people. So, to achieve this, all children must have access to an education system that is inclusive (UNICEF, 2007). This dimension advocates for the provision of education to include the marginalised groups (UNICEF 2007; Tikly & Barrett, 2011). Marginalised groups in society referred to, in this document, include the disabled, females, people in rural disadvantaged areas, and others.

Different literature has come up with different definitions for inclusive education, and they are mostly correct. However, this study would like to align itself with the definitions developed by the Enabling Education Network (EENET) at its participatory seminar in Agra, India in 1998. According to the EENET (1998:15), inclusive education refers to “one or the combination of continuously embryonic procedures of change and perfection within schools”. Inclusive education widens access to education by systematically making it more accommodative to all, friendly to different learners, and appreciated by various people. In other words, inclusive

education should not be a once-off project that can be delivered and completed within a short space of time (EENET, 1998).

Inclusive education should acknowledge that all children have the capacity to learn irrespective of their age, language, gender, ethnicity, disability, health status, etc. (EENET, 1998; Miles & Singal, 2010). Inclusive education provides systematic educational structures and pedagogies that meet the needs and promote the inclusion of all children in a society (EENET, 1998). It is characterized by an active process which is frequently evolving and should not be disadvantaged by classes that have many learners or a lack of teaching and learning resources (EENET, 1998).

Again, inclusive education changes education policies and procedures so that education can respond to individual learners' abilities. It enforces an education culture that is nonsexist, nondiscriminatory based on individuals' abilities, and nondiscriminatory on the bases of language, socio-economic background, ethnicity and religion (EENET, 1998; Dalton, McKenzie & Kahonde, 2012; Tunjera, N. & Chigona, A. 2020). Therefore, as per the above explanation, inclusive education must not be perceived as only focusing on disabled learners within mainstream education, as is understood by many people.

Furthermore, inclusive education is an educational mechanism that identifies and bridges any barriers that exclude learners within a teaching and learning environment (Stubbs, 2008; Miles & Singal, 2010; Dalton, McKenzie & Kahonde, 2012). It should focus on identifying and removing barriers that disadvantage learners in access to education, barriers that disadvantage learners from participating in classrooms, and barriers that restrict learners from achieving their academic potential (EENET, 1998; Dalton, McKenzie & Kahonde, 2012).

Because of the above, countries started to heed the call for inclusive education within their systems. Most if not all countries that subscribed to the "*Education for All*" movement developed policies and strategies for the introduction of inclusive education (Dalton, McKenzie & Kahonde, 2012). Policies were mostly aligned with the Salamanca Statement and Framework for Action on Special Needs Education (EENET, 1998; UNESCO, 1994). In South Africa, the framework that ensures inclusivity in the SA education system is outlined in the Education White Paper 6: Special Needs Education: Building an Inclusive Education and Training System (DoE, 2001). This policy framework is a guide for SA schools to implement and practice inclusive

education. Globally, policies align themselves to two dimensions of social justice that will enable schools to practice inclusive education (Stubbs, 2008). These are the redistribution and recognition dimensions (EENET, 1998; UNESCO, 1994; Dalton, McKenzie & Kahonde, 2012).

The redistribution dimension of inclusive education

Inclusive education calls for the achievement of social justice through the redistribution and recognition dimensions (Fraser, 2007; Tikly & Barrett, 2011). The redistribution dimension deals with how resources are distributed to accommodate different kinds of learners. The 21st century inclusive education teaching and learning requires the provision of schools with, among others, textbooks, computers, overhead projectors, interactive whiteboards, access to the Internet, iPads, smart phones, etc. (Stubbs, 2008; Banister & Reinhart, 2011). This will ensure that all learners regardless of their abilities and disabilities are well catered for. Looking at the above-mentioned resources, it is evident that most of them are characterized by ICT. Therefore, the use of ICT resources is dominant within 21st century schools.

The redistribution of ICT resources is a social justice matter because the use of different ICT resources ensures the accommodation of marginalised groups of society within the mainstream education system. ICT resources provide different users with auditory, visual, audio-visual, 3-dimensional ways of communicating the message (Banister & Reinhart, 2011; Dalton, McKenzie & Kahonde, 2012). For example, ICT equipment can be used to assist learners with disabilities. These ICT resources for disabled people are valuable tools can assist learners with disabilities, so that they are not excluded from educational opportunities (Banister & Reinhart, 2011; Tunjera, N. & Chigona, A. 2020).

It should be noted however, teachers' technological skills play a critical role when using these ICT learning materials. For these resources to be effective, they need to be compatible with the teachers' didactic practices, language abilities and educational professional etiquette (Tikly & Barrett, 2011). This shows that the resources are not independent of teachers. That is why this study calls for prospective teachers to have Technological Knowledge (TK), Technological

Pedagogical Knowledge (TPK) and broadly TPACK. If teachers do not have this knowledge, it is likely that the ICT equipment distributed to schools will not be utilized for their intended purposes, and that will impact the realisation of social justice (Banister & Reinhart, 2011; Tikly & Barrett, 2011).

The recognition dimension of inclusive education

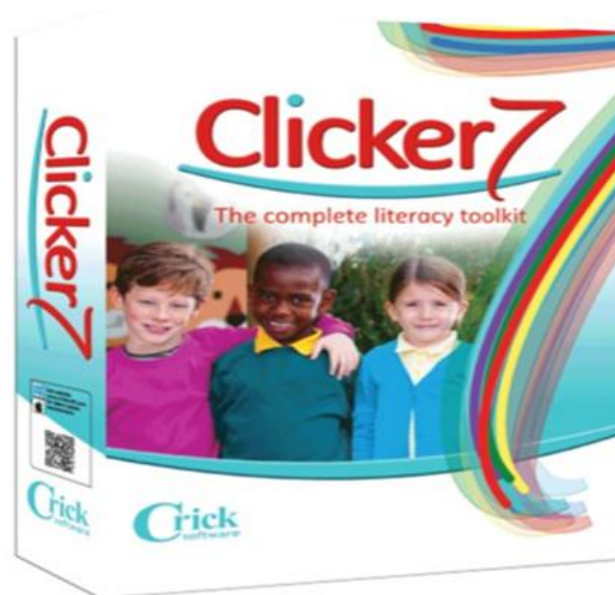
The recognition dimension of social justice deals with the acknowledgement of learners' culture, financial background, ethnicity, and language (Tikly & Barrett, 2011). Inclusivity in this case focuses on the cultural dimension of schooling. Schools should inculcate a culture of nondiscrimination because of socio-cultural identities (Polat, 2011; Tikly & Barrett, 2011). This dimension requires inclusive education to recognise individualism, normality, and the promotion of the world of equality in all respects (Polat, 2011). This calls for the recognition of individuals irrespective of their religion, nationality, race, sexuality, and culture (Banister & Reinhart, 2011; Polat, 2011; Tikly & Barrett, 2011).

The use of ICT comes in handy with this dimension because different learners, regardless of their barriers to learning, impairment and disabilities, can be assisted. Teachers can use technological resources to ensure quality teaching and learning for all groups of learners (Polat, 2011, Dipace, 2013). Apart from the normal mainstream technologies, teachers can be assisted by using assistive technologies that compensate for the difficulties that learners might have. Examples of assistive technologies include, among others, keyboards for disabled persons, communications devices, and screen readers. Also, devices used together with specialised applications technology to cater for individualised educational needs help to ensure access to education (Polat, 2011; Tikly & Barrett, 2011). For example, the BRAILLENOTE TOUCH is the first all-in-one braille tablet that combines the simplicity and accessibility of a note taker with the power and efficiency of a modern smartphone or tablet.



Picture 1: BRAILLENOTE TOUCH

The second example can be of software that can be used with the computer or Tablet to assist learners with learning difficulties and disabilities. CLICKER 7 LITERACY SOFTWARE is one such software that is used to assist learners that have learning difficulties and disabilities like autism, dyslexia, hearing impairments, low vision (partially sighted), Downs Syndrome, Cerebral Palsy, speech and language difficulties and physical disabilities. Clicker is compatible with several devices like PCs, SMART Boards, interactive whiteboards, the eBeam and others.



Picture 2: CLICKER 7 LITERACY SOFTWARE

This dimension calls for teachers to have ICT skills to ensure quality monitoring and data manipulation which can assist in revealing learners that are disadvantaged (Tikly & Barrett, 2011). Teachers need effective strategies for alternative pedagogies that can accommodate learners with differing needs. They should be well conversant with alternative methods, strategies, materials, and assessment strategies that can be used for teaching and learning in an inclusive classroom. This can be accomplished through the new approaches to educational design (Dalton, McKenzie & Kahonde, 2012). According to Dalton, McKenzie & Kahonde (2012: 5), “the Centre for Applied Special Technology (CAST) in 1998 came up with a new model for educational design called the Universal Design for Learning (UDL)”.

The UDL model is composed of three main philosophies, namely, variation of expression, variation of action and expression, and variation of engagement (Dalton, McKenzie & Kahonde, 2012, Dipace, 2013). It is only through ICT that teachers can design teaching and learning activities that allow for the accommodation of learners with diverse individual needs. Having looked at the above dimensions of inclusivity, this study therefore argues that teacher education and training should equip teachers with TPACK to be able to practice the UDL model. The TPACK framework will be discussed in detail in the next chapter.

2.3.2 The relevance dimension of social justice

The relevance dimension is the second phase of the theoretical understanding of social justice. It deals with how aims and lesson objectives are relevant for all learners (Tikly & Barrett, 2011). This dimension requires that educational aims and objectives respond to the needs of communities, and these must in turn contribute to the national goals and priorities, which will then assist a country to be relevant and contribute to the global community (Tikly & Barrett, 2011; Reed, Gultig & Adendorff, 2015). About social justice, the relevance dimension is further concerned with capabilities and functions that people within specific communities and nations value. This dimension calls for the school curriculum to recognise and reflect the identities and needs of different social groups (Tikly & Barrett, 2011).

“Education for All” requires the curriculum of countries to include literacy, numeracy, and life skills to ensure quality education, curriculum relevance and inclusive education (UNICEF, 2007). *“Education for All”* is in line with the prescripts of the relevance dimension of social justice. As a subscriber to the *“Education for All”* movement, the SA government introduced these subjects in its curriculum. Starting from Curriculum 2005, National Curriculum Statement (NCS) R-12 to the present Curriculum and Assessment Policy Statement (CAPS), the basic education curriculum of SA is designed to ensure that learners are provided with knowledge and skills that are relevant to them and can assist them with their day-to-day lives (DBE, 2011). The curriculum also aims to promote the acquisition of indigenous knowledge while adhering to the global context (DBE, 2011; Reed, Gultig & Adendorff, 2015).

Furthermore, in adhering to the prescripts of social justice, the SA curriculum strives to prepare learners to be global citizens irrespective of their financial background, colour and gender. The learners should be afforded an opportunity to become citizens who will participate in the development of the country’s knowledge and economy (DBE, 2011; Reed, Gultig & Adendorff, 2015). The curriculum must stick to basic education principles of social change, participatory learning, quality knowledge and skills that will benefit the entire society (DBE, 2011). The SA curriculum aims to promote inclusive education, human rights, quality education and the advancement of indigenous knowledge systems (DoE, 2001; DBE, 2011).

The SA curriculum comprises common subjects, namely, home language, first additional language, mathematics, and life skills/orientation apart from specialised subjects (DBE, 2011). This packaging of subjects ensures that the SA curriculum adheres to the prescripts of the *“Education for All”* movement as mentioned above.

The inclusion of different languages adheres to the relevance dimension of social justice (UNICEF, 2007). Prescribing that learners learn their home language and an additional language ensures that education becomes relevant to learners. Also, teaching learners their home language ensures equality of all languages. Again, in most schools, home language or first additional language becomes the language of teaching and learning (DBE, 2011; Tikly & Barrett, 2011). This makes the content of different subjects relevant, easy, and understandable. Also, to realise relevance of the curriculum, various countries have adopted a system consisting of a bilingual or

trilingual language approach, preferring indigenous languages in the early school years and the other languages in the later years (DoE, 2001; Tikly & Barrett, 2011).

Mathematics is indispensable to quality education and human rights. By having numeracy skills, people can do basic things like counting, calculating money, buying, selling, and contributing to the economy of the country (UNICEF, 2007; DBE, 2011). This is a social justice issue as people are enabled to contribute towards the economy of the country; mathematics provides a relevant dimension of social justice in this case.

Life skills are so helpful in quality education because they ensure that learners learn about issues that are relevant in their everyday lives. Life skills is a social justice phenomenon because it teaches learners about issues like HIV and AIDS awareness, health education and conflict resolution (Tikly & Barrett, 2011). Most researchers that are subscribing to the human rights approach to social justice emphasise that life skills in education makes people aware of issues like conflict resolution, cultural repression, social inequality, causes of poverty, causes of war, etc. (UNICEF, 2007; Tikly & Barrett, 2011).

2.3.3 The democratic dimension of social justice

The democratic dimension relates to the participatory parity aspect of social justice. As mentioned above, participation parity, according to Fraser (2007), refers to hearing the voices of all people. This dimension calls for the participation of all individuals in their education, the education of their children and the education of the society at large. The quality of education is a subject of debate for learners, parents, and communities (Fraser, 2007; Tikly & Barrett, 2011; Tunjera, N. & Chigona, A. 2020). This calls for the voices of all people within the education setup, and the participation of every individual in education. Concepts like life skills should not be a school subject only but should be part of the entire education of people, i.e. in and outside of school.

According to this dimension, education should not only be realised in school but should also be available in other areas of society. Community organizations, Non-Governmental Organizations

(NGOs), religious organizations, advocacy groups, and so on, should be instrumental in education and the quality of education. These organizations should assist the education system in debating issues around societal norms and values, religion, cultural values, multiculturalism, and traditional values (Tikly & Barrett, 2011).

2.4 UNDERSTANDING ICT IN EDUCATION

The term ICT is used to describe the range of hardware, which includes radio, television, desktop computers, portable computers, laptops, iPads, projection equipment, cellular phones; software applications, which include generic software, specific software, multimedia resources, ‘apps’; and connectivity, which is the Intranet and Internet. The above resources are used for communication, creation, dissemination, storage and management of information (Kozma, 2005; Nyambane & Nzuki, 2014). Some authors refer to these as digital resources, but this study prefers to use the term ICT.

ICT characterizes current society, pervading all aspects of modern life. Recently, there has been a global awareness into how ICT can be utilized to deliver education in an efficient and effective way across all levels of education, including formal and non-formal settings (Glazzard, Denby & Price, 2014; Jung & Ottenbreit-Leftwich, 2019).

ICT and the realisation of quality education and development should not be viewed as separate entities. ICT should be viewed as enhancing innovation in education. ICT has the potential to enable teaching and learning to happen anywhere, anytime, and anyhow (Anderson, Van Weert & Duchâteau, 2002; Kozma, 2005; Nyambane & Nzuki, 2014; Voogt, & McKenney, 2017). Again, ICT expands the range of options available for the provision of quality education. It provides teachers with a range of choices in terms of teaching and learning strategies, strategies to administer and manage learning environments and different assessment strategies (DHET, 2014; Glazzard, Denby & Price, 2014; Jung & Ottenbreit-Leftwich, 2019).

Another important contribution of ICT to the global call of the “*Education for All*” campaign, is that ICT can easily open access to education, provide educational resources to improve the

quality of teaching and learning, and can be used by education managers to improve the effective management of educational institutions (UNESCO, 2002). ICT is also seen to promote educational modification, advance learners' life skills, and prepare them to participate in the global economy and the information society (Kozma, 2005; Hepp, Welling, & Aksen, 2009; Voogt, & McKenney, 2017).

Furthermore, with regard social justice, ICT is a way of assisting governments to improve on service delivery (Kozma, 2005). It can also be a mechanism for increasing the productivity and efficacy of both the public and the private sector. ICT is regarded as a tool for alleviating poverty in communities, increasing access to health care services, providing education to all, and improving people's quality of life. (UNESCO, 2002; Kozma, 2005).

In the context of this study, the link between ICT, quality education and social justice appears obvious. The use of ICT and its networks has the potential to expand the education institutions' range of processes and influence to go beyond their geographic locations (Kozma, 2005; Voogt, & McKenney, 2017). This simply means that the use of ICT can ensure the inclusion of learners that are in rural areas or remote areas. Again, ICT can be utilized to assist multiple teaching and learning functions and can also serve a diverse array of learners including the disabled and marginalised groups (UNESCO, 2002; Kozma, 2005; Tunjera, N. & Chigona, A. 2020). Having looked at all the above, ICT has the potential to benefit both teachers and learners, and these benefits can enable schools to realise their core function of providing quality education.

2.4.1 ICT in higher education

The infusion of ICT in education is a given and not a debate anymore (Glazzard, Denby & Price, 2014; Nyambane & Nzuki, 2014). The use of computers and personal computers is high in both organizations and households, respectively (Nyambane & Nzuki, 2014). Mobile technology and its use have become an indispensable part of every person's life. Internet use and mobile Internet penetration is extremely high as people are using the Internet through computers, tablets, and

mobile phones. Through all these, ICT has become the central feature of schooling and the 21st century classroom (Liu, 2012; Glazzard, Denby & Price, 2014; Karatza, 2019).

The above situation has influenced governments to come up with legislation for ICT. The policy objective of the DHET is to have a higher education system that is responding to individual citizens' needs; the needs of employers in the public and private sectors; and to develop and respond to the objectives of the broader society (DHET, 2014). Looking at this policy requirement, higher education institutions are expected, by government, to produce teachers that will assist citizens in both the public and private sectors to cope with the demands of 21st century living (DHET, 2014; Glazzard, Denby & Price, 2014; Karatza, 2019).

Lately, ICT is seen as an integral part of educational reform processes geared towards improvement of access to education and the advancement of quality of education (Van Wyk, 2015). ICT is not a just a tool to replace existing teaching strategies, but an important instrument or mechanism utilized to advance new ways of teaching and learning (Nyambane & Nzuki, 2014; Voogt, & McKenney, 2017). ICT is an integral part of education because it ensures that education fulfils its social justice role. Below are some of the recent ICT trends that promote quality education and advance social justice.

2.5 RECENT ICT DEVELOPMENTS IN EDUCATION

ICT has become an indispensable part of education in recent years. The role of e-learning and educational technology has become part and parcel of schools. The trends in the evolution of these technologies have ensured that schools adhere to the prescripts of social justice. From the above discussion of social justice, the below trends will ensure that education institutions eliminate barriers to access to education, reduce travel time associated with distance from an educational institution, assist with redistribution of resources, allow for personalised learning, and other benefits.

Below are ICT and educational technology trends that advance quality education and social justice. These technological advances ensure that ICT adheres to the dimensions of social justice.

2.5.1 Web 2.0 Technologies

The concept Web 2.0 refers to the varying inclinations in the usage of the World Wide Web (WWW) technology (Murugesan, 2007). The WWW is composed of technologies that improve the sharing of secured information. These technologies encourage end-users to be creative when exchanging information and encourage end-users to collaborate with one another (Shang, Li, Wu & Hou, 2011). They are also technologies that make the end-users to be more active when using the web. This technological advancement has given birth to social networking sites like Facebook, Twitter, Instagram, etc. Motion picture sites like YouTube, YouTube Kid, blogs, wikis, etc. are some of the technological developments that came about because of the WWW (Murugesan, 2007; Shang, et al., 2011; Voogt, & McKenney, 2017).

Searching, links, authoring, tags, extensions, and signals are the distinguishing characteristics of Web 2.0 technologies (Andersen, 2007). The search features of these technologies enable users to find information through keyword searching. The link feature guides users to important information and the best pages that are frequently used on the said topic (Shang, et al., 2011).

The authoring feature gives the users the authority to update the given content and create their own (Andersen, 2007; Shang, et al, 2011; Voogt, & McKenney, 2017). Tags categorise content by creating tags that simplify information searching. The extensions feature is used to automate pattern matching, and the signals feature uses the technology that notifies users of content changes (Andersen, 2007; Shang, et al., 2011; Karatza, 2019).

The Web2.0 technologies are advantageous to education because they inspire teachers and learners to utilize technology in classrooms. Using Web2.0 technologies in schools encourages active participation of the end-users, be it teachers or learners (Shang, et al., 2011). It affords the end-users an opportunity to create content rather than passively receiving it. When using these technologies, teaching is not top-down but rather a move towards a more constructivist pedagogy. Web2.0 encourages learners to take responsibility and co-create their learning experiences (Bennett, Bishop, Dalgarno, Waycott & Kennedy, 2012; Liu, 2012; Voogt, & McKenney, 2017).

When using Web2.0 technologies in the classroom, teaching and learning becomes interesting to learners because of its ease of communication, coordination, and online self-expression (Murugesan, 2007; Bennett, et al., 2012).

Again Web2.0 technologies offer learners new prospects to take control of their learning (Andersen, 2007). They also enable more collaborative ways of working that allow for the creation of communities of practice and encourage dialogue and knowledge sharing (Andersen, 2007; Shang, et al., 2011; Bennett, et al., 2012).

In summary, Web2.0 technologies are referred to as the “read-write” technologies that contribute to content and interact with other web users. This study will discuss a few of the technological applications that are relevant to education and teacher education.

2.5.2 Mobile learning (m-learning)

Mobile learning has risen because of the increased number of learners possessing electronic mobile devices, and advances in wireless, 3G and 4G technologies (Booyse & Du Plessis, 2014). These hand-held ICT devices have penetrated education and have influenced teaching and learning. M-learning refers to the usage of wireless or mobile gadgets by learners while they are in motion (Booyse & Du Plessis, 2014). Devices that are frequently used for these purposes are mobile phones, palmtops, tablets, PCs, laptops, personal media players, etc. (Park, 2011).

M-learning is characterized by using the above-mentioned devices connected and independent of classroom time, space and sometimes teachers (Booyse & Du Plessis, 2014). Just like face to face teaching and learning, M-learning can deliver almost any educational experience. Learners can use mobile technology to facilitate meetings with peers all over the world through video conferencing. It can also be used by learners to share documents or projects using cloud computing (Park, 2011; Booyse & Du Plessis, 2014).

According to Melhuish & Falloon (2010: 5), there are “five features of M-learning that make it beneficial to education. First, the devices are portable and can be easily carried around by

learners. Second, these devices are affordable and as a result they can be easily acquired by learners. Third, the technology employed allows for real-time learning opportunities. Fourth, the technology makes it possible for learners to network easily through the Internet. Last, M-learning makes it possible for individualised and personalised learning experiences”.

Regarding portability, mobile devices change the pattern of teaching and learning. The devices enable education not to be confined to the four walls of the classroom. They also increase participation in education (Melhuish & Falloon, 2010; Park, 2011; Voogt, & McKenney, 2017). Second, because of their affordability and ubiquitous access, the devices are easily accessible and enable learners to be part of the global community.

Third, the mobile devices engage and process information whenever and wherever learners want and decentralise teaching and learning (Melhuish & Falloon, 2010; Park, 2011, Karatza, 2019). Fourth, M-learning enables social interactivity and connectivity among learners themselves and among teachers and learners. For instance, the use of mobile applications with their distinct features enable learners to share their queries or educational discoveries with each other in real-time. Last, regarding their individualised and personalised experiences, the devices’ single user logon and personalised choice of applications caters for learners’ individual needs (Melhuish & Falloon, 2010).

From the above, it is evident that the impact of mobile technology and social media in education has changed the way learners interact and present ideas (Melhuish & Falloon, 2010; Park, 2011; Tunjera, & Chigona, 2020). This has a huge impact on scholastic exchange and credibility of information among institutions. This feature greatly benefits the quality of education and advances education from a social justice point of view (Johnson, Becker, Estrada & Freeman, 2014).

2.5.3 Open Educational Resources (OER)

The study thus far has shown that easy entry to education, and acquisition of information and knowledge are fundamental rights to every human being. The cost associated with the provision

of access to quality education became a problem worldwide (UNESCO, 2002). This encouraged the global community to investigate means that could eradicate the high costs of educational resources. As a result, Open Educational Resources (OER) was introduced and adopted by many higher education institutions in many countries (Hylén, 2006).

According to Hylén (2006: 3) the term “OER was first adopted by UNESCO in 2002”. This conference adopted OER as an open means of providing of educational resources to many people. For these people to use OER, they must have access to ICT. Also, most importantly, OER are accessible to all on a non-commercial basis (Hylén, 2006). These digitalised materials are available free of charge and are open to teachers, learners, and communities for usage and for the purposes of teaching, learning and research (Hylén, 2006). Again, Johnson, et al. (2015: 14) refer to OER as teaching, learning and research resources that are publicly available for use by all, that have been released under an intellectual property license for free use by all, and can be used for different purposes.

From the above two definitions one can easily define OER as any resources available free of charge or at nominal costs to members of the society for educational purposes and research (Johnson, et al., 2015). These resources include textbooks, course materials, full courses, modules, streaming videos, simulations, games, software, assessment tools and virtually any other materials that can be used for educational purposes. In most cases, in European countries, OER is used to access higher education or to educate communities on issues of national interest like literacy or democracy or HIV and AIDS, and others.

The advantages of these resources are that they are digital in nature and licensed through an intellectual property license which gives permission for their free use or re-purposing by different users (Krelja, 2016). Again, with OER, education can fulfill its social justice purpose of being accessible to everyone who wants to learn, and teachers can enrich their teaching practice (Krelja, 2016).

Furthermore, OER encourages and provides independent individual flexible learning opportunities for learners. The licensing of OER ensures free education, and their availability bridges the gap between different strata of society and between countries (Hylén, 2006; Krelja, 2016). The other advantage of OER is that they quicken knowledge flow and increase the

number of individuals involved in the education process (Hylén, 2006). So, from a social justice point of view, one can say that OER ensures inclusivity in education and the redistribution of resources, and encourages the participation of all people in education, be it formal or non-formal education.

To come up with a plan to facilitate the accessibility of higher education for most South Africans, the DHET hosted a seminar on the 23rd July 2013 to discuss open learning (DHET, 2013). This seminar was predominantly attended by SA universities and produced a Concept Note on Open Learning in Post School Education and Training in SA (DHET, 2013). The intention of DHET with this document was to encourage higher education institutions in SA to increase access to educational programmes, open curriculums, and open choices to programmes and assessment options within the South African higher education system (DHET, 2013). This was an attempt by the SA government to open access to higher education and therefore respond to the prescripts of social justice and quality education.

2.5.4 Massive Online Open Courses (MOOCS)

To facilitate OER, the mode of Massive Online Open Courses (MOOCS) was established (Yuan & Powell, 2013). MOOCS are rooted within the principles of open and free education and knowledge shared irrespective of financial background and/or geographic locations (Yuan & Powell, 2013). This concept revolves around massive intake of students or learners who are accommodated in online classes that are not capped. Second, the classes are open, which means these classes are free but if one needs a certificate of attendance a nominal fee is charged by other institutions (Karsenti, 2013). Third, there is no attendance of classes, everything is online. It is a combination of streaming video, forums and written and interactive online materials (Yuan & Powell, 2013). Fourth, to emphasize key features of the classroom such as engagement, interactivity, and networking MOOCS are mostly in the form of formal and non-formal courses of different programmes (Chen, 2013; Karsenti, 2013; Yuan & Powell, 2013).

MOOCS may be considered a new kind of distance education, especially within the higher education sector (Karsenti, 2013). Their advantages are that they make higher education accessible, they cultivate the literacy of people, and they ensure lifelong learning (Chen, 2013; Karsenti, 2013; Yuan & Powell, 2013). MOOCS also expand access to university education globally, and they allow students a better view of the world. Their use enables students to learn other cultures and education systems (Chen, 2013). MOOCS are an ICT-orientated means of advancing the participation dimension of social justice as discussed above. They massively open-up access to higher education globally.

2.5.5 Flipped classrooms model

Another recent trend in ICT in education is the flipped classroom model. The flipped classroom is a pedagogical model that swaps the elements of classwork with those of homework (Du, Fu & Wang, 2014). With this model, learners at home view a short video prepared by the teacher, of the topic to be discussed in class. The parents assist their children with the lesson at home and the time they have in the classroom is dedicated to discussing assessment activities and/or projects given by the teacher (Du, Fu & Wang, 2014; Johnson, et al., 2015; Schmidt & Ralph, 2016).

Flipped classroom is a model that flips time spent in the classroom with the time spent outside the classroom. It shifts the learning responsibility in terms of pace, volume of content and content level from the control of the teacher to the control of the learner (Johnson, et al., 2015; Jin, & Harp, 2020). This model encourages higher activity involvement, critical and creative thinking and project-based learning. It also promotes the involvement of parents in the education of their own children and encourages learners to work together to solve local and global problems (Du, Fu & Wang, 2014; Schmidt & Ralph, 2016).

This model again encourages learners to work at their own pace, fosters collaborative learning and limits the frustrations of learners when faced with a difficult task (Schmidt & Ralph, 2016). It also benefits learners whose learning styles are disadvantaged by the normal education

environment (Du, Fu & Wang, 2014; Jin & Harp, 2020). Learners go to class with content and the role of the teacher is that of an expert who provides support and eradicates misconceptions (Schmidt & Ralph, 2016). This pedagogical approach has the same features as blended learning, problem-based learning and other teaching approaches and tools that are leading in a collaborative learning environment (Johnson, et al., 2015).

2.5.6 Gamification

Gamification is one of the latest trends in ICT in education and has gained popularity globally. (Sandusky, 2015). Gamification refers to the application of gaming features, procedures, design rudiments and frameworks into a non-game environment to promote user or player engagements (Stott & Neustaedter, 2013; Sandusky, 2015). The game mechanics involve elements like points, leader board and gadgets that are common to many games. Within the education setting, games are designed to have elements of fun and motivation while systematically enhancing learning and changing learners' behaviors and achievements (Stott & Neustaedter, 2013; Kriel, 2015).

Furthermore, Kriel (2015: 9) makes a clear differentiation between gamification and the use of games in the classroom. The difference is that games are used for leisure while gamification is the application of features of games to entice people to be involved in education (Kriel, 2015).

These game elements can mostly be used in a blended learning set-up and/or in open-ended digital experiences that are technologically driven (Stott & Neustaedter, 2013; Sandusky, 2015). The elements of gamification are critical to social justice in the sense that fun in education can be provided in both physical space and online space. The online space is used to accommodate learners from even remote rural areas (Stott & Neustaedter, 2013; Kriel, 2015). In short, gamification can advance the inclusive dimension of social justice.

Again, games, as part of gamification, can be accessed from different digital platforms like smart-phones, tablets, Learning Management Systems (LMS) or any other digital device. As a result of the digital nature of games, learners are not confined to one gadget or digital platform and can use these at any time (Stott & Neustaedter, 2013; Kriel, 2015; Sandusky, 2015).

Furthermore, gamification assists in developing critical and creative thinking skills, problem solving, ICT literacy skills, and learner collaborative skills in the classroom (Kriel, 2015). Many teachers might think that designing games for classroom use is difficult, but it is not.

Games for education involve a linear five-step design process. According to Huang & Soman (2013: 7), “the five-step process of gamification in education requires that first, teachers should understand the target audience and the context. Second, they should define learning objectives.

Third, they should be involved in structuring the experience. Fourth, teachers should identify the required resources, and last, they should apply gamification elements”.

The above process is not difficult to apply but requires teachers to do proper planning, and in most cases teachers who have the knowledge of computer design software like Adobe, Dreamweaver, Authorware, and other similar software are able to design computer games with ease (Huang & Soman, 2013). It should also be noted that the above process not only applies to computer / digital games but can also apply to non-digital games (Huang & Soman, 2013; Kriel, 2015).

Benefits of gamification in education

As a new concept in education, gamification has constantly and successfully benefited the 21st century classroom. The following are among other benefits of gamification in education:

First, gamification increases the fun and enjoyment in learning. The learning becomes fun and it is an inspiration to learners to be engaged in their classroom activities (Kriel, 2015).

Second, it provides learners with the freedom and ownership of their learning. This is because learners can learn at their own pace and time (Kriel, 2015; Sandusky, 2015). Third, the use of educational games gives learners the freedom to fail. According to Stott & Neustaedter (2013: 1), “games are designed to encourage learners to participate in education without fearing of making mistakes that are irreversible because games provide players with multiple existence within a game and allows them to start from scratch should they falter”. This has the same effects as

formative assessment. Transformative pedagogy encourages formative assessment and so, gamification provides the same principle of learners working on something and if they fail, they try again until they get it correct (Stott & Neustaedter, 2013; Kriel, 2015; Sandusky, 2015).

Fourth, gamification can provide rapid feedback. Research has shown that feedback is important in education because it encourages progress (Stott & Neustaedter, 2013). So, gamification has this element of providing players with immediate feedback and this motivates and encourages players to be involved in the game and as such benefits their learning (Stott & Neustaedter, 2013; Kriel, 2015; Sandusky, 2015).

Another benefit of gamification is that it encourages progression in learning. Stott & Neustaedter (2013: 29) say this has, “in modern pedagogy, the same principle as scaffolding. The more learners succeed at a lower level the more a learner is encouraged to go to the next level”. So, when the game has been well designed and structured following the Bloom’s Taxonomy, the more learning will be in a scaffolding instruction (Stott & Neustaedter, 2013; Kriel, 2015). This benefit makes learning less intimidating to the learners because it is divided into small relatively easy tasks that encourage players to progress from one level to the other (Kriel, 2015).

The above-mentioned trends are important to the use of ICT for quality education and social justice. These trends call for teachers to assume a different role, unlike before. The next section looks at the changing role of teachers in the 21st century and their impact on quality education and social justice.

2.6 ICT IN THE PRACTICE OF 21ST CENTURY TEACHING AND LEARNING

2.6.1 The changing role of teachers in the classroom

The above discussions show the high expectations regarding the roles of teachers in the 21st century classroom. Among the expected roles, teachers must cope with the rapidly ever-changing educational technology and the needs of this new breed of learners, the so-called Millennials. As

schools are among the core drivers of social justice, the tasks that teachers must perform are increasingly becoming important to the 21st century classroom (Roberts, Newman & Schwartzstein, 2012; Mokoena, 2015).

As the major role-players within this ever-changing digital world, teachers have the role to foster coherence and discipline in thinking. They also should ensure the availability of different sources of information to benefit and advance critical thinking within a society (Watson & Watson, 2011; Jung & Ottenbreit-Leftwich, 2019).

Again, the role of teachers, in this information explosion, is to teach learners to retrieve, analyse and disseminate information and to retain coherence when developing arguments (Watson & Watson, 2011). Teachers must also show learners how to integrate information from different disciplines and to be able to think in inter-disciplinary modes as they construct their own meaning (Johnson, et al., 2014).

The Internet is useful to education, but it can also be harmful. It provides learners with different kinds of content that can be of help to their studies but can also distract them. For example, sex and pornography is trending in the digital space. Identity theft is rife, and rumours and gossip have invaded the social networking space. All these are causing ethical dilemmas and so teachers have the role to teach learners ethics of the digital world (Chen, 2013).

Here, the teachers' responsibility is not to disadvantage learners from acquiring information but to provide them with competencies and knowledge to have a choice between right and wrong or between good and bad. Teachers need to teach learners ethics to adhere to for the benefit of themselves and the society (Chen, 2013; Du, Fu & Wang, 2014).

ICT has made it possible for learners to have access to information about an array of choices in almost all aspects of life (Krelja, 2016). With this in mind, teachers have the role to guide learners on how to cope with the challenge of unlimited choices. This involves the skill to cope with choices to make about life in general, careers, businesses, studies, etc. (Chen, 2013; Du, Fu & Wang, 2014).

Learners are supposed to be guided to act responsibly and decisively without succumbing to pressure of doing wrong. Therefore, access to information must be used to better livelihoods of learners and the community they live in (Connell, 2009; Du, Fu & Wang, 2014; Krelja, 2016).

Another role of teachers in the 21st century classroom is to inspire learners to be originators of new knowledge (Pritchard, 2007; Karsenti, 2013). The latest educational environments in which learners find themselves call for them not to be just recipients of knowledge and information but to also be creators of it (Karsenti, 2013; Du, Fu & Wang, 2014). For example, realizing intellectual property as OER for usage and adaptation under Creative Commons is a way of encouraging creativity from learners to globalize education and encourage information sharing (Hylén, 2006; Krelja, 2016).

Lastly, creativity and design elements have become indispensable to the 21st century classroom (Connell, 2009; Du, Fu & Wang, 2014; Krelja, 2016). Teachers are expected to have abilities to create and design resources in different forms. The digital world requires teachers to be creative (Du, Fu & Wang, 2014). This creativity is needed for the development of among others, MOOCS, OER, flipped classrooms, Web 2.0 technologies, gamification, etc. (Chen, 2013; Stott & Neustaedter, 2013; Du, Fu & Wang, 2014; Krelja, 2016).

2.6.2 Advantages for teachers

The first benefit of ICT in education is that it enables teachers to gain knowledge, skills and attitudes that make them globally competitive and informed (Louw & DuToit, 2010). The use of the Internet encourages teachers to share best practices with other teachers that are teaching the same subjects; it also encourages them to share resources, expertise and advice among a community of practice (Pritchard, 2007; Van Wyk, 2015). It furthermore provides teachers with a pool of resources to be used in the classroom to explain difficult concepts to learners.

Second, the use of different hardware and software enhances teachers' creativity. A teacher that can use different hardware and software is enabled to present subject matter creatively in ways that meet the immediate educational needs of the learners. The teachers' ability to access

information with ease enables them to benchmark themselves against their peers locally, nationally, and even globally (Glazzard, Denby & Price, 2014; Van Wyk, 2015). This benefit further enables teachers to employ innovative teaching methods and strategies. It also turns teachers into reflective practitioners that set high standards of teaching (Hatton & Smith, 1995; Van Wyk, 2015)

The third, important benefit of ICT is its great flexibility. ICT is a tool that supports existing teaching methods in a face-to-face classroom, it enables the facilitation of education through online learning, and it makes education inclusive in nature (Pritchard, 2007; Nyambane & Nzuki, 2014; Van Wyk, 2015). The inclusive nature of ICT ensures that learners with learning barriers and physical handicaps can be easily accommodated in the classroom (Younie & Leask, 2013; Van Wyk, 2015).

Fourth, ICT is labour saving in the sense that it makes it easy for teachers to access information, plan and prepare lessons, design teaching activities and develop assessment tasks (Louw & DuToit, 2010; Van Wyk, 2015). ICT furthermore provides teachers with effective tools that make it easy to present learning activities and to provide feedback to learners with ease (Louw & DuToit, 2010).

Last, the use of ICT assists with the bridging of the digital divide between teachers and learners. Using ICT, teachers can easily move away from the teacher-orientated approaches toward teaching in a learner-centered approach (Louw & DuToit, 2010). Teachers that integrate ICT in their teaching in most cases are relevant to their learners and this encourages a harmonious relationship between the two parties (Louw & DuToit, 2010).

2.7 BARRIERS ASSOCIATED WITH ICT INTEGRATION IN SCHOOLS

ICT integration is one of the latest changes that has been introduced to teaching and learning (Nyambane & Nzuki, 2014). Like any other new development or change, it comes with challenges, obstacles, and barriers. As mentioned above, the main challenges towards ICT integration are technology, connectivity and knowledge and skills.

In most cases, education as a field cannot solve materials-related barriers like connectivity and resources. But education is relevant in solving non-material barriers like knowledge and skills. Having this in mind, it is critical for teacher training institutions to provide adequate knowledge and skills to pre-service teachers. Knowing barriers associated with ICT integration will inform the correct training of pre-service teachers.

This section of the study focuses on the barriers associated with teachers' knowledge and skills regarding the infusion of ICT in the classroom. Many researchers use different categories to classify barriers that hinder the effective use of ICT by teachers. Among the researchers that have looked at this issue, this review has adopted the categories that were first outlined by Ertmer in 2009, as quoted by Bingimlas (2009) and Goktas, Yildiring & Yildiring (2009).

Furthermore, this review will discuss the research by Tsai & Chai (2012) which was an extension of the study that was conducted by Ertmer (2009). According to Ertmer (2009: 48), "barriers to ICT integration are both extrinsic and intrinsic". Extrinsic barriers are regarded as first-order barriers while intrinsic barriers are second-order barriers (Goktas, Yildiring & Yildiring, 2009).

2.7.1 First-order barriers (Extrinsic)

Ertmer's (1999) first-order barriers include external factors that hinder the integration of ICT in the classroom. These are lack of adequate access, time, training, and institutional support (Bingimlas, 2009; Goktas, Yildiring & Yildiring, 2009; Tsai & Choi, 2012).

Lack of accessibility

Several research studies have shown that lack of ICT resources is a major barrier to ICT integration. ICT integration depends on the availability of hardware, software, and the Internet (Bingimlas, 2009). Teachers who do not have access to ICT resources, both at school and at home, are unlikely to integrate ICT (Bingimlas, 2009; Buabeng-Andoh, 2012; Nyambane & Nzuki, 2014).

Accessibility of ICT resources for teachers differs from continent to continent and country to country. In a continent like Europe, hardware and software barriers are not widely experienced, but the problem is with broadband Internet access, poor organization of resources, and poor-quality hardware (British Educational Communications and Technology Agency, 2004; Bingimlas, 2009). In Africa, the situation is different as barriers range from hardware, software, and Internet access. But in developing African countries the situation is not as bad because governments have prioritized the use of ICT in several government sectors, including the education sector (Buabeng-Andoh, 2012; Nyambane & Nzuki, 2014).

In SA, the following initiatives are worth mentioning as they will show the SA government's intention to curb the lack of ICT accessibility among the citizens and schools in this country. In 2004, the then Department of Education published a policy framework entitled the *White Paper 7* (DoE, 2004). In this document the DoE committed itself to ensuring that every SA learner at all schools will be ICT capable by 2013 (DoE, 2004). Furthermore, the DBE adopted a strategy to provide all teachers in schools with laptops to improve ICT usage in schools (DBE, 2015).

The other initiatives are the presidential initiative as outlined in the National Development Plan (NDP) 2030 (National Planning Commission, 2013). One of the milestones of the NDP is to make high-speed broadband Internet universally available to all citizens at a competitive price (NPC, 2013). Furthermore, this plan intends to improve the schools' infrastructures in the rural areas. The logic behind this is that in rural communities, schools are one of the few institutions that communities have access to (NPC, 2013). So, schools in these communities should be strengthened and equipped with the latest infrastructure, equipment and resources (especially ICT infrastructure) to enhance the school's role in assisting communities with education, library facilities and media, and to act as a source of information (NPC, 2013).

Technical support

Another external barrier associated with ICT integration is the technical ability of teachers to solve hardware, software, and network problems. Many teachers find it difficult to solve technical faults of their ICT equipment and this discourages them from using these resources in the classroom (BECTA, 2004; Bingimlas, 2009). Technical glitches such as waiting for the

website to open, inability to use certain operating and applications software, failing to connect to the Internet etc., discourages teachers in the use of ICT (Bingimlas, 2009).

Education departments nationally or districts and schools should ensure that teachers are given technical support so that they are not discouraged. Alternatively, schools in a district should have a technical person specifically appointed to support several schools, or one or two willing teachers should be taken for technical in-service training to support others. If there is no technical support, hardware will regularly breakdown, there will be no maintenance, and ICT laboratories and equipment will be absolute white elephants (BECTA, 2004).

Lack of time

Several research studies on the barriers to ICT integration agree with Ertmer (2009) who found that teachers indicate lack of time to be a barrier towards their integration of ICT in the classroom (Bingimlas, 2009; Salehi & Salehi, 2012). Teachers need but lack time to locate or look for information on the Internet. They also lack time to prepare lessons with ICT resources and explore and practice using the technology. They lack time to deal with technical problems and/or receive adequate technical training (BECTA, 2004; Bingimlas, 2009).

On the other hand, the lack of time cannot be a barrier if a teacher has enough ICT skills because in its nature, ICT enables teachers to work smarter rather than work harder. So, having well developed skills allows the teacher to work faster with resources; as a result, it saves them time and their lessons are professionally presented.

Lack of professional development and support

Professional development and support is an indispensable key factor of ICT integration. The rapid changes in ICT requires that teachers be given professional development from time to time (Nyambane & Nzuki, 2014).

BECTA (2004: 28) indicated that as part of the initial training of teachers, their professional training should have pedagogical training, content training and skills training that is coupled with ICT integration. For teachers to be relevant to their learners, the authorities should provide them with Continuous Professional Development (CPD) that is relevant to the demands of the 21st century classroom. The lack thereof becomes a barrier to in-service training of teachers; this also

affects the new teachers joining the profession because they find things in school to be old-fashioned (Nyambane & Nzuki, 2014). However, in SA the DBE has developed a framework for digital learning as an ICT integration CPD guiding document (DBE; 2018)

2.7.2 Second-order barriers (Intrinsic)

These are the intrinsic barriers associated with the abilities and skills of teachers in how to use ICT. They include teachers' beliefs, vision, and views about the use of ICT in the classrooms (Goktas, Yildirim & Yildirim, 2009; Tsai & Choi, 2012; Ndebele, 2020). This category of barriers is a teacher-level barrier as they indicate individual teachers' capabilities of dealing with ICT for teaching and learning (Bingimlas, 2009; Goktas, Yildirim, & Yildirim, 2009; Tsai & Choi, 2012). The following are the second-order barriers that have been identified by most research studies.

Lack of computer self-efficacy

Self-efficacy in general refers to the self-confidence that an individual has in their capability to do a thing or strive to do thing (Buabong-Andoh, 2012; Jin & Harp, 2020). It revolves around an individual's ability, belief, and confidence to perform a given task or activity to achieve certain goals or objectives (Buabong-Andoh, 2012; Ndebele, 2020). Teachers' confidence in using ICT in their classrooms contributes directly towards their computer self-efficacy. Lack of confidence and teachers' computer nervousness are contributing factors in lack of computer self-efficacy (BECTA, 2004; Bingimlas, 2009; Jin & Harp, 2020).

The first reason that makes teachers lack confidence in using ICT is that most of them consider themselves not to be well-skilled in using ICT resources. Teachers in most cases are worried they might be exposed to their learners, in the sense that they do not know how to use ICT equipment (BECTA, 2004; Jin & Harp, 2020).

The second reason that contributes towards the lack of computer-self efficacy is the teachers' fear that the use of ICT will make them lose their professional status; they see the use of ICT as replacing them or removing their traditional pedagogical skills (BECTA, 2004; Bingimlas, 2009; Jin & Harp, 2020).

Lack of ICT competence

ICT competence refers to the teacher's ability to handle a variety of ICT resources and applications for different purposes (BECTA, 2004). For example, the teacher's ability to use resources like a computer, Tablet (iPad), Smart-phone and their applications, i.e. applications programmes and mobile apps for teaching and learning. The confidence level of teachers in using a variety of resources also contributes towards this barrier (BECTA, 2004; Johnson, et al, 2015; Ndebele, 2020).

Most studies have indicated that many teachers who are unable to integrate ICT in their teaching and learning is because of a lack of technological knowledge and skills (Bingimlas, 2009). To boost teachers' ICT competence, they must be provided with adequate, appropriate and timely ICT training as part of their CPD or as an indispensable part of their teacher education (BECTA, 2004; Bingimlas, 2009, DBE, 2018).

Gender

Gender differences have been identified as a barrier among teachers, towards ICT integration. There are differing views on the matter (BECTA 2004). Research by Buabeng-Andoh (2012: 140) revealed that male teachers used ICT more than female teachers, while the research conducted by BECTA (2004) indicated that there is a little difference regarding the correlation between teachers' gender and their usage levels of ICT. Looking at the two, one can conclude that the two studies were conducted at two different continents – i.e. the Buabeng-Andoh research was conducted in Ghana while the BECTA study was conducted in Britain, hence the differences (Buabeng-Andoh, 2012; Jin & Harp, 2020).

Resistance to change

Resistance to change by teachers towards ICT has been found to be a barrier (Bingimlas, 2009). Change is not easy in any circumstance because it deals with beliefs and attitudes. Teachers' knowledge and understanding of how to infuse ICT in their teaching is an integral factor in their use of ICT (BECTA, 2004; Buabeng-Andoh, 2012). So, if teachers do not believe that ICT will positively impact their teaching and their facilitation of learning, they will not change. Teachers resist change because of their personal beliefs (BECTA, 2004; Buabeng-Andoh, 2012; Jung & Ottenbreit-Leftwich, 2019).

Another view is that resistance to change seems not to be a barrier itself; instead, it is an indication that something is wrong (Bingimlas, 2009). This resistance to change is because of, among other factors, new developments, Internet access, technical support, technical expertise, or time for planning (Buabeng-Andoh, 2012). According to Bingimlas (2009: 238), "first-order barriers are the ones that make teachers resist change and ultimately make them to have a negative attitude towards ICT integration".

2.7.3 The third-order barriers

In recent years, more focus has been on the TPACK framework which addresses the required knowledge base towards ICT integration (Tsai & Chai, 2012). After scrutinizing the TPACK framework, Tsai and Chai (2012: 1058) believe that "the need to think about design is a barrier that hampers the integration of ICT".

In recent times, they believe, the classroom has become a dynamic environment that needs teachers to use their design thinking skills to create attractive learning materials and activities. Teachers must show creative abilities they can use in different learning contexts (Tsai & Chai, 2012). For example, teachers should be creative when developing Microsoft PowerPoint presentations, i.e. their presentations should have colour, animations, appropriate sequences, sound, and other features that encourage viewing. So, the lack of design thinking skills can be a barrier to ICT integration because if the teacher does not have them, the digital content presented to learners can be boring (Tsai & Chai, 2012)

2.8 CONCLUSION

This chapter has shown the importance of ICT in education and how indispensable ICT is in the advancement of social justice. The discussion first explained quality education, then discussed dimensions of social justice. The chapter further showed the relationship between ICT, quality education and social justice. From this discussion it is evident that through ICT, education can serve and be accessible to people with disabilities (inclusive education), people living in remote rural areas, and different gender groups. This chapter showed that through ICT, education will advance social justice matters like the developments for poverty alleviation, access to education regardless of locality, digital divides between communities, and digital divides between teachers and learners. With all these in mind and the latest educational technologies, this chapter has shown that the role of teachers has changed drastically. So, teacher education institutions should be modelled to produce teachers that can survive the demands of the 21st century classroom and the advancement of social justice.

As this chapter has shown the relationship between ICT, quality education and social justice. The next chapter of this literature review will deal with the relationship between knowledge, curriculum, and ICT. The chapter will advance a discussion on the knowledge types needed in the curriculum of pre-service teachers. The chapter broadly explains what and why knowledge and curriculum are important in teacher education. Then it looks at the conceptual framework, i.e. Technological Pedagogical Content Knowledge (TPACK) that according to this study will clearly outline the knowledge base needed by pre-service teachers to cope in the 21st century classroom. Furthermore, this chapter will discuss the three theoretical strands that are relevant to the topic, namely, Bernstein's theories on curriculum structure, social constructivism and connectivism. Both the conceptual framework and the theoretical frameworks are chosen because of their contribution towards knowledge building, quality education, social justice, and the ability to infuse ICT in education.

CHAPTER 3

KNOWLEDGE, CURRICULUM, AND ICT FOR TEACHER EDUCATION

3.1 INTRODUCTION

This chapter is a review of the literature on the knowledge that teachers must acquire at universities to enable them to integrate ICT in the classroom. The chapter first introduces the concepts of knowledge and curriculum. Second, it discusses the Technological Pedagogical Content Knowledge (TPACK) framework as a conceptual framework underpinning this study. Last, the chapter discusses the three theoretical strands related to this study. The three theories were chosen because of their strong alignment to knowledge, curriculum structure, social justice and ICT in education.

3.2. WHY KNOWLEDGE

Education should be open to all groups of people for it to emancipate all members of societies (Wheelahan, 2012). The emancipatory role of education should be achieved through well-structured knowledge that is captured in the curriculum of educational institutions (Biggs & Tang, 2011; Reed, Gultig & Adendorff, 2012; Wheelahan, 2012). What to be learned or what to teach characterises any curriculum (Biggs & Tang, 2011; Wheelahan, 2012). Curriculum theories, whether from an implicit or explicit point of view, are usually guided by knowledge theories or frameworks (Wheelahan, 2010; Biggs & Tang, 2011; Reed, Gultig & Adendorff, 2012).

Education institutions have a role of providing people with access to information that cannot be easily available in their families and communities (Biggs & Tang, 2011). Teachers are expected

to possess specific knowledge and skills that make this happen. Based on the above, this study intends to show the kind of expertise needed by prospective teachers to cope with the demands of their work upon completion of their studies. Again, the chapter focuses on what kind of knowledge need to be infused in the teacher education curriculum, for prospective teachers to have specialised knowledge in teaching.

In answering the question about why knowledge, it should be noted that knowledge is core to the curriculum and a well-structured curriculum sets a tone for quality education. To start with, Biggs & Tang (2011) identify the two kinds of knowledge that university students should acquire when studying. These are declarative and functioning knowledge (Biggs & Tang, 2011). According to them, declarative knowledge refers to the knowledge about things and it is mostly expressed verbally or in symbolic form. This kind of knowledge is public knowledge found mostly in textbooks that are in libraries or through the Internet (Biggs & Tang, 2011).

Functioning knowledge on the other hand is the knowledge that informs action that puts theory into practice. This is the knowledge that enables the knower to use theory for application and solve problems within a professional context (Wheelahan, 2007; Biggs & Tang, 2011). For example, in teaching, functioning knowledge enables teachers to apply pedagogic principles to content knowledge to teach better in their classrooms.

Another interesting argument about why knowledge is important in education is presented by a well-known curriculum theorist Michael Young. Young (2007:1289), in answering the question ‘*what are schools for?*’, answers this by saying “schools are institutions that predominantly focus on the acquisition of knowledge”. In explaining school knowledge, Young (2007:1294) came up with the concept powerful knowledge (Young, 2007; Reed, Gultig & Adendorff, 2012). According to him, knowledge has for many years been neglected by education policy makers and education researchers, especially sociologists of education (Young, 2007).

In explaining what powerful knowledge is, Young (2013:106) states that powerful knowledge emphasises the purpose and conditions to produce access to information. One of the characteristics of powerful knowledge are that it is consistent in nature and people who possess it have a way of thinking that is undoubtable. Second, it possesses the basis for signifying accurate alternatives, and those who have it, are able to think critically and creatively beyond their

everyday involvements (Young, 2013). Third, this kind of knowledge is gathered through one's experiences in life and its concepts are formed through evidence acquired. Therefore, because of this, powerful knowledge is evolving and can from time to time be challenged through new evidence obtained (Beck, 2013; Young, 2013). Fourth, this kind of knowledge is obtained at education institutions, especially higher education institutions, because these are places where academics and/or specialists are (Young, 2013). Fifth, this kind of knowledge is subjective because of the evolution of information and the extent to which specialisations are formed. It can change anytime because of new evidence gathered and researched (Beck, 2013; Young, 2013). Last, knowledge is often but not always specialised knowledge (Beck, 2013).

Therefore, based on the above, one can define powerful knowledge as content and independent knowledge that is acquired in school. It is specialised knowledge which is different from but complements everyday knowledge. Powerful knowledge is systematic in nature and involves the blending of both specialised and everyday knowledge. As it is mostly found in education institutions, it is characterised by selection and pacing of content. Teachers who possess powerful knowledge can accommodate different types of learners – i.e. they can operate within the inclusive classrooms as discussed above. It also harmonises the relationship between teachers and learners of different types.

From a social justice point of view, Wheelahan (2010:8), when answering the questions (a) *what should we teach?*, (b) *what knowledge is important?*, and (c) *why is knowledge important?*, states that the primary role of education is to provide access to knowledge. Also, theoretical knowledge is indispensable to democracy and access to it contributes to distributional justice. Looking at Wheelahan's (2010) views, one notices that these are like the three dimensions (inclusion, relevance, and democracy) of social justice as discussed in the previous chapter.

Furthermore, Wheelahan (2012), when explaining the impact of theoretical knowledge, uses Young's (2007) concept of powerful knowledge by indicating that theoretical knowledge is socially powerful knowledge (Wheelahan, 2012). Knowledge is important because it encourages conversation and debate within a society. Theoretical knowledge encourages societies to think, imagine, make connections, and make projections for the future (Wheelahan, 2010, 2012).

Again, answering the question why knowledge is important, one needs to note that due to the information explosion of the 21st century, because of ICT, communities have benefited greatly to the extent that they are now referred to as knowledge societies. In explaining knowledge societies, Evers (2000: 29) characterises them first as societies that have members that attain high average standards of education. Also, its labour force is composed of researchers, knowledge managers, specialists, etc. Second, organisations within these societies, be they in the private sector, government sector, or civil society, are changed to be learning centres that will benefit the entire community. Third, in these societies, there is a culture of using information to produce knowledge. The acquired knowledge is used in different industries for production. Last, in these societies, technology is greatly used to retrieve, produce, store and disseminate information to better develop new knowledge.

The views above show how indispensable knowledge is to education. From those discussions, it is evident that curriculums should be informed by sound content, pedagogy, and technology. Teachers should have powerful theoretical knowledge that is characterised by deep content, pedagogy, and technology. Education must prepare learners to operate within the information society and a well-structured curriculum must be a vehicle through which knowledge is packaged to achieve this (Biggs & Tang, 2011; Reed, Gultig & Adendorff, 2012; Wheelahan, 2012). The next section discusses the curriculum and its different facets.

3.3 CURRICULUM STRUCTURES

The concept of curriculum refers, broadly, to the formal academic programmes provided by education institutions. The curriculum is reflected in subjects or courses or modules that are systematically aligned to equip learners with information that will provide them with knowledge required at a certain level of education (Graham-Jolly, 2015; Booyse, Du Plessis, & Maphalala, 2020). Different resources are used, e.g. printed media, audio-visual media, and multimedia resources etc., to carry the required information to and build the needed knowledge.

Graham-Jolly (2015: 231) refers to “curriculum as different components of a programme of study to be followed to achieve or move to a higher level of education”. Another definition, according to Graham-Jolly (2015: 232), is that “curriculum encompasses school-based opportunities afforded to learners in school, for them to progress to the next grade / standard of education”. It comprises lessons that are part of the agreed upon content. Timetables are set up based on the time to be allocated to different subject matter. Its aims and objectives are to provide learners with knowledge, skills, and attitudes, so that they can contribute to the economy of their respective countries (Graham-Jolly, 2015, Ndebele, 2020).

Curriculum is inclusive in nature as it not only refers to the prescribed curriculum but also mentions the role of the hidden curriculum (Graham-Jolly, 2015; Booysel, Du Plessis, & Maphalala, 2020). The combination of the two makes the concept of curriculum wide enough to address the cognitive, affective, social, and physical well-being of learners.

It should be noted that schools are distinctive institutions with the sole purpose of enabling learners to acquire knowledge not found at home or in their communities (Hepp, Welling, & Aksen, 2009; Young, 2013). The school curriculum stipulates the knowledge that needs to be imparted in schools. It deals with the sequential way of making learners acquire knowledge. A well-structured curriculum should consider the knowledge that learners bring to school. It should infuse powerful knowledge systematically and should ensure that learners build their own individual knowledge (Young, 2013; Graham-Jolly, 2015; Booysel, Du Plessis, & Maphalala, 2020).

The agents that implement the above discussed concept of curriculum are teachers. Teachers should be professionally trained to implement this well-structured curriculum. They should possess specialised knowledge and skills required for implementing the curriculum (Young, 2013). Teachers should have skills to access, process and disseminate information to learners for learners to form their own knowledge (Wheelahan, 2012; Young, 2013; Graham-Jolly, 2015). Again, teachers must master the art of selecting and sequencing information within the curriculum to facilitate the acquisition of powerful knowledge (Wheelahan, 2012; Young, 2013).

With the above in mind, this study is of the view that quality education and social justice can be achieved if the school curriculum can provide learners with knowledge, skills and attitudes

required by the knowledge society. An integrated curriculum will assist education institutions to achieve this notion. The next subsection briefly discusses the features of an integrated curriculum and shows how it is formed. This is an attempt by this study to show how teachers' knowledge at higher education institutions should be classified and framed to equip prospective teachers with knowledge, skills, and attitudes to properly function within 21st century schools.

3.3.1 An integrated curriculum

The integrated curriculum is broadly referred to as the curriculum that connects different areas of specific content. It is synonymous with interdisciplinary teaching, thematic teaching, and synergistic teaching. This kind of a curriculum provides links among different learning areas like mathematics, natural sciences, social studies, music, art, technology, etc. The content is organised in such a way that it is infused in the subject matter (Lake, 1994, Ndebele, 2020).

Another definition of this concept that the study ascribes to is that provided by Basil Bernstein (1975). According to Bernstein (1975:7), the concept of “integrated curriculum is the curriculum that shifts emphasis from education in depth to education in breadth; it is one that moves from content closed to content openness”. This kind of curriculum emphasises teaching people how to think better. Among its features, integrated curriculum fosters deep understanding of concepts, increases the status and rights of learners, encourages flexibility in the learning environment, and encourages social relationships between teachers of different learning areas (Bernstein 1975; Wheelahan, 2007; Hoadley & Jansen, 2012). Furthermore, this curriculum encourages horizontal relationships between teachers/lecturers and learners/students. So, this sharing of ideas and concepts contributes towards deep learning (Biggs & Tang, 2011). Because of this, participants, in this case teachers and learners, become contributors to global knowledge generation and sharing (Hoadley & Jansen, 2012).

To me, the above explanation of the concept of integrated curriculum as articulated by Bernstein (1975) and others who subscribed to his explanation, makes a lot of sense and provides a meaning that is relevant to the 21st century classroom. This research supports this explanation

because it sees the curriculum as contributing towards deep learning, ascribes to openness on the part of both teachers and learners, encourages flexibility, and links education with the providing of solutions to everyday life (Singh, 2002; Wheelahan, 2010;Booyse, Du Plessis, & Maphalala, 2020). This research sees this approach as having the characteristics that will ensure that teaching and learning support quality education, social justice, and the creation of powerful knowledge as discussed above.

Having looked at the features of knowledge and curriculum above, the next section of this chapter discusses the knowledge base that pre-service teachers must have. It further discusses the integrated way in which this knowledge base can be attained or built. As prospective teachers will be operating in the knowledge society, the section below will attempt to show how technology has become an integral part of the knowledge required of teachers for them to be relevant in the 21st century schools. The ICT integration model discussed below provides the knowledge bases needed for pre-service teachers to possess powerful knowledge.

3.4 ICT INTEGRATION MODEL

According to Kimmons, Graham & West (2020) the purposes and components of a model should be characterized by the *what, how, why* and *who/where/when*. The first component, i.e. the *what*, requires the model to be comprehensive enough but adequately limited to allow for parsimony and to prevent overreaching. A model should include enough variables, ideas and have detailed explanations (Kimmons, Graham & West, 2020). Second, the model should show the inter-relatedness of the components it proposes. Its structure should allow for the model to make sense of the world in different ways. Third, it must provide logic and rationale to support *why* components are related in the proposed form. Forth, a model must be bound by a context representing the *who, where, and when* of its application (Kimmons, Graham & West, 2020).

Currently, various models are used to train teachers on effective technological integration. These include among others the Levels of Technology Integration (LoTi), Technology Acceptance Model (TAM), Substitution – Augmentation – Modification – Redefinition (SAMR),

Replacement – Amplification – Transformation (RAT), Technological Pedagogical Content Knowledge (TPACK), Technology Integration Planning (TIP), Technology Integration Matrix (TIM) and recently the Passive, Interactive, Creative, Replacement, Amplification, Transformation (PICRAT) .

This study uses the TPACK model because according to the researcher, it is an appropriate model that is in line with the four components, *what, how, why and who/where/when*, as discussed above. Also, this study chooses this model because it is a model most referred to in several education policies of the South African education system, among others the *revised MRTEQ* (DHET, 2015) and the Professional Development Framework for Digital Learning (DBE, 2018)

Technological Pedagogical Content Knowledge (TPACK) is a teacher knowledge model aimed at enabling teachers to effectively teach with technology. It is an extension of Lee Shulman’s framework of Pedagogical Content Knowledge (PCK) to include the use of technology in schools (Shulman, 1986, 1987; Mishra & Koehler, 2006). The TPACK framework was first presented by Punya Mishra and Matthew Koehler in 2006 (Mishra & Koehler, 2006; Koehler, Mishra & Cain, 2013).

Again, the study adopts the TPACK model because this model can be easily applied to the purposes of initial teacher training qualifications. Also, the TPACK model can the bridge digital divide between teachers and learners in schools. Hence, recent research studies have proposed TPACK as a teacher knowledge model appropriate for 21st century teaching (Koehler, Mishra & Cain, 2013). Again, there is a need for this kind of a framework because ICT is protean, unstable and opaque in nature, so this framework will provide teachers with flexible knowledge to cope in a technologically inclined classroom (Mishra & Koehler, 2006; Koehler, Mishra & Cain, 2013).

Furthermore, in answering the question, ‘*why this framework?*’, Mishra & Koehler (2006: 14) argue that “teaching is a complex domain. So successful teaching depends on flexible access to knowledge and the application and systematic organization of powerful knowledge in the classroom”. Again, teaching operates in a dynamic environment, so for teachers to be successful, they need to understand learners’ sequence of thinking and learning, the learners’ way of gathering content knowledge, and learners’ technological knowledge (Mishra & Koehler, 2006;

Mishra & Koehler, 2008). This can be achieved by equipping learners with the necessary knowledge they need to master their subject content.

Integrating ICT in education requires knowledge of the three main domains of a learning environment, namely, content, pedagogy, and technology. Content, pedagogy, and technology are the three knowledge dimensions that form the bases of the TPACK framework. The TPACK framework is thus the interaction between and among the above-mentioned domains of knowledge in all forms of acquisition to formulate objective knowledge needed for the 21st century classrooms (Mishra & Koehler, 2006; Koehler, Mishra & Cain, 2013). The TPACK model is diagrammatically represented as follows:

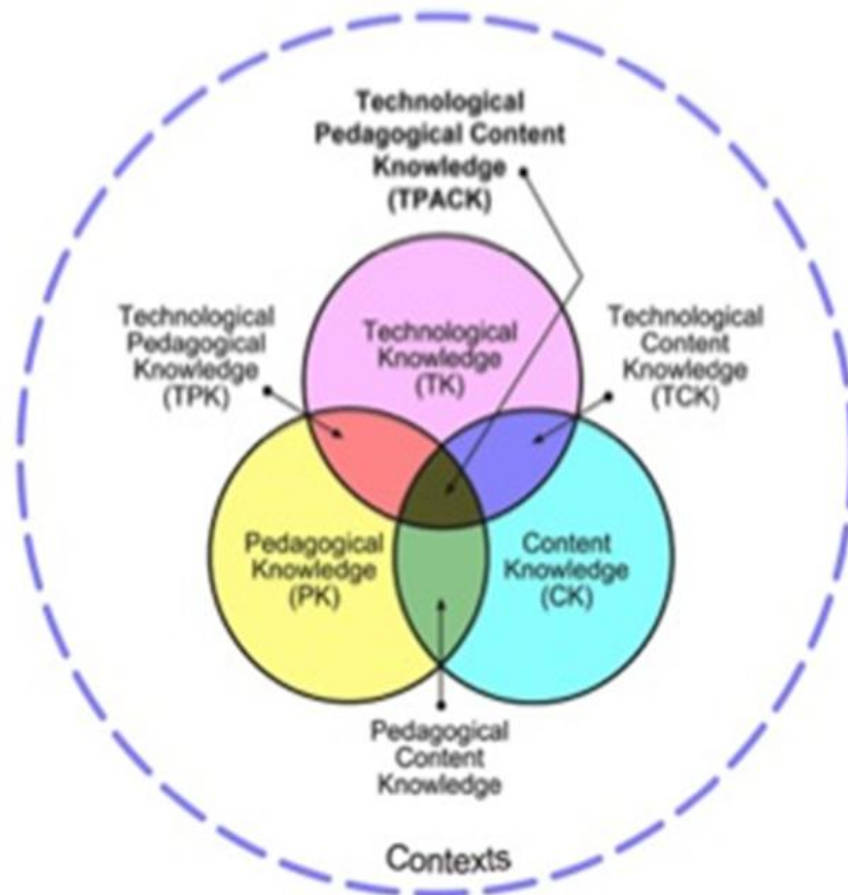


Figure 1: Mishra & Koehler, 2006

Figure 1 shows the TPACK framework and its seven knowledge domains. The three core components of this framework are content, pedagogy and technology (Mishra & Koehler, 2006, 2008). In addition to these, the three components are combined in pairs. These combinations form another three components, namely, Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK). The rest of the components combine to form the framework entitled Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006).

This study proposes that to successfully integrate ICT in the curriculum of pre-service teachers, the TPACK framework should be adopted as an ICT integration model to guide the initial teacher qualifications' curriculum. Mishra and Koehler (2006: 14) state that “this theoretical framework about the connection between technology and teaching is intended to transform teacher education and training, as well as professional development of in-service teachers”. This study argues that the successful infusion of the TPACK framework in the teacher education curriculum will equip prospective teachers with knowledge to provide quality education that will advance the precepts of social justice. The following seven knowledge domains should be infused in the curriculum to ensure the production of teachers capable of integrating ICT in their classroom (Mishra & Koehler, 2006).

3.4.1 Content Knowledge (CK)

This domain refers to the outstanding knowledge of the subject matter that teachers must have to teach. A teacher must have a thorough understanding of the subject matter or content that they are going to teach (Shulman, 1987; Mishra & Koehler, 2006; Koehler, Mishra & Cain, 2013). The teacher must have expertise on the subject level that he/she will be teaching; for instance, the subject knowledge of mathematics at primary school, high school and university differs. According to Shulman (1987: 6), the teacher's “content knowledge should embrace subject concepts, theories used in the subject, relevant philosophies, organizational frameworks, evidence and proof, as well as reputable tactics and ways of developing such knowledge”.

Content knowledge requires teachers to have an understanding and deep knowledge of the subject area they are teaching (Koehler, Mishra & Cain, 2013). For example, the content knowledge of mathematics requires a teacher to be familiar with mathematics components like algebra, geometry, trigonometry, calculus, and on top of this, to know mathematical concepts, facts, theorems and scientific methods of solving problems. Whereas, in the field of music, a teacher must have the knowledge of the history of music, music from different cultures, different genres and composition of music. In this technological era where access to information is so easy, teachers that do not have deep knowledge of their subject matter stand to risk losing respect and integrity in the eyes of their learners (Biggs & Tang, 2011; Koehler, Mishra & Cain, 2013). In short, the content knowledge base comprises of the teachers' depth and breadth of conceptualization of the subject matter (Lederman & Gess-Newsome, 1992).

Again, content knowledge should enable a teacher to answer content specific questions that may arise from the students and the peers. It should also be in greater depth to enable a teacher to teach beyond the textbook, at different levels or using different methodologies or different pedagogies (MaKinster & Trautmann, 2014).

3.4.2 Pedagogical Knowledge (PK)

Pedagogical knowledge refers to a deepened understanding of strategies, methods, and processes that teachers should employ in the teaching and learning of their respective subject specializations (Mishra & Koehler, 2006, 2008; Koehler, Mishra & Cain, 2013). It involves a thorough understanding of the aims and objectives of a subject, the educational purpose and values of the subject, the ability to plan activities that will make the learning of the subject easy and make the subject relevant and enjoyable to learners (Mishra & Koehler, 2006, 2008; Koehler, Mishra & Cain, 2013). MaKinster & Trautmann (2014: 340) states that “pedagogical knowledge broadly covers what teachers know related to teaching, curriculum, and assessment”.

Also, PK is about teachers' understanding of how learners learn, classroom management skills, lesson planning, development of classroom activities, and assessment of learners (Mishra &

Koehler, 2006; Koehler, Mishra & Cain, 2013). PK requires teachers' understanding of the cognitive theories, and social and developmental theories of learning, and these can be applied to learners in the classroom (Mishra & Koehler, 2006; Koehler, Mishra & Cain, 2013). The teacher should have the ability to determine how best to present ideas and concepts to be in line with the needs of the learners in their respective classrooms (MaKinster & Trautmann, 2014)

This knowledge domain also involves the teachers' understanding of the techniques or methods used within a classroom context. It also involves understanding the target audience – in this case, pre-primary learners or primary learners or high school learners, etc., and strategies for evaluating the respective learners (Lederman & Gess-Newsome, 1992; Chai, Koh, Tsai & Tan, 2011; Koehler, Mishra & Cain, 2013).

3.4.3 Pedagogical Content Knowledge (PCK)

PCK is about the knowledge and understanding of a subject matter taught, meaning the pedagogy of a specific subject. PCK relates to Shulman's (1986: 4) belief that "real teaching requires an understanding of both content and pedagogy". It does not require one to be just a content expert or just pedagogy expert, but it requires teachers to have expertise to match content with relevant pedagogy so that effective learning can take place (Mishra & Koehler, 2006). According to Mishra and Koehler (2008: 9), this knowledge domain "revolves around the teacher's ability to properly teach, plan relevant activities for learning, understand the core and hidden curriculum, conduct assessment, and report results of a subject".

Hence, the concept of PCK is the transformation, by the teacher, of the content (Shulman, 1986; Mishra & Koehler, 2006; Koehler, Mishra & Cain, 2013). A teacher who has a deep PCK is able to interpret the subject matter well, can present the subject matter in a way suitable to their learners, and can develop suitable teaching and learning materials to meet the needs of individual learners in their classrooms (Shulman, 1986; Mishra & Koehler, 2006; Chai et al, 2011; Koehler, Mishra & Cain, 2013).

Last, PCK is the teachers' awareness of the connection between different content-based ideas, learners' previous knowledge, different teaching strategies, and alternative problem-solving strategies within a teaching and learning environment (Chai et al, 2011; Koehler, Mishra & Cain, 2013). It is the teacher's ability to provide learners with chances to apply concepts to real life contexts, help learners develop the ability to critically evaluate ideas using scientific reasoning and to use teaching strategies that assist learners' misconceptions in their subjects (MaKinster & Trautmann, 2014). PCK is the teacher's ability to manage learners effectively when learning, the ability to develop strategies that challenge advanced learners and the teacher's ability to develop pedagogic strategies to help learners who are struggling academically (Chai et al, 2011; MaKinster & Trautmann, 2014).

3.4.4 Technological Knowledge (TK)

The technological component of this framework was added to the original PCK framework of Shulman (1986) by Mishra & Koehler in 2006. They referred to this knowledge as the teachers' standard knowledge of technology, and the skills to operate particular technologies (Mishra & Koehler, 2006, 2008). This definition did not suffice and attracted a lot of criticism due to the ever-changing nature of ICT. In trying to address the criticisms of their initial definition, Koehler, Mishra and Cain (2013: 14) implemented the definition of Fluency of Information Technology (FITness) which stated that technological knowledge is way above the traditional notion of computer literacy (Koehler, Mishra & Cain, 2013). TK requires an individual to understand ICT in general, to apply it for productivity at work and at home (Koehler, Mishra & Cain, 2013). FITness further specifies that TK is the ability of one to recognise when ICT can be useful or destructive towards the realisation of set goals and an individuals' ability to integrate technological changes (Koehler, Mishra & Cain, 2013). According to MaKinster & Trautmann (2014: 340), "As teachers learn to use a piece of software, they need to be able to imagine how their students would use it, what opportunities it would create, and what challenges they might face."

TK requires a deep understanding and mastery of ICT so that they can access, process, and disseminate information (Graham, 2011). It also refers to the teacher's understanding of communication and problem solving (Koehler, Mishra & Cain, 2013). It requires the teachers' knowledge of the use of both technologies that are still in analog form, like pencil, chalkboard/whiteboard, microscope, etc., and recent technologies that are in digital form, like computers, tablets, mobile phones, Internet, etc. The knowledge required here should not be about physical resources only but should also be about processes applied to solve problems with these devices (Graham, 2011). Most of the technological devices are not made for the sole purposes of education. So, TK here requires teachers to adopt and adapt these technological resources to serve and benefit the educational environment (Mishra & Koehler, 2006, 2008).

3.4.5 Technological Content Knowledge (TCK)

TCK refers to the teacher's knowledge of the interchangeable relationship between technology and content (Koehler, Mishra & Cain, 2013). It is simply the way content and technology influence and constrain one another (Mishra & Koehler, 2006, 2008). It characterises the integration between what a teacher knows about applicable technological applications and about the topic of interest (MaKinster & Trautmann, 2014). Here the expectation is that a teacher must know a great deal about the subject matter that they teach. Teachers should have a deep understanding of the technological applications that can be used to teach the subject, and to clarify and explain the subject matter. They should know that certain technologies are best suited for certain subject matter learning (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013). For example, software application like Google Earth can be useful to teach geography, GeoGebra can be a useful application to teach Geometry in Mathematics and Google Translate can be used to assist students that are studying foreign languages or a second language or third language.

It involves the teachers' understanding of the ways in which educational technologies can represent concepts, topics, and processes in ways that are challenging, engaging and meaningful to learners. It is the teacher's ability to find technological tools with which to present and explore a variety of subject concepts (MaKinster & Trautmann, 2014). According to Koehler & Mishra

(2009:65), understanding the impact of technology on the practice and knowledge of a given discipline is critical to developing appropriate technological tools for educational purposes. Hence, teachers, and/or prospective teachers, must possess the TCK to help them with the choice of technologies that affords and constrains the type of content ideas that can be taught.

In this era, teachers are expected to have knowledge of new and existing technological applications that can be used to assist learners to learn. Teachers should also have knowledge of computer applications to enable them to bridge barriers to learning (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013). Having TCK also assists teachers when they must provide electronic content to their learners and can enable the teacher to set and participate in electronic classrooms and/or mobile classrooms or ICT learner management systems, or blended learning.

3.4.6 Technological Pedagogical Knowledge (TPK)

TPK refers to the shared relationship between technology and pedagogy. It is defined as the teacher's knowledge and understanding of the use of technology devices that can advance the attainment of pedagogic goals (Koehler, Mishra & Cain, 2013). It is the teacher's ability to select the most suitable tools or applications based on their appropriateness for the specific pedagogical approach (Koehler, Mishra & Cain, 2013). It involves knowledge of technological devices that influence the nature of the learner-teacher interaction. For example, in a school that has different educational electronic resources like computers, interactive whiteboards, radios/CD players, etc., a teacher must know which electronic resource to use for which grade, for which learners, and for which subject matter. TPK is the teacher's capability to develop creatively and be flexible in the use of available technological resources and to repurpose these resources for specific pedagogical environments (Mishra & Koehler, 2008).

For instance, most software programmes such as Microsoft Office Suite are developed for business purposes. But different applications within this programme can be used for various pedagogical goals, for example, an applications programme like Microsoft Excel. This is a general spreadsheet application that can also be used to assist a teacher to do classroom

administration duties like capturing marks, doing class lists, calculating percentages and averages, and controlling class attendance (Mishra & Koehler, 2008). TPK enables a teacher to use different hardware and software to diligently achieve pedagogical goals. It provides teachers with the capabilities to remove non-functional fixed pedagogies, and to advance skills to look beyond any technological device.

3.4.7 Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK – pronounced “t-pack”) is at the center of the above-mentioned knowledge bases. It is the latest form of knowledge and understanding that goes beyond the basic components of content, pedagogy, and technology, of teaching and learning (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013). It involves the knowledge of the interaction between content, pedagogy, and technology (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013). TPACK is further explained as the teacher’s synthesized knowledge of the knowledge areas described above with the intention to integrate technology to meet pedagogical needs within a specific context. It describes how teachers’ knowledge of educational technology interacts with PCK in ways that produce effective teaching and opportunities for learners learning (MaKinster & Trautmann, 2014).

TPACK encompasses the teacher’s ability to use technology to make teaching and learning easy. It involves the use of ICT to bridge barriers to learning (Koehler, Mishra & Cain, 2013). This knowledge domain is about the teacher’s knowledge and ability to detect learners’ prior knowledge (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013). It enables teachers to apply technology timeously and continuously to create, maintain and re-establish a dynamic balance among content, pedagogy and technology (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013).

According to Koehler & Mishra (2009: 66), TPACK is “effective teaching with technology, requiring an understanding of the representation of concepts using technology; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes

concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones". In short it is a use of appropriate technology in a content as part of a pedagogical strategy within a given educational context (Koehler, Mishra & Cain, 2013; MaKinster & Trautmann, 2014).

The TPACK framework also works from both the conceptual and theoretical perspectives so that researchers and teachers can determine pre-service teacher readiness to effectively integrate ICT in their teaching (Mishra & Koehler, 2008; Koehler, Mishra & Cain, 2013). It is used to benchmark the teachers' knowledge of ICT integration and can also be used to determine intervention strategies needed for Continuous Professional Development (CPD) of teachers (Mishra & Koehler, 2008; Koehler, Mishra, Akcaoglu & Rosenberg, 2013).

Revised version of the TPACK framework. The contextual knowledge was not part of this study but can be pursued for further research on the topics on TPACK.

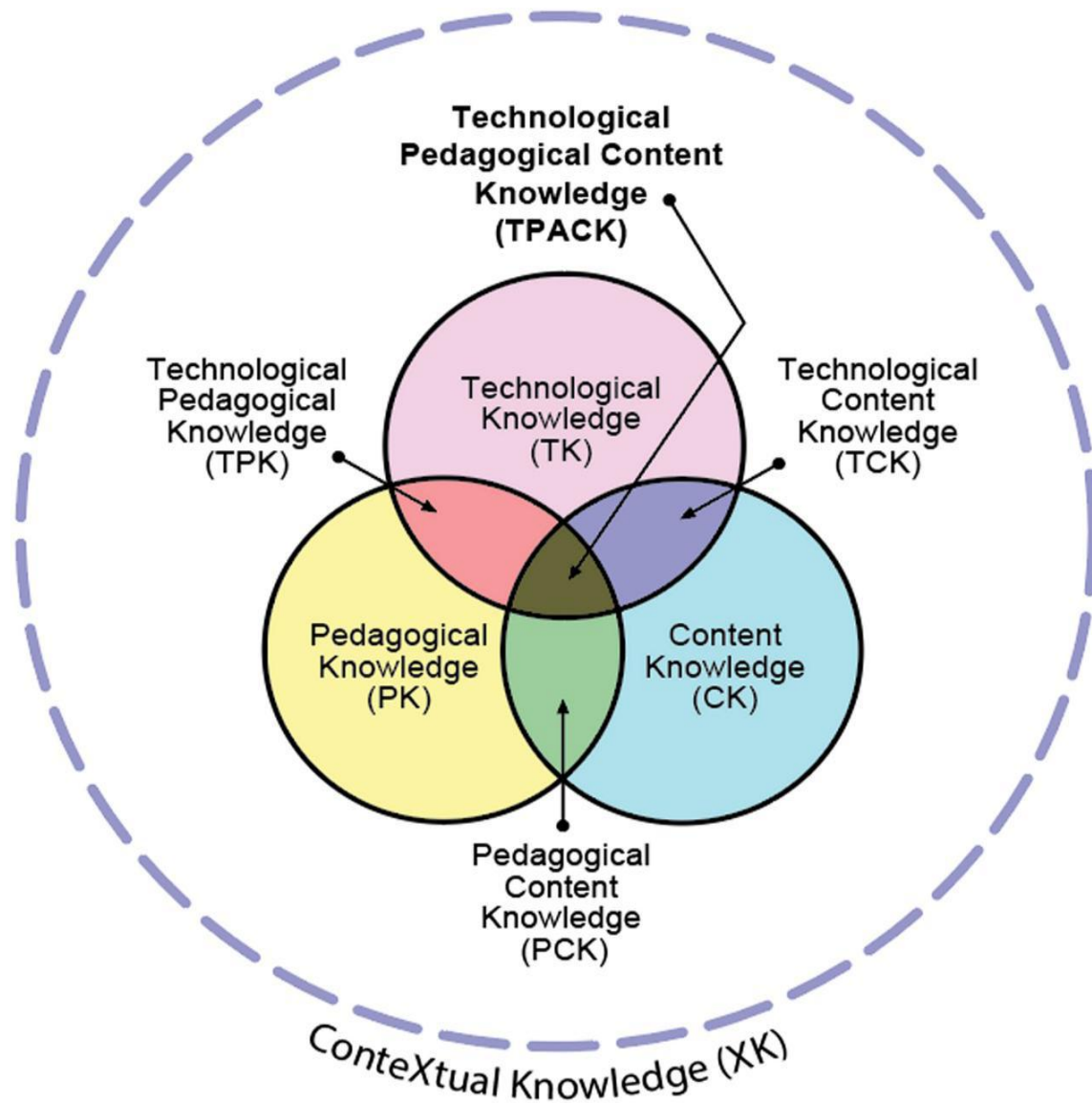


Figure 2: Revised TPACK Framework (Mishra, 2019)

3.4.8 Limitation of the TPACK Model

Like any other model the TPACK model has its own limitations. Kimmons, Graham & West (2020) propose six criteria to determine the quality of teacher education technology integration models. The six criteria according to them are: clarity, compatibility, student focus, fruitfulness, technology role and scope (Kimmons, Graham & West, 2020)

The *clarity* criteria relate to how simple, clear, and easy the model is to understand. *Compatibility* refers to how the model complements or supports the present educational practices deemed useful to teachers. *Fruitfulness* is the way the model encourages teachers to think fruitfully when grappling with problems of technological integration. The *technology role* criteria look at how the model treats technology integration as a means for achieving specific pedagogical or other benefits. *Scope* looks at how the model is sufficiently parsimonious and able to ignore aspects of technology integration not useful to teachers, but sufficiently comprehensive to guide other practices. Last, *student focus* “criteria determine as to whether does the model clearly emphasise learners’ involvement and learner outcomes” (Kimmons, Graham & West, 2020: 179). Using the above criteria, the limitations of TPACK can be identified as follows.

First, the TPACK model has a clarity problem in the sense that the boundaries between the different knowledge domains are fuzzy and there seem to exist hidden complexities. For example, the boundaries between TCK and TPK (Koehler & Mishra, 2009; MaKinster & Trautmann, 2014; Kimmons, Graham & West, 2020). Using TPACK has not been domain or topic specific and it predominantly focuses on educational technologies in general. This has contributed to its lack of clarity regarding TPACK as a theoretical framework (MaKinster & Trautmann, 2014).

Second, TPACK has a compatibility limitation in the sense that it does not explicitly guide useful classroom practices like lesson planning, classroom management and assessment (Kimmons, Graham & West, 2020). As a result of this limitation this model can pose a challenge for beginner teachers in how to use technology for planning, management, and assessment. Third, the model has a fruitfulness limitation in the sense that the distinctions may not be empirically verifiable or hierarchical. For example, the distinctions between TPACK versus PCK (Kimmons, Graham & West, 2020).

The last limitation of this model is its scope. This model may be too comprehensive for teachers especially when it must be infused in the curriculum of the pre-service teacher qualifications. For example, integrating TPACK in the curriculum of the Postgraduate Certificate in Education (PGCE), a one year capping qualification that trains students who initially did not study education but would like to be teachers post-graduation, lacks parsimony for their context (Kimmons, Graham & West, 2020). Again, for one to have TPACK relies on the teacher’s

beliefs and attitudes towards ICT, access to different educational technologies, the Internet, and lately, access to data as most applications are available online. Also, it requires the ability of the teacher to embrace change because ICT has a rapid change characteristic (MaKinster & Trautmann, 2014; Kimmons, Graham & West, 2020). Regardless of the above limitations, TPACK is the most used ICT integration model by many countries among others including India, US, UK, Australia, Thailand, and SA. (Kimmons, Graham & West, 2020).

3.5 THEORETICAL FRAMEWORK

This study has identified three (3) theoretical strands that are relevant and can contribute towards prospective teachers' ICT knowledge and curriculum structure. These theories ensure ICT integration that is geared towards prospective teachers' knowledge of how to infuse ICT to provide quality education that advances social justice. Again, three theories were chosen for this study because they are relevant towards transformative pedagogies. The transformative pedagogies involve higher levels of pedagogical practice, are learner-centred, engage higher order thinking skills and encourage a diversity of interactions between learners, content, and teachers (DBE, 2018). The transformative pedagogies offer more opportunities for learners to seek the support of ICT to enhance deep learning. The below theories advocate for, among others vertical and horizontal knowledge discourses, learner-centeredness, deep learning, ICT integration and connectivity.

3.5.1 Basil Bernstein's theories on curriculum structure

Basil Bernstein's work was heavily influenced by David Émile Durkheim, a French sociologist (Sadovnik, 2001). He came up with an original sequenced line of thought (Bernstein, 1973a, b, 1975; Sadovnik, 2001). This he developed through constant refinement of the original thought, expansion and reorganizing of ideas previously used, and interrogation of problems which interested him. His theory was developed over four of his papers over the years, namely: *On the*

Classification and Framing of Educational Knowledge (1973); *Codes, Modalities and the Process of Cultural Reproduction: A Model* (1981); *On Pedagogic Discourse* (1986); *Vertical and Horizontal Discourse: An Essay* (1999) (Bernstein, 1973a,b,1975,1990,1996, 1999, 2000; Sadovnik, 2001; Czerniewicz, 2010; Bertram, 2012).

The early work of Bernstein started with the concept of a code (Bernstein, 1973a, b, 1975). According to him, a code is a principle which is obtained using implicit knowledge and is attained by selecting and joining relevant meanings to form realisations within a context. This was Bernstein's initial work on language which scrutinised the relationship between public language authority and shared meaning (Bernstein, 1973a, b, 1975; Sadovnik, 2001; Czerniewicz, 2010; Bertram, 2012).

The formation of a code can be defined by the relationship between coding orientation and coding form. This orientation is realised according to the formula below:

$$\frac{O^{E/R}}{C_{ie}^{\pm} F_{ie}^{\pm}}$$

This formula has three elements, namely, orientation (O), Classification (C) and Framing (F), that influence language learning and education in general (Sadovnik, 2001; Cause, 2010). The $O^{E/R}$ in this formula refers to the coding orientation, i.e. whether restricted (R) or elaborated (E). In the elaborated orientation, the meanings are universal; they do not rely on the context and they are not directly affected by any material (Sadovnik, 2001; Bertram, 2012). For example, the school, due to its official pedagogic discourses and practices, is a form of an elaborated orientation. The restricted orientation on the other hand is the one that has a particular meaning, which is determined by the context, and forms a direct relation with a specific material (Sadovnik, 2001; Bertram, 2012). For example, what a child learns within a family structure can be both restricted and elaborated, depending on the social position of that family.

The C and F in the above formula correspond with Classification and Framing. These are used respectively to analyse power and control over a given social structure (Sadovnik, 2001; Bertram, 2012). The \pm symbols refers to strong or weak values, the (i) refers to internal relations and the (e) to external relations within a given context of communication in the family, school, work, etc. (Sadovnik, 2001; Bertram, 2012). Classification and Framing can be explained as follows.

Classification

Classification is about the way in which boundaries between categories such as subjects, spaces, discourses, agents, structures, or practices are maintained (Bernstein, 1973a, b; Sadovnik, 2001; Singh, 2002). Classification can be weak (-) or strong (+). A strong classification is when there is a distinct separation between categories. For example, at universities, boundaries between different courses in most cases are kept separate. The classification is strong, for instance, in the separation between the law faculty and education faculty. Strong classification enables disciplines to be insulated from one another and erects a division between those who participate in the various disciplinary contexts (Bernstein, 1973a, b; Sadovnik, 2001).

Another feature of strong classification is that it forms a strong level of identity and belonging for the representatives, such as lecturers, specialists, researchers, etc. (Sadovnik, 2001). When these representatives interact within their respective disciplines, their identity is strongly tied to those disciplines. The problem arises when the boundaries are weakened. The agents become insecure and mostly resist change (Sadovnik, 2001). A strongly classified curriculum is a closed curriculum which is also termed a collection type of a curriculum (Sadovnik, 2001).

A weakly classified curriculum is an open curriculum which is then termed integrated. In a nutshell, a classification value in any teaching and learning environment creates specific recognition rules whereby students are aligned to a context (Bernstein, 1973a, b; Sadovnik, 2001; Bertram, 2012). The dawn of democracy in South Africa called for an integrated curriculum. In other words, this era called for a weakly classified curriculum which has versatile agents, e.g. lecturers, teacher, specialists, that can operate within an open curriculum in an elaborated orientation.

Framing

Framing on the other hand refers to the social relations between categories (Bernstein, 1973a, b). It is about how categories are controlled. It refers to the person or individual who controls the teaching and learning environment. Unlike classification which focuses on the curriculum, framing has to do with pedagogy (Bernstein, 1973a, b). It refers to how knowledge is spread within pedagogic practices (Bernstein, 1973a, b; Sadovnik, 2001; Cause, 2010).

Just like classification, framing can also be strong (+) or weak (-). Within the schooling context, strong framing is when the teacher oversees several aspects of pedagogy (Bernstein, 1973a, b). Weak framing is when learners have some control over some or all aspects of the teaching and learning encounter (Bernstein, 1973a, b; Singh, 2002). In other words, framing is about how content is selected, organised, paced, and timed. Classification on the other hand is about who oversees the pedagogic encounter (Sadovnik, 2001). Classification and framing determine whether the curriculum is a collection type of a curriculum or an integrated type of curriculum (Bernstein, 1973a, b; Singh, 2002).

3.5.2 Social constructivism

The second theory relevant to this study is social constructivism. This theory is relevant to this study because of its strong relevance to 21st century learning. In explaining social constructivism, Amineh & Asl (2015) define it as a theory which states that knowledge originates from shared, joint human activities. This theoretical framework suggests it is through human interaction that knowledge can be shared understanding and shared meaning (Amineh & Asl, 2015). Lev Vygotsky, a Soviet psychologist, strongly influenced this theory. According to Vygotsky (1978a: 36), “cognitive growth starts with the interaction with other human beings, and then within an individual”. This means that the roots of an individual’s knowledge emanate from their interaction with others and their interaction with their immediate surroundings. What then are the

views of social constructivism regarding reality, knowledge, learning and learners, teaching and teachers?

The ontological notion of social constructivism is that reality is created through shared human social activity (Vygotsky, 1978a, b). This simply means that members of a society or a group create a view of the world and its properties based on common understanding. Furthermore, social constructivism is of the view that since reality is not established before social intervention, it is not something that can be discovered by individual. Therefore, it does not exist prior to social intervention (Vygotsky, 1978a, b; Amineh & Asl, 2015).

The epistemological stance of social constructivism is that knowledge is constructed through human, social and cultural interaction (Vygotsky, 1978a, b). Vygotsky (1978b) argues that knowledge is first constructed in a social setting and then is internalized and used for individual purposes. This view is that through collaboration, that is, sharing individual perspectives, new knowledge is constructed (Vygotsky, 1978b; Amineh & Asl, 2015).

Social constructivism views the provision of education as an active social process (Vygotsky, 1978a, b). In this process, learners are encouraged to learn to determine principles, concepts, and facts themselves (Pritchard & Wollard, 2010; Amineh & Asl, 2015). In explaining learning, Vygotsky (1978) is of the view that learning occurs when one moves from the current intellectual level to a higher level which more closely approximates the learner's abilities. This move is what Vygotsky (1978a, b) termed the zone of proximal development (ZPD). The zone of proximal development is the result of a social interaction where this movement occurs.

ZPD is the distance between the real developmental level as determined by independent problem solving and the level of possible development as determined through problem solving under adult direction or in association with capable peers. It implies that knowledge and learning depend on the understanding of social experiences (Vygotsky, 1978a, b).

Social constructivism also acknowledges the uniqueness and complex nature of learners. This theory encourages learners' individual versions of the truth as influenced by their background, culture, interaction with the world, and interaction with knowledgeable individuals within a society (Woo & Reeves, 2007; Amineh & Asl, 2015).

In this theory, teachers are mediators and facilitators of learning (Amineh & Asl, 2015). They facilitate how reality, knowledge and learning are attained (Amineh & Asl, 2015). Good teachers are the ones that facilitate learning by asking relevant questions, giving support to learners, offering guidelines and creating the appropriate environment for learners to achieve, and by continuously and interactively engaging in debates and dialogue with their learners. The last important role of the teacher, according to this theory, is that they become designers of learning materials that support the given learning environment, be it monologue, digital or web-based (Woo & Reeves, 2007; Amineh & Asl, 2015). It is evident that this theory accommodates the use of ICT and all the prescripts of quality education and the dimensions of social justice.

The reason social constructivism was chosen as a theoretical strand in this study is its relevance to the use of ICT in the classroom. Social constructivism is truly relevant to both the social justice and TPACK framework as discussed above. It is the researcher's view that the use of ICT contributes to the access, inclusivity, relevance, and democratic dimensions of social justice. Social constructivism ensures that the use of ICT in education contributes towards the dimension of social justice. Today people live in societies that are increasingly dependent on the use of ICT, especially computer technologies and mobile technologies. It is also a known fact that the use of ICT is gaining popularity in education and this has given rise to social constructivist classrooms.

3.5.3 Connectivism

This section discusses connectivism as the third theoretical framework that is relevant and critical to this study. Connectivism is a contemporary learning theory that was introduced and articulated by George Siemens (2005) and Stephen Downes (2005). This learning theory investigates, among other aspects, learning in the digital age, technology usage and networks in education, and the fading half-life of knowledge (Downes, 2005; Siemens, 2005; Bell, 2011; Boitshwarelo, 2011; Siemens, 2014). Connectivism tries to provide an explanation of complex learning in the rapidly changing digital social world of teaching in the 21st century.

Siemens (2005: 5) provides a definition of this learning theory by saying that connectivism “is the integration of principles explored by chaos, network, and complexity and self-organization

theories. Learning is a process that occurs within nebulous environments of shifting core elements – not entirely under the control of the individual. Learning (defined as actionable knowledge) can reside outside of ourselves (within an organization or a database), is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing”.

This learning theory sees learning as a process of linking specialised modes of information sources. Its focus is to capacitate people to know more than what they already know (Siemens, 2005, 2014). Connectivism advocates for the nurturing and maintenance of connections as people continuously learn. The core skills revolve around the individual’s ability to form connections between fields of study, different ideas, and different concepts (Downes, 2005; Siemens, 2005; Bell, 2011; Boitshwarelo, 2011; Siemens, 2014).

The key features of connectivism found in different literature sources indicate that central to the theory is how learners connect and feed information into the learning communities they have formed. It enables active participation of learners in their communities of practice (Downes, 2005; Siemens, 2005; Kop & Hill, 2008; Bell, 2011; Boitshwarelo, 2011; Siemens, 2014). In this case, the learning community is seen as a group of individuals learning together through continuous discussion because of their similar interest (Siemens, 2005).

Learners form different communities of learning from different networks. These networks are from various origins but connected; they are autonomous in nature, diverse, and formed through creative knowledge (Boitshwarelo, 2011). Connectivism interprets knowledge as not individualistic nor in one location but as being distributed across information networks or various individuals (Downes, 2005; Siemens, 2005; Siemens, 2014).

Because of networks (computer networks, power grids and social networks), information is constantly evolving and there is a need to endlessly evaluate the validity and accuracy of knowledge considering the newly acquired information (Downes, 2005; Siemens, 2005; Boitshwarelo, 2011; Siemens, 2014).

This theory encourages inter-disciplinary connection in the knowledge creation process. This involves knowledge formulation out of chaos. It capacitates learners with the ability to recognise patterns from hidden messages to form new meaning (Siemens, 2005, 2014). This is largely

influenced using the Internet and other different technological resources. Connectivism views knowledge as residing in databases and these databases need to be managed so that new knowledge can be formed. For learning to occur, these databases need to be made available to the right people in the right context (Siemens, 2005, 2014).

Another feature of connectivism is the establishment of information and knowledge flow within social networks. Maintaining information flow benefits communities of practice and therefore contributes to knowledge formation and sharing (Downes, 2005; Siemens, 2005; Boitshwarelo, 2011; Siemens, 2014). This theory enables learners to recognise patterns of information and to realize whether the presented information is important or not important. These abilities are important in our personal growth and learning (Boitshwarelo, 2011).

From the above features it should be noted that connectivism is not limited to the online environment but is a versatile theory (Boitshwarelo, 2011). It advocates for learning as not an internal process but an open collaborative process with activities that involve individuals, groups and technological networks (Siemens, 2005, 2014).

This theory is important to this study in the sense that it embraces the use of technology in education and the social impact of information in learning and knowledge gathering. Connectivism has an impact on educational management and leadership, media, news and information sharing (Siemens, 2005; Kop & Hill, 2008; Boitshwarelo, 2011). It also contributes to personal knowledge management, designing of the learning environment, and sharing of communal resources that communities use to carry out its practice, including routine tools, actions, language and symbols (Siemens, 2005; Kop & Hill, 2008; Boitshwarelo, 2011).

3.6 CONCLUSION

This chapter reviewed the literature about the knowledge that pre-service teachers need to be trained on for them to integrate ICT in education. This was done by first discussing the importance of knowledge in education and the way a curriculum is set. Second, the chapter explored the TPACK as an ICT integration model relevant to this study. Last, this chapter discussed three theoretical frameworks, namely, social realism, social constructivism and connectivism that aligned to transformative pedagogies and are relevant to this study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter discusses the research methodology underpinning this research study. The chapter first discusses the research paradigm used in this study. Then the chapter discusses the research design and the research methods. The chapter further discusses the research instruments, research techniques and data reduction and analysis used in this study.

4.2 RESEARCH PARADIGM

This study is informed and underpinned by an interpretive paradigm. The term paradigm originates from the Greek word *paradeigma* which means pattern. Thomas Kuhn (1977) was the first researcher to use the term paradigm to signify a conceptual framework shared by a community of scientists to offer them a convenient model for examining and understanding problems and to find solutions to them.

A paradigm integrates concepts, variables and problems that are linked to specific methods, approaches and instruments or tools (Kuhn, 1977). It is a set of beliefs, values, and assumptions that researchers have in common about the nature and conduct of a research (Kuhn, 1977). In short, a paradigm is a pattern, structure and framework or system of ideas, values, and assumptions. (Kuhn, 1977; Olsen, Lodwick & Dunlop, 1992; Cohen, Manion & Morrison, 2011; Creswell, 2013). According to Cohen, Manion & Morrison (2011: 55), “paradigms rest on

different ontologies and different epistemologies. It is the lens through which the researcher views the world”.

As mentioned above, the interpretive paradigm was considered ideal for this study because of its unique characteristics and because it enabled the collection of qualitative type of data that form part of the study. The purpose of this study, the ontology, epistemology, and methodology are best suited within the interpretive paradigm.

4.2.1 Interpretivism

A distinct characteristic of interpretivism is that reality consists of people’s individual experiences about the world around them (Maree, 2007). Hence people construct the social world by sharing meanings, interacting with and/or relating to each other (Maree, 2007).

The reason for doing research, according to the interpretive paradigm, is to understand human nature. Therefore, this study was undertaken to understand and interpret students’ abilities to integrate ICT after they have gone through teacher education curriculums at universities.

The ontological assumptions of the interpretive paradigm are that there are multiple socially constructed realities (Creswell, 2007; Maree, 2007; Chilisa, 2011). Reality is constructed through interactions with fellow human beings (Maree, 2007; Creswell, 2013). Individuals’ daily routines, discussions with fellow human beings, discussions, and texts that people read, enable them to make sense of their social world and hence their reality (Maree, 2007; Goldkuhl, 2012; Creswell, 2013). Therefore, reality exists because of human interactions and social contact (Maree, 2007; Goldkuhl, 2012; Creswell, 2013).

The epistemological dimension of the interpretive paradigm is that the world is understood through the mental processes of interpretation. This is influenced by social interactions within a social context (Maree, 2007; Goldkuhl, 2012; Creswell, 2013). The nature of knowledge is individualistic, hence those active in the research process construct knowledge through experiences in real life or natural settings (Maree, 2007; Goldkuhl, 2012; Creswell, 2013). To

add to this, interpretivists assume that knowledge and meaning are acts of interpretation, hence there is no objective knowledge which DoEs not include thinking and/or reasoning humans (Goldkuhl, 2012). Furthermore, the enquirer and the enquired are engaged in a personal process of talking and listening, reading, and writing. This then results in more personal, interactive modes of data collection (Chilisa, 2011; Denzin & Lincoln, 2011; Creswell, 2013). This study used the interpretive paradigm because of its characteristics. These characteristics allowed the researcher to construct reality through interactions with people, to understand issues by thinking and making links through thought processes, and to use the skills of listening, reading, and writing to come to conclusions.

4.3 RESEARCH DESIGN

A research design is a master plan or model for a research study. This plan is characterised by a series of activities and advanced decisions taken to roll out the plan (Denzin & Lincoln, 2011; Creswell, 2013). A research design is influenced by a paradigm, methodology and approaches.

A research design depends on the questions that influence the researcher's inquiry. This process is not a mechanistic exercise, but largely rests on the purpose of the research and phenomenon being investigated (Cohen, Manion & Morrison, 2011). The research paradigm, on the other hand, influences the design because it directs practice and the line of thinking based on the nature of an enquiry, along the ontological, epistemological and methodological dimensions (Terre Blanche & Durkheim, 1999). This study is underpinned by an interpretive paradigm; therefore, it is qualitative in nature and follows a phenomenological approach.

4.3.1 Research Approach

The research approach of this study is qualitative and follows a phenomenological approach. These approaches are mostly used in the social sciences to assist researchers to study social and

cultural problems (Denzin & Lincoln, 2011; Creswell, 2013; Merriam & Tisdell, 2016). This study was undertaken in the field of education; hence it adopted a qualitative approach. A qualitative research approach is mostly used to explore and to discover problems that are little known about a matter at hand (Denzil & Lincoln, 2011; Silverman, 2013).

The reason behind choosing this approach for this study is because it is relevant to the interpretive paradigm. The interpretive paradigm requires the researcher to be an active participant and observer who engages in the activities and differentiates the meanings of actions as they are expressed within specific social contexts (Creswell, 2013). Although this study was not phenomenological, it has principles of phenomenology. This is because phenomenology focuses on the discovery and expression of basic characteristics of a certain phenomenon as they present themselves (Creswell, 2013).

According to Creswell (2013: 26), the focus of the phenomenological approach is to understand the essence of the experience. Based on the problem statement, one needs to describe the essence of the phenomenon, in this case ICT in education. Phenomenology is a qualitative approach that best suits studies in education, philosophy, and psychology; that is why it is relevant for this study (Creswell, 2013). This study employed the phenomenological approach using documents and interviews as data collection instruments, and to choose the sample.

4.4 RESEARCH METHODS

In accordance with the interpretive paradigm, this study used interviews as instruments for data collection. Both group interviews and individual interviews were used because of their suitability in collecting the qualitative type of data required.

Interviews were chosen because they characterise the interpretive paradigm. Interviews are critical within the interpretive paradigm because, according to King & Horrocks (2011), interpretive research is in most cases idiographic. Idiographic means “describing aspects of the social world by offering a detailed account of specific social settings, processes or relationships”

(King & Horrocks, 2011: 11). So, interviews were chosen in this study to understand social settings, processes, or relationships that student teachers find themselves in.

Second, everyday conversations are mostly face-to-face, and this makes researchers to feel at ease when using this technique (King & Horrocks, 2011). The researcher felt at ease in using this technique and it also assisted the researcher to build a rapport with interviewees. Third, interviews were chosen for this study because qualitative research interviews are flexible, they emphasise open-ended, non-leading questions, and they focus on personal experience (Cohan, Manion & Morrison, 2011; King & Horrocks, 2011; Marvasti & Frieie, 2017).

Last, interviews were preferred in this study because they focus on people's detailed experiences. They encourage a relationship between the interviewer and the interviewee, and a high level of confidentiality and anonymity, especially in this qualitative research. Below are the types of interviews used in this study.

4.4.1 Types of interviews

This study sought to investigate the curriculum processes employed at universities to capacitate student teachers with the knowledge to integrate ICT in their prospective classrooms. Semi-structured interviews were preferred over structured and unstructured interviews because they enable the researcher to mix the structure of questions and this allows for flexibility. Structured interviews were not used in this study since they provide little room for variation in response. The interviewer in this type of interview pre-determines short and clearly worded questions (Denzil & Lincoln, 2011). In most cases, these questions are not open-ended and require exact answers (Denzil & Lincoln, 2011; King & Horrocks, 2011).

Similarly, this study did not use unstructured interviews because of their non-standardised open-ended depth (Denzin & Lincoln, 2011). In most cases, unstructured interviews are used to comprehend the multifaceted behaviour of individuals without imposing any a priori categorisation to disadvantage the inquiry (Merriam, 2009; Punch, 2013). Unstructured types of interviews require both the interviewer and the interviewee to relax and there is no clear

direction of the interview. Hence this study chose semi-structured interviews because they have a clear advantage over unstructured interviews (Denzil & Lincoln, 2011; King & Horrocks, 2011; Punch, 2013).

The researcher took into consideration several issues when framing the interview questions. These included the focus of the questions, the scope, and avoiding presuppositions. The questions were drafted to focus on meaning and the experiences of the participants. These types of questions were used because, according to King & Horrocks (2011: 26), research questions used in a qualitative study should focus on the experiences of the participants and the meanings they attach to the topic in question.

King & Horrocks (2011: 26) state that “even though the research questions may have the right kind of focus, they may still be inappropriate in terms of scope”. This prompted the researcher to strike a good balance regarding the scope of the questions used. Research questions that are too broad may be difficult to answer while the ones that are narrow are likely to produce findings that are not useful (Denzin & Lincoln, 2011; King & Harrock, 2011). In trying to avoid presupposition, the researcher ensured that no leading questions were used when interviewing participants. Instead the researcher used probing questions to elicit responses and to seek to add depth to the interview data.

In this study, group interviews as well as individual interviews were conducted using a preferred schedule of questions (see Annexures B, C, D). As much as possible, the researcher conducted these interviews face-to-face or person-to-person, in most cases at the participant’s own environment or settings. Most of the time the participants preferred to be interviewed at their workplaces. Group interviews were mostly conducted in the boardrooms while individual interviews were mostly conducted in the participants’ offices.

This close relationship ensured that the researcher was close enough to clearly hear the participants and to read their non-verbal communication (Denzin & Lincoln, 2011; King & Horrocks, 2011). Only one participant requested to be interviewed through Skype. This was not a physical person-to-person interview but rather an electronic interview. Skype is a software application for an Internet-based telephone system. Skype enables face-to-face conversations at two remote places (King & Horrocks, 2011). Once downloaded, the researcher and the

participants can speak face-to-face using PC to PC audio or video technology (King & Horrocks, 2011). The researcher still categorised this as a face-to-face interview as the interview happened in real-time. Group interviews were semi-structured because all the questions were flexibly worded (Merriam, 2009; Denzin & Lincoln, 2011).

Interviews were chosen because they enabled the researcher to build rapport with the interviewees. According to King & Harrock (2011: 48), building rapport with participants is a key ingredient in successful qualitative interviews. Rapport is essentially about trust, and it enables participants to feel comfortable in opening to the researcher (King & Horrocks, 2011).

Interviews in this study were audio-recorded using a digital audio recorder except for the one interview done through Skype. The Skype interview was video recorded for the researcher to fully participate in the interview. Again, it was video recorded so that the researcher could capture all the verbal and non-verbal communication (King & Harrock, 2011).

4.5 RESEARCH INSTRUMENTS

To gain clarity regarding the topic of the research, documents were analysed as part of data collection. Documents, which in most cases are referred to as a record of an event or process, may take different forms that can be produced by individuals, groups or organisations (Cohen, Manion & Morrison, 2011; Coe, Warning, Hedges & Arthur, 2017). Document analysis is a data collection technique that assures the researcher that the information is mostly accurate, and it provides a clear, tangible record. It is important for a researcher to clear delineate between the literature review of a study and the use of documents as part of the data gathering strategy (Maree, 2007). Maree (2007: 57) distinguishes between the two by indicating that “reviewing literature affords the researcher an opportunity to view trends and debates within a subject in question”. The use of documents, on the other hand, is a data gathering technique that assists the researcher in focusing on all types of written communication that may shed light on the phenomenon being investigated (Gray, 2004, 2013).

The Revised Policy on the Minimum Requirements for Teacher Education Qualifications referred to in this study as the Revised MRTEQ was used as a policy for data collection. The revised MRTEQ document was selected because it is a guiding document that stipulates the minimum requirements that a teacher qualification must meet at universities in South Africa. It sets the ten basic competencies of a beginner teacher and the standards that must be adhered to by each initial teacher qualification offered by higher education institutions in SA. This is a primary document of the study because this study is about ICT integration in the curriculum of initial teacher qualifications. The ten basic competencies as articulated by this policy, with assigned alphanumeric designators for easy reading later in this document are as follows:

Table 4.1: Basic competencies of a beginner teacher

No.	Basic Competency
1.	Have sound subject knowledge.
2.	Know how to teach their subject(s) and how to select and determine the sequence and pace of the content in accordance with both subject and learner needs.
3.	Know who their learners are and how they learn – they must understand the learners’ individual needs and tailor their teaching accordingly.
4.	Know how to communicate effectively in general, as well as in relation to their subject(s), in order to mediate learning.
5.	Have highly developed literacy, numeracy, and Information Technology (IT) skills.
6.	Be knowledgeable about the school curriculum and be able to unpack its specialised content, as well as being able to use available resources appropriately, so as to plan and design suitable learning programmes.
7.	Understand diversity in the South African context in order to teach in a manner that includes all learners. They must also be able to identify learning or social problems and work in partnership with professional service providers to address these.

8.	Be able to manage learning effectively across diverse contexts in order to ensure a conducive learning environment
9.	Be able to assess learners in reliable and varied ways, as well as being able to use the results of assessment to improve teaching and learning.
10.	Be able to reflect critically on their own practice, in theoretically informed ways and in conjunction with their professional community of colleagues in order to constantly improve and adapt to evolving circumstances

(DHET, 2015; DBE, 2018)

4.5.1 Other documents consulted

The following policies were also consulted for the purpose of document analysis: The National Qualifications Framework Act (67/2008); Professional Development Framework for Digital Learning: Building Educator Competencies in Facilitating Learning with Digital Tools and Resources; Draft White Paper on e-Education: Transforming Learning and Teaching through Information and Communications Technologies (ICT) [White Paper 7]; Action Plan to 2014: Towards the Realisation of Schooling 2025; Action Plan to 2019: Towards the Realisation of Schooling 2030; and Special Needs Education: Building an Inclusive Education and Training System [White Paper 6].

The Professional Development Framework for Digital Learning was selected in order to give the researcher an idea about what ICT integration competencies the Department of Basic Education is looking for in teachers that are in-service. Even though this is a professional development framework, it can be used for both ICT integration for in-service training and ICT integration for specialised postgraduate qualifications like B.Ed. (Hons) Mathematics Education / Science Education / Geography Education / Languages / Technology Education etc. Its thirteen digital learning competencies were read in order to plug the ICT integration gaps identified in the revised MRTEQ document, because the revised MRTEQ has only one ICT specific basic

competency, i.e. competency No. 5 above. The thirteen digital learning competencies are as follows:

Table 4.2: Educator digital learning competencies

No.	Digital Learning Competencies	Code
1.	Adopt the habit of an enquiring mind regarding the educational value of using digital tools and resources.	DLC1
2.	Be reflective about challenging current digital learning and teaching practice.	DLC2
3.	Understand the role of the teacher, the learner, and the digital resources during digital learning.	DLC3
4.	Participate in local and global professional learning communities	DLC4
5.	Select appropriate digital tools and resources when fulfilling the roles of the educator.	DLC5
6.	Integrate digital tools and resources to enhance learning objectives in various learning environments.	DLC6
7.	Develop learners ' global awareness and understanding using digital communication and collaboration tools.	DLC7
8.	Transform learning through the innovative use of digital tools and resources.	DLC8
9.	Enhance class management, assessment, and feedback processes through the use of digital resources.	DLC9
10.	Integrate learners ' skills development in terms of digital literacies with curriculum-based learning.	DLC10

11.	Demonstrate commitment to the vision for digital learning in the province, district, and school.	DLC11
12.	Accept responsibility for planning and implementing digital learning at the school.	DLC12
13.	Initiate peer support and collaborative, work-place learning.	DLC13

(DBE, 2018)

The Action Plan to 2014: Towards the Realisation of Schooling 2025, and Action Plan to 2019: Towards the Realisation of Schooling 2030, were chosen because they stipulate the goals of the SA government concerning schools, and the roles that teachers need to play in achieving these goals. White Paper 6 was analysed as a specific/specialised document that is prescribed for schools on achieving an inclusive education system. White Paper 7 was analysed because it is a guideline document focusing specifically on addressing the integration of ICT in schools.

Also, an analysis was done to determine whether the revised MRTEQ provides correct guidelines to universities for developing a teacher qualification that meets government expectations for ICT integration. This exercise seeks to establish the link between revised MRTEQ and White Paper 7 with specific reference to ICT integration, and the link between the revised MRTEQ and Schooling 2030 with reference to providing quality education. Analysing all these documents was the researcher’s attempt and intention to determine whether these SA policy documents strive to encourage quality education, “*Education for All*”, and the achievement of social justice.

4.6 RESEARCH TECHNIQUES

4.6.1 Sampling

Purposive sampling was used for this study (Denzin & Lincoln, 2011). Purposive sampling is mostly used in qualitative research to enable the researcher to focus on characteristics of a population that are of interest and can help the researcher to answer the research questions. This type of sampling is also known as judgemental, selective, or subjective sampling (Cohen, Manion & Morrison, 2011).

The purposive sampling approach was chosen because it is widely used in qualitative studies. This approach is used in applied research and uses non-probability methods for selecting the sample (Ritchie, Lewis, Nicholls & Ormiston, 2013). Its units are deliberately selected by the researcher (Denzin & Lincoln, 2011). The units have features or characteristics which provide a detailed explanation and understanding of the central theme and questions of the study (Denzin & Lincoln, 2011; Creswell, 2013; Ritchie, et al., 2013). Some researchers call it judgement sampling while others argue that criterion-based is a more appropriate term than purposive (Ritchie, et al., 2013).

The first sample was drawn from a group interview with the Free State Department of Basic Education (DBE) Senior Education Specialists (SES) for E-Learning and IT Coordinators. This group of education specialists was included to gain insight from their observations about the ICT knowledge of newly qualified teachers in schools. The research had to establish which dimension of the TPACK framework is most lacking in the training of prospective teachers. The SES would have this information as they are the ones that provide in-service training in the form of Continuous Professional Development (CPD) to all teachers. These participants were chosen to provide information as to which dimensions of the TPACK framework are common problems for newly qualified teachers. Also, from these group interviews the researcher was able to structure the questions for individual interviews.

Influenced by the chosen paradigm and methodology, in determining the sample for this study, six universities were selected. The six universities comprised two universities of technology, two traditional academic universities, and two newly built universities in the Republic of South Africa. At each university, the study focused on faculties or schools of education which offer B.Ed. (SP&FET) programmes for teacher education and training. The reason for choosing universities of technology was to determine the level of ICT, now that the universities of technology claim to be technology driven. The two traditional universities were chosen because

these universities claim to be advanced in research and academics. The reasoning behind choosing newly built universities in SA was that they should have the latest technologies that are research driven.

Out of each faculty or school of education at the above-mentioned universities, the researcher interviewed two lecturers: one lecturer offering computer/digital literacy to B.Ed. (SP & FET) student teachers; and one lecturer responsible for any B.Ed. subject major specialisation, e.g. Languages as a major, Natural Sciences as a major, Economic and Management Sciences as a major, etc. These lecturers were individually interviewed for them to provide their personal experience with the preparation of prospective teachers. The above sample size was chosen to provide enough rich and detailed information.

4.6.2. Credibility

A triangulation technique was used to ensure credibility of this study. Triangulation refers to the utilisation of two or more methods of data collection in a study to produce understanding (Cohan, Manion & Morrison, 2011; Creswell, 2013). This study used the type of triangulation called triangulation of sources. This type of triangulation happens where the qualitative researcher uses different data sources within the same data collection instrument (Cohan, Manion & Morrison, 2011; Silverman, 2013). This study used group interviews and individual interviews to triangulate and find correlation of data. The study intensively used interviews and the participants were asked the same questions, though some questions were designed for different purposes and sections.

All the questions were designed to assist the researcher to answer the research question. The first set of questions (Annexure B) were for group interviews for Senior Education Specialists at the FS DBE. The group interviews assisted the researcher to set up research questions for individual interviews. So, the second set of questions (Annexure C) were for lecturers teaching the modules on computer literacy or digital literacy as they are called by different universities. The third set of questions (Annexure D) was for subject methodology lecturers, i.e., with

specialisation in Languages, Natural Sciences, Economic and Management Sciences, IT & Technology, etc.

Data was triangulated by using group interviews followed by individual interviews and documents from different sources like policies, books, and articles to enhance the credibility of the study.

4.6.3 Dependability

Dependability refers to the researcher's careful handling of the data collected. Informed consent was received from all the participants. In this study the researcher used an electronic tape recorder to record all the interviews conducted. Permission was requested from the participants for using the tape recorder. So, each participant gave consent that they can be recorded. One individual interview was conducted through Skype. The interview which was done through Skype was video recorded for the researcher to fully participate in the interview. Again, it was video recorded so that the researcher could capture all the verbal and non-verbal communication (King & Horrocks, 2011). This was the only interview which was not conducted person-to-person but was face-to-face through electronic means.

4.6.4. Confirmability

This refers to the respondents' exact words rather than the researcher's own words that can sometimes not be the precise words of the respondent (Cohen, Manion & Morrison, 2011). To ensure confirmability, this study used the audit trail technique. The researcher sourced the services of an independent transcribing firm that transcribed the audio messages to text. The transcribing specialist provided the researcher with a transcription certificate attached as Annexure I. The text transcriptions were used by the researcher to interpret the findings and draw

conclusions from the data collected without running the risk of misrepresenting the data collected from the respondents.

4.6.5 Transferability

Transferability is the provision of evidence in relation to how the findings of a study can be applicable to other contexts, circumstances, and different time periods (Cohan, Manion & Morrison, 2011). All the interviews were conducted at the participants' workplaces. Lecturers were interviewed in their offices at their respective universities. Only one lecturer was interviewed through Skype, but the location was still at the lecturer's university office. The group interviews were conducted at the board room of the DBE offices.

4.6.6 Strategies to ensure rigour

To ensure rigour, the researcher requested ethical clearance from the institutions where data was to be collected. The study's ethical clearance was granted by the Central University of Technology's, Faculty Research and Innovation Committee (FRIC) (Annexure E). This clearance enabled the researcher to get permission from the Free State (FS) DBE to conduct research in the province (Annexure F). The research directorate of the FS DBE informed the District Directors of the sampled districts about the existence of the research to be conducted in respective districts (Annexure G). The supervisor also provided the researcher with a letter indicating permission to collect data (Annexure H). This letter together with the university ethical clearance letter was used primarily to request the participation of individual lecturers at universities.

The participants provided the researcher with consent regarding their participation. It explained the purpose of the study, informed the participants that it is their free will to participate in the study and that they can withdraw at any time should they choose to do so. The researcher

requested the participants to sign the consent form even before the commencement of data collection. This was done to avoid any potential risk to participants and to ensure that the researchers' methods are honest, fair, and non-manipulative (Berg, 2001).

When collecting data, the researcher assured the participants of their privacy and confidentiality. In order not to jeopardise the study, participants were approached with great sensitivity and awareness. The participants were assured of the anonymity of their responses in all cases (Cohen, Manion & Morrison, 2011). Privacy and confidentiality of the participants were never jeopardised to protect them from any harm (Denzin & Lincoln, 2011).

4.7. DATA REDUCTION AND ANALYSES

This study collected data from the field using different instruments, including group and individual interviews and document analysis. The qualitative data analysis was used for this study. The analysis was done as follows:

4.7.1 Data reduction

In this study, data was reduced by editing, segmenting, and summarising (Huberman & Miles, 2002). This happened while analysing the collected data. The researcher used research questions to structure themes. Information obtained from the transcript was then segmented accordingly. First, transcripts from group interviews with the IT subject advisors were grouped together. Second, transcripts of interviews with university lecturers were grouped together. These were further sub-divided into transcripts from lecturers that were lecturing on computer literary/digital literary and a sub-division of transcripts of interviews of lecturers on subject methodologies. Text information relating to each question was then identified. Transcription was done by an external professional transcribing company (see Transcriber's Certificate as Annexure I).

4.7.2 Data analysis

According to the Cohen, Manion & Morrison (2011: 537) “there is no single or correct way to analyse and present qualitative data”. This task is approached depending on one’s individual expertise and abilities. Cohen, Manion & Morrison (2011: 537) outline “seven ways of analysing and presenting data. They indicate that data can be analysed by focusing on people, methods or themes, instruments, case studies, and by narrative account” (Cohen, Manion & Morrison, 2011: 551).

Because this study mainly collected data through interviews, the researcher adopted thematic analysis as outlined by King and Horrocks (2011: 152). The thematic analysis according to King and Horrocks (2011: 152-158) is categorized into three stages, namely, “descriptive coding as stage one, interpretive coding as stage two, and overarching themes as stage three”.

According to King & Horrocks (2011: 152), during stage one, the focus is on the researcher identifying those elements of the transcript data that are likely to be helpful in addressing the research questions. It involves reading, highlighting relevant material, and attaching brief comments on the transcript. This is then followed by defining descriptive codes as one progresses.

Stage two is the stage of interpretive coding. King & Horrocks (2011: 154) state that “this stage requires the researcher to identify codes that clearly describe relevant features of responses that were received from the participants”. And the researcher should focus on attaching meaning to the responses received from the participants (King & Horrocks, 2011). During this process the researcher needs to establish codes, interpret meaning according to a cluster of research questions, and link and interpret the codes relating to the meaning as found in the whole study (King & Horrocks, 2011).

During stage three, the stage of overarching themes that characterises key concepts of the analysis, King & Horrocks (2011: 156-158) state that “it requires the researcher to derive key themes for the data set. Here the researcher should consider themes from the theoretical and/or

practical viewpoint of the project”. Last, the researcher must construct diagrams, graphs, charts, etc. to represent relationships between levels of coding in the analysis (King & Horrocks, 2011).

4.7.3 Data display

Data display is about the way a researcher organises, compresses, and assembles information from the data collected (Huberman & Miles, 2002). The information can be displayed in the form of graphs, charts, networks, causal models, and different types of diagrams like Venn diagrams. This study displayed data by using tables followed by a discussion of the themes that emanated from the respondents’ responses.

4.8 CONCLUSION

This chapter described the research methodology of the study. The chapter first discussed the chosen paradigm. Second, the researcher outlined the research design and research methods. Then research instruments underpinning this research were discussed. Last research techniques, sampling strategies and procedures for validity and reliability were discussed. The next chapter will discuss the findings of the study.

CHAPTER 5

FINDINGS OF THE STUDY

5.1 INTRODUCTION

This chapter presents and reports the findings of this study. The report is organised in terms of the main and subsidiary research questions underlying the study. The themes emerged from the literature review on quality education, social justice and TPACK framework. These themes were matched with data collected through group interviews and individual interviews. In addition to this, these themes were analyzed based on the information gathered from the documents, especially the revised MRTEQ policy.

A descriptive method of data analysis was used to identify patterns in the data collected from group interviews, individual interviews and policy documents developed by the DHET to guide teacher education qualifications.

5.2 DISCUSSION OF FINDINGS

Participants who provided information were assigned alphanumeric designators to ensure anonymity. The letters "ES" represented senior education specialists who were participants in group interviews. The letters "LC" represented lectures for computer/digital literacy, and "LM" represented subject methodology lectures. The lecturers were participants in individual interviews.

The following codes are used to denote the focus group interview that was formed by Senior Education Specialists (SES) from the two education districts in the Free State Province.

Table 5.1: Presentation of participants in the focus group interview

District	Responsibility of SES	Code
Education District 1	SES: E-Learning	ES1
	SES: IT Coordinator	ES2
Education District 2	SES: E-Learning	ES3
	SES: IT Coordinator	ES4

The following alphanumeric designators are used to denote each of the twelve (12) lecturers interviewed from the six (6) sampled universities in SA. At each university, one (1) lecturer responsible for the course computer literacy/digital literacy and one (1) lecturer responsible for subject methodology were interviewed. The participants were as follows:

Table 5.2: Presentation of participants for individual interviews

University	Course offered by Lecturer	Code
University 1	Digital Literacy	LC1
	Mathematics Methodology	LM1
University 2	Computer Literacy	LC2
	Mathematics Methodology	LM2
University 3	Computer Literacy	LC3
	Technology Education Methodology	LM3
University 4	Digital Literacy	LC4
	English Methodology	LM4
University 5	Computer Literacy	LC5
	Primary School Mathematics Methodology	LM5

University 6	Computer Literacy	LC6
	PGCE Education & Science Methodology	LM6

The findings are presented by providing the participant’s responses to the questions. These responses were categorized into themes. For triangulation purposes, data gathered through literature review, focus group interviews, individual interviews, and document analysis were exhaustively examined to compare, contrast and match with available data.

The researcher used both deductive and inductive data analysis (Cohan, Manion & Morrison, 2011). Other themes were predetermined by the researcher when reading through the literature and through the researcher’s experience as a teacher. To give the participants a voice in the research, the researcher used NVivo coding. According to Bazeley & Jackson (2015: 3) using NVivo when analyzing qualitative data helps the researcher to manage data, to manage ideas, query data, visualise data and draw reports from the data. Again, to give the participants a voice in this research, the codes, terms, and phrases used by the participants themselves are presented verbatim (see Annexure I).

Research Question 1

This question enquired about the importance of ICT in education. It enquired about the use of ICT to promote quality education. It also enquired about the value of ICT and how it is used to enable education to meet the requirements of social justice. Literature has proven that it is through ICT that social justice, especially inclusive education, can be achieved.

South Africa is a country with a young democracy. There is a great deal that needs to be done to ensure that it is free of its past injustices brought by colonialization and apartheid. It is through quality education that the inequalities of the apartheid era can be corrected. Social justice can eradicate the injustices of the past and can heal the wounds of the apartheid era. It is through ICT that the injustices of the past, such as lack of access to education, can be addressed. Access,

especially to higher education, can be addressed through ICT in the form of MOOCS, distance education, flipped classroom etc. Also, when looking into inclusive education, one finds that there is no way that ICT can be excluded from inclusive education. This is because most assistive devices are ICT devices. So social justice is largely reliant on the use of ICT.

Table 5.3: The importance of ICT towards quality education and social justice

THEME 1	ISSUES EMERGING FROM THEME
The value of ICT on quality education and social justice	<ul style="list-style-type: none"> • All children can learn and can be supported to learn • The impact of technology and Internet • The emergence of global communities • Education becoming a global commodity • The emergence of the 21st century / virtual classrooms • Teachers and learners becoming global participants • The fourth industrial revolution (4IR)

5.2.1. Findings of theme 1: The value of ICT on quality education and social justice

Focus group interviews

In relation to the first question, it emerged that the respondents were aware of the importance of ICT in promoting both quality education and social justice. From their personal experiences, the respondents indicated that the newly qualified teachers knew the value of ICT and how it could assist them to provide quality education. The respondents answered the question about quality education as if quality education is the accumulation of higher order thinking skills only. The

respondents did not show insight as to all the characteristics of quality education as discussed in Chapter 2.

For instance, one responded indicated that:

ES 1: ...quality education is a way to bridge that gap between the higher order thinking skills that they were using outside the classroom and marrying that with the curriculum inside the classroom.

Regarding the value of ICT towards the advancement of social justice, first, the respondents did not show any logical knowledge of what social justice entails. But with an explanation provided by the researcher, the respondents then were able to indicate the value of ICT towards social justice.

Instead of mentioning technology as the important factor in the value of ICT in education, the respondents in the focus group took a different approach in answering this question. The respondents here looked at the kind of learners that we have in schools.

ES1: Yes, the thing is if we look at the way our learners learn, the learners are approaching learning differently, they live in a world that is driven by ICT and young kids are exposed to technology at a very, very early age. They come to school with a lot of information that they gathered from the Internet.

ES2: ICT is important in education as it enables learners to actually apply higher order thinking skills.

ES4: Most newly qualified teachers are aware that it is only through ICT that they can teach inclusively.

Ultimately all the respondents indicated that the newly qualified teachers were aware of the importance of ICT to quality education and to social justice. However, they indicated the problem is still how to implement the use of ICT to achieve this.

Individual Interviews

The question first wanted to establish the respondents' understanding of the concept of quality education and social justice. Most respondents did not provide a satisfactory answer. The responses received did not show that the respondents understand the characteristics of quality education and the dimensions of social justice as discussed in chapter two of this study. For instance, one respondent tried to answer this question by saying:

LM1: ...in particular in mathematics we have got very abstract mathematical concepts which often times one would think of them as the absolute knowledge and absolute truth, they would say 1 plus 1 is 2 and it is always 2 and then people try to submit those kind of arguments but maybe not for the purpose of this discussion but in any way through its power we are able to visualise certain things.

In answering the questions relating to social justice, most respondents were not aware of the dimensions of social justice. Their answers were only based on racial inequality. The respondents were not aware that social justice is more than just racial discrimination.

LM 2: Ja, when it comes to refugees, I am part of the internationalisation committee, last time I was also shocked that the University is having a certain quarter to take not only refugee, foreign students.

LM4: It is difficult to teach our student teachers how to practice inclusive education because even with us as lecturers we are unable to practice it.

LM5: The University has taken an initiative to train us in the Universal Design for Learning (UDL). This is to ensure that we as lecturers can practice inclusive education in our lecture halls.

Again, in relation to the use of ICT for social justice, most of the respondents indicated that the evolution in ICT has an impact on curriculum, pedagogy and the way learners learn. Some have indicated that globalization and the Internet has made education a global commodity and learners and teachers, by using the Internet, are becoming members of the global community.

Advancing a more technical answer to this question, the respondents provided the following:

LC1: Countries internationally through the industrial revolution most of the things are moving to online and online uses technology which computers are part of.

LM2: Computers help students to search for information easily, it makes education fun and students participate in their class social network groups.

Another respondent presented a different angle from the rest.

LC 3: No to me what I have picked up is in the conversations I have been having with teachers and students is, our students at University are digitally savvy so when they come it the digital knowledge, background of being able to use cell phones for everything because of being the generation that they are and finding a different institution of higher learning makes them to be you know not interested in learning so but now the problem is if we integrate ICT into their learning the question is what aims do we put behind, do we put it in order to accommodate them because of being the generations that they are or do we do it in order to teach a new generation that is coming, you see so that is my opinion.

From the answers provided by the respondents it is evident that using ICT is beneficial to both teachers and learners. Teachers should possess skills that will accommodate these millennial generations of learners. If not, there will be a digital divide between learners and teachers. So prospective teachers should be trained to possess digital skills that will enable them to operate in this environment.

Document analysis

Most of the documents that were consulted for this study acknowledge that by providing quality education, most education systems succeed in advancing social justice. When reading these sources one realises that it is through education that most countries can achieve social justice. In

clarifying the need for social justice, the White Paper on Higher Education in SA states that even after the dawn of democracy, there are still deep-rooted inequalities as a result of our past; it is not accidental that the remaining inequalities in wealth, educational access and attainment, health care and opportunities are still largely based on gender and the colour of one's skin (DHET, 2014).

Furthermore, this policy document stipulates that the standard of living of most South Africans should be equal. However, most black people are living under poor conditions. Blacks are still provided with lower-quality public services in terms of health care, education, social services, etc. (DHET, 2014). Patriarchy is also experienced in most communities. Especially in rural communities, women and girls continue to be exposed to a substandard condition of life, including exclusion from education and training, exclusion from occupying management positions at work, exclusion from ownership of businesses, etc. (DHET, 2014).

The document also indicates the differences that exist irrespective of race and gender, inequalities on the bases of financial status, health status and ability or disability status. Public institutions are targeted to eradicate the above-mentioned inequalities and the fiscus should be geared towards addressing the social injustices of the past (DHET, 2014).

The revised MRTEQ on the other hand aims to enable universities to provide quality teacher education programmes that address the serious problems facing the SA education system (DHET, 2015). This document attempts to respond to the poor content and pedagogical knowledge found amongst teachers, as well as address the education inequalities of the apartheid era (DHET, 2015). The revised MRTEQ aims to incorporate situational, contextual, and pedagogical elements of education. This is done to help teachers develop expertise to operate in a free, diverse, and inclusive education system (DHET, 2015).

Another document that responds to the prescripts of "*Education for All*" as articulated by the UN is the White Paper 6: Special Needs Education, Building an Inclusive Education and Training System. This policy addresses the dimensions of social justice as discussed in chapter 2 of this research (DoE, 2001).

The policy advocates for the education system to acknowledge that it is possible for all children and youth to learn. Also, children need support for them to function in an education environment

(DoE, 2001). Third, the education system of SA should meet the individual needs of learners irrespective of their abilities. Fourth, the education system should acknowledge and respect inequalities and strive to build similarities among learners. Fifth, the education system should recognise formal school education, home education and knowledge gathered from the community at large. Sixth, the needs of learners should play a significant role when determining teaching methods, content in a curriculum and assessment. Last, this document requires the education system to increase learner participation in schools and cultural activities, and to bridge barriers to learning (DoE, 2001).

All documents consulted agree that it is through education that we can address social justice. None of the documents are contrary to this view, however the question remains with the implementation. The documents are not clear as to how this can be done. All the users/readers of these documents are stuck with the 'how' part of these documents as some of the principles or views are new to our education system. This poses a challenge to many universities as providers of teacher training, and to schools as providers of the actual teaching of learners.

Most documents that were consulted showed the importance of ICT as the answer to the ever-changing world. The documents indicate that ICT is enabling teachers and learners to be members of the global community.

The revised MRTEQ is the most important policy for this research in the sense that it gives guidelines to universities on how to structure their curriculum. So according to this policy, teachers who have just joined the profession should possess ITC skills, language proficiency and mathematical skills (DHET, 2015). This document further prescribes that newly qualified teachers must possess the above-mentioned skills to manage the classroom environment effectively across all contexts (DHET, 2015).

White Paper 7, on the other hand, provides a view that the importance of ICT in education is to assist with whole-school development. This document regards ICT as an important management and administrative tool that is used as a technology platform for the South African Schools Administration management System (SA-SAMS) to increase productivity. According to this document, the other advantage of ICT integration is that it enables communication among

teachers, it enables collaborative teaching and learning, and it advances learner creativity and participation (DoE, 2004).

In the same breath, the Action Plan to 2019 has set out strategic priority goals that must be reached by schools. The goals that are relevant to this project/study are Goal 16 which stipulates that the “education system should advance the professionalism, teaching skills, subject knowledge and computer literacy of teachers throughout their whole careers” (DBE, 2015: 46). Goal 22 stipulates that the “education system should improve parent and community involvement in the governance of schools, partly by improving access to important information via the e-Education strategy” (DBE, 2015: 46). The other relevant goal is Goal 27 which states that the education system in SA should improve monitoring and evaluation and provide schools with the essential support to provide quality education (DBE, 2015).

It should also be noted that to achieve the above stipulated goals, the SA government has implemented the White Paper 7 as the guiding document to implement e-Education. So, the two policy documents should be read together to ensure the execution and integration of ICT in SA schools.

Last, the revised MRTEQ states that the training of teachers should also include fundamental learning. Fundamental learning according to this policy, refers to the teachers’ competency with regards to the usage of second official languages, usage of ICT resources, and teaching in a diverse learning environment (DHET, 2015). All the above guiding documents are of the same view that ICT is indispensable to any level of education and it should be used for the success of the education for all citizens.

Question 2

This was a heavily loaded question where the researcher wanted to find out whether the respondents are aware of the knowledge teachers need to have to integrate ICT. It also sought to find out whether the participants can respond to issues around the different knowledge bases needed by teachers to integrate ICT.

Table 5.4: ICT for knowledge on content, pedagogy and technology

THEME 2	ISSUES EMERGING FROM THEME
ICT for knowledge on content, pedagogy and technology	<ul style="list-style-type: none"> • Opening learning through diversity • Redistribution of resources, quality learning resources • Inclusive education • The use of the Internet • Content, pedagogy and technology

5.2.2. Findings of theme 2: ICT for knowledge on content, pedagogy and technology

Focus groups interviews

The respondents indicated that from their observations and their experiences of working with newly qualified teachers, they realised these teachers were not properly trained for ICT integration. Some indicated for instance that:

ES3: Yes, newly qualified teachers know how to use the computer, however they are not aware how it can assist them to make their work easy.

ES1: ...in fact they can use Microsoft applications, but they cannot use these to ease their work or use them for classroom purposes.

ES4: What I realised is that they know applications in isolation to education. I mean they do not know how to use them for educational purposes, yes.

ES 4: Yes, newly qualified teachers use a lot of YouTube videos to see how other teachers teach certain concepts.

It is therefore noted that even though these teachers received training in ICT, the training was not specifically related to education. All the applications are taught for general use not for classroom use.

Individual interviews

Most participants, especially lecturers, indicated that teachers should have knowledge of the Microsoft Office applications software. Most of them indicated that they should know Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and Microsoft Access. For instance, one respondent indicated that:

LC 4: It is enough if students want to integrate ICT, to only know Word, PowerPoint, and Excel.

The most popular application that the respondents mentioned as critical in ICT integration is Microsoft PowerPoint. Most of them believe that by knowing how to use Microsoft PowerPoint, they have integrated ICT.

In addition to the above, one respondent indicated that it is enough to know other computer applications like YouTube:

LM 3: And the other thing is that I can just talk of the YouTube thing.

Another application is the Interactive Whiteboard. LC3 indicated that they are exposing student teachers to the Interactive Whiteboard because they are lecturing technology graphics, and this device makes it easy for students to explain the content.

Although most of the respondents are aware of the importance of the Internet, most of them see it as a mechanism to access information. They see it as a tool to expand access to the education of people in remote areas. The respondents were not fully aware of the Flipped classroom concept where they expand access. Again, the use of MOOCS as discussed in chapter 2, student teachers have not been exposed to by most universities to expand access to education.

The implementation of inclusive education is still a challenge to most universities. The respondents were clueless as to how they can assist student teachers to participate in an inclusive classroom environment.

Some participants indicated that they have not thought about exposing their student teachers to teach in an inclusive environment, which is, teaching slow learners, learners with vision and hearing problems, and the physically handicapped, etc.

LM 2: Yes, in a very explicit manner, ja I would not say I have done that.

LM 3: No, actually my brother, within my scope of teaching I do not include such things.

LM 5: Because I'm responsible for PGCE I don't have enough time to address that element of education.

However, one respondent indicated that in their university they are trained in the Universal Design for Learning (UDL). As a result, they make their student teachers aware of diversity in the classroom. The respondent stated:

LM 5: People with disabilities, visually impaired and all these things so when, you go to classrooms you teach them how to accommodate all those people.

Document analysis

The documents consulted addressed this question using three different approaches. First, access can be expanded by maximising the number of people who must have access to education. The statistics presented in 2013 indicated that 3,4 million youth ages between the ages of 15 to 24 were not employed, nor were they in education or being trained in SA. The abbreviation used in SA for this group is NEET, meaning Not in Employment, Education and Training (DHET, 2014). The NEET make up 32,9% of the age group 15 years to 24 years. It should be noted that 29,7 % of the country's men are in the NEET category while 36,1 of women are in this category (DHET, 2014). These statistics call for an increase in education opportunities to the marginalised groups,

notably women, people with disabilities, people in rural areas, etc. The redistribution dimension of social justice will address this disparity in the sense that it will increase the numbers of people that access education, will provide relevant education programmes, and provide an affordable education system and innovations. The documents have captured the gist of these problems, however solutions to these problems still pose a challenge.

The second point about expanding access not only revolves around making spaces available in education, but also requires provision of relevant programmes to the masses of the people. Most documents that were consulted are of the view that the programmes offered should be relevant to the masses of the people, to boost the economy of the country and to enable most of the people to be role players in the economy. The revised MRTEQ states that prospective teachers should have knowledge of how to provide education in a diverse learning environment, to accommodate learners with barriers to education (DHET, 2015). For example, prospective teachers should be empowered to deal with issues like HIV and AIDS, poverty and the lingering effects of apartheid, diversity, promotion of inclusivity, and environmental sustainability at schools (DHET, 2015).

Failure to do the above can result in students calling for the decolonisation of the curriculum, as is the case here in SA. Some academics, students and the community at large are of the view that the programmes do not respond to the needs of the societies and the country's economy generally. Hence the recent outcry to decolonise the curriculum at higher education institutions. This outcry is in relation to the relevance dimension of social justice as discussed in chapter 2.

Another important factor outlined by these documents is to provide access to education, which should improve the quality of products that the country produces. The education system should produce graduates that are productive and innovative for the country to be a global economic role player. Teachers should produce learners that are innovative and able compete with their peers globally. This must be irrespective of the learners' socio-economic background, race and colour.

Hence the establishment of the National Student Financial Aid Scheme (NFSAS) by the SA government, to open doors to learning for students coming from poor family backgrounds. Recently, in the year 2017, the government committed to provide free higher education to students coming from families that are earning a combined gross salary which is less than R300

000 per annum. This includes children from the middle-class families like the children of the parents that are working as nurses, the police, teachers, etc.

Question 3 & 4

The findings below relate to both research question 3 and research question 4. Question 3 aimed to investigate the level to which universities have incorporated the TPACK framework in their undergraduate curriculum. Question 4 looked at how the revised MRTEQ policy has influenced the structure of universities regarding the infusion of the separate knowledge bases of the TPACK framework. For easy reading, the researcher grouped these responses to show the link between the university curriculum and what the revised MRTEQ has prescribed. The focus group interviews are not discussed in these findings because the respondents were not responsible for the university curriculum. But the responses that were gathered from these focus group interviews assisted the researcher to formulate questions for the individual interviews.

Both these questions aimed to establish whether prospective teachers are provided with the necessary knowledge bases that are needed in the 21st century classrooms. The question sought to discover whether prospective teachers can provide quality education that can integrate ICT and can implement all that has been uncovered in the above two questions. This question aimed to find out whether student teachers are well-trained to implement what is expected by other education policies, except the revised MRTEQ. The researcher is of the view that the country has got good, progressive policies but there is no articulated implementation strategy, hence this question. This question forms the gist of this study as it is based on the conceptual framework of the study as discussed in chapter 2.

Table 5.5: Acquisition of Content Knowledge

THEME 3	ISSUES EMERGING FROM THEME
Content Knowledge (CK)	<ul style="list-style-type: none"> • Deep learning • Depth and breadth of subject knowledge • Using teaching and learning support materials • Supplementing subject knowledge to get better content knowledge • ICT complementing content knowledge

5.2.3. Findings theme 3: Content Knowledge (CK)

Individual interviews

This theme addresses the first pillar of the TPACK Framework. All the respondents seemed to agree that this provides student teachers with the required content knowledge. They indicated that upon the admission process, they selected student teachers that have passed subjects in which they want to specialise. This forms the initial base for the student teachers' content knowledge; that is, their matric performance is in line with subjects they want to specialise in as teachers.

Again, most respondents indicated that they encourage student teachers to buy prescribed books and they encourage these students to use the library for studying and enrichment. Some respondents indicated that they encourage their student teachers to read or research more about the subject they specialise in so that they can have better insight into the subject they will be teaching. One respondent said:

LM 3: The use of various learning and teaching support materials encourages deep learning.

Furthermore, most respondents indicated that more content is gained by using the Internet. The respondents indicated that they encourage the usage of Google to search for information on the Internet by their learners. To them, the Internet enables different search engines to be used as an information retrieval instrument and further supplement information gathered from the prescribed textbooks and the lectures that they provide.

The respondents all agree that ICT is immensely helpful in supplementing student teachers' content knowledge and it also provides students with the most recent information on concepts. The use of ICT to advance content knowledge is highlighted by the following respondents.

LM 1: I use the programme called GeoGebra to advance the student teachers' knowledge of Geometry.

LM 2: ICT can be used for the advancement of graphs; graphs can be related to get all the dimensions.

LM 5: I explain certain calculus concepts using the computer and students, more especially first year students, find it fascinating.

LM 4: Computers are useful for content knowledge as I use it to download video of set work or book like Macbeth & Romeo and Juliet.

Document analysis

All the documents agree that prospective teachers must have a high level of content knowledge. This deep knowledge of the content will enable them to explain concepts easily to their students. For instance, in revised MRTEQ, this knowledge dimension is referred to as disciplinary learning. The document defines this as disciplinary or subject matter knowledge. This knowledge, according to the revised MRTEQ, is captured in two components of the teacher education curriculum. First, it will be presented in the study of education and its foundations. Second, it will be presented in the study of the specific specialised subject matter relevant to the academic disciplines underpinning teaching subjects (DHET, 2015). Third, it is also regarded as the first basic competence of a beginner teacher according to the revised MRTEQ (DBE, 2018; DHET, 2015).

This document further stipulates that the B.Ed. qualification is pitched at National Qualifications Framework (NQF) Exit level 7 and should have a minimum total credit equal to 480 credits. So, for learners to gain entry to this qualification, their minimum entry requirement is a National

Senior Certificate (NSC) or an NQF Level 4 National Certificate (Vocational) with endorsement for entry into Bachelor Studies and with appropriate subject combinations.

From the above-mentioned specifications, when developing the curriculum of this degree, universities must ensure that a minimum of 50% of credits (240 credits) is allocated to teaching a specialisation phase and/or subjects. This must include subject-focused disciplinary pedagogical and practical learning. For example, if a student specialises in, for instance Mathematics, 240 credits must be allocated to Mathematics content, methodology and practical learning, throughout the four-year study. Another stipulation is that at least 120 credits should be pitched at Level 6 and 60 credits pitched at Level 7 of the NQF. The 240 credits for the teaching of a specialisation, according to the revised MRTEQ, is to ensure that student teachers acquire the depth and breadth of subject matter knowledge (DHET, 2015).

The above stipulation by the revised MRTEQ is to ensure that newly qualified teachers acquire sound subject knowledge at a higher level. Again, the teachers that are to be produced by this qualification should have knowledge of selecting, sequencing, and pacing of their subject content in accordance with both subject and learner needs (DHET, 2015).

Table 5.6: Acquisition of Pedagogical Knowledge

THEME 4	ISSUES EMERGING FROM THEME
Pedagogical Knowledge (PK)	<ul style="list-style-type: none"> • Principles and practices of teaching • Methods of teaching • Teaching strategies • Curriculum • Pedagogic differentiation

This is the second pillar of the TPACK framework, the PK, entails knowledge about the assortment of teaching practices, strategies, and methods to promote learning. In addressing this theme, the respondents and documents provided this data.

5.2.4 Findings of theme 4: Pedagogical Knowledge (PK)

Individual Interviews

All the respondents indicated that student teachers need sound knowledge of teaching strategies, methods, and an understanding of differences in learning. According to them, student teachers need to acquire knowledge about the different learning styles. The respondents all agreed that without pedagogical knowledge, teaching and learning will not bear the required results.

The respondents indicated that as required by the revised MRTEQ, student teachers are exposed to educational foundations in the form of philosophy, psychology, sociology, etc. The student teachers should be exposed to content relating to how learners learn, learning and teaching resources, teaching strategies, classroom management, and professional conduct within the school environment.

Some participants brought to the researcher's attention that one critical element of pedagogical knowledge is that of assessment. The respondents indicated that:

LM 4: I expose my students to different assessment strategies. They need to understand that assessment measures the success or failure of any teaching and learning encounter.

LM 5: Students must know that assessment is very important in teaching. I tell them that formal assessment puts learners on track.

In a nutshell, all respondents indicated that pedagogical knowledge is essential to the quality of education in general. And without it, student teachers cannot function appropriately in the classroom. Again, this knowledge exposes student teachers to how learners learn and what teachers must do to facilitate learning.

Document analysis

Pedagogical knowledge is discussed and highlighted in most documents consulted, as the pillar of any teaching qualification. In the revised MRTEQ, students studying for a teacher qualification must be exposed to pedagogical learning. Pedagogical learning, according to this document, incorporates general pedagogical knowledge. This general pedagogical knowledge refers to the study of the principals, practices, and methods of teaching (DHET, 2015). Again,

the revised MRTEQ explains pedagogical learning as learning that includes learners’ knowledge, learning, curriculum, and general teaching and assessment strategies (DHET, 2015).

Furthermore, this document proposes that when developing the B.Ed. degree programme, universities must allocate at least 40% of the total credits of their qualifications. The 40% of the total credits equals 192 credits which should be accounted for by educationally focused disciplinary learning. This area must include the educational foundations, general pedagogy, foundations of learning and situational learning. The foundations of education should have 96 credits pitched at level 7 for an education degree to be awarded (DHET, 2015).

To address diversity, both the White Paper 6 and the White Paper on Post-School Education advocates for differentiated pedagogy (DoE, 2001; DHET, 2014). These documents encourage institutions of higher learning to expose student teachers to differentiated instruction and assessment. These documents require student teachers to be exposed to frameworks or a philosophy for effective teaching that accommodates diversity (DoE, 2001; DHET, 2014). Student teachers should be made aware that learners vary in terms of culture, socio-economic status, language, gender, ability/disability, personal interest, etc. As prospective teachers, they must be aware of these varieties as they plan their curriculum at a micro-level (DoE, 2001; DHET, 2014).

Table 5.7: Acquisition of Technological Knowledge

THEME 5	ISSUES EMERGING FROM THEME
Technological Knowledge (TK)	<ul style="list-style-type: none"> • Audio media, visual media, audio visual media, multimedia • Computer literacy • Computer technology • Mobile technology • Internet

5. 2.5 Findings of theme 5: Technological Knowledge (TK)

Individual interviews

First, all respondents agreed that they expose their student teachers to basic teaching equipment like the chalkboard. Then students are introduced to technologies like overhead projectors. This was an indication that student teachers are predominantly exposed to audio, visual and audio-visual resources.

Second, in responding to the question about multimedia resources, most participants indicated that they expose their student teachers to computers only. This is because most faculties of education do have computer laboratories in their infrastructure.

About multimedia resources, the respondents further indicated that they expose student teachers to the Learner Management System (LMS) that the university uses. Most universities that were visited use the Blackboard LMS and student teachers use these to get their tutorials, assignments, and assessments. There was no evidence that lecturers teach students how to use these LMS resources for future use. The only responses to this knowledge base were:

LC 3: Okay they are exposed to a number of equipment but the first equipment which they are introduced to is a computer including all its components.

LC 5: Ooh students are introduced to the computer and Blackboard for their study guides and assignments.

LC 6: We introduce our students to the computer because a majority of them come from the rural areas and they are not used to it.

Third, the respondents vary in terms of the other equipment they exposed the students to. Some indicated that they enable student teachers to be acquainted with the use of the interactive whiteboard. This is a multimedia resource that is composed of a computer, overhead projector, and a white screen.

LM 3: To some extent we introduce them to the use of the interactive whiteboard.

LM 2: Students first have to learn on how to use the chalkboard. Yes, ja we start first with the chalkboard.

Another one indicated that:

LM 5: As we are training primary school teachers, we encourage them to develop transparencies and use them with an overhead projector.

Last, some respondents indicated that they expose student teachers to tablets.

LM 2: In addition to the computer, I requested the e-learning section of the university to workshop my methodology student on how to use tablets in the classroom.

Document analysis

Most documents consulted indicated that student teachers should be exposed to visual equipment, auditory equipment, and audio-visual equipment. In these documents, visual media includes chalkboard, posters, charts, models, photos, photo cameras (including editing software), etc. Audio equipment includes tape recorders, radios, and DVD players. Audio-visual media, according to these documents, include personal computers, laptops, interactive whiteboard, video conferencing systems, and mobile technology (cell phones & tablets).

In addition, White Paper 6 also recommends that student teachers should be exposed to specialised equipment like Braille writers, voice synthesizers, hearing aids and adopted ICTs, and the personnel to accommodate the full range of different learning needs (DoE, 2001). This document urges that student teachers should be exposed to effective use of assistive technologies for them to know how to use them in addressing the needs of people living with disabilities.

However, data collected indicated that most student teachers lack knowledge regarding the use of most audio-visual equipment. This is because the lecturers themselves do not have the knowledge of how to use these resources. Most universities still lack when it comes to teaching student teachers how to operate in an inclusive classroom. Yes, the policies require student

teachers to be exposed to this equipment, but institutions still lack the skills on how to expose them.

Table 5.8: Acquisition of Technological Content Knowledge

THEME 6	ISSUES EMERGING FROM THEME
Technological Content Knowledge (TK)	<ul style="list-style-type: none"> • Internet for content information • Assistive technologies to teach subject specific content • Geometry sketch pad, GeoGebra, etc. • Using subject specific software/app • Using YouTube to teach subjects • Using mobile technology to teach subject specific content

5.2.6 Findings of theme 6: Technological Content Knowledge (TCK)

Individual interviews

The respondents did not say much about the reciprocal relationship between technology and content. Most of them only indicated the Internet is useful in supplementing content.

LM 5: We normally encourage students to use the Internet

One other respondent indicated that they supplement the laboratories with the use of videos for the demonstration of experiments.

LM 6: Students that are specializing in physics can also watch videos of the experiments without going to the laboratories.

Some respondents indicated that student teachers are exposed to certain computer software that is subject specific. For instance, the following said:

LM 1: I did ask them this year to solve statistics and then to sit down and then come with the graph and draw the table using the Excel, not drawing it by freehand.

LM 2: In the other one that I try and expose the students to, in the main, is the GeoGebra because remember I am in the math. So, I try to do a lot of GeoGebra, and I also tried to integrate GSP in geometry using sketch pad.

The other software that the respondent indicated they exposed the students to is YouTube. For instance, the following respondents said:

LM 4: Our students like to search for YouTube video of the content, so we let them use them for their subject knowledge.

LM 6: I let them use YouTube to see how other teachers teach.

Document analysis

Not much has been said about this knowledge base in the revised MRTEQ. This document only mentions that newly qualified teachers should be able to explore new digital tools and resources for their subjects; some are mentioned in the CAPS document of their respective subjects.

The other document that is explicit about this kind of knowledge is the White Paper 6 (DoE, 2001). This document requires teachers and prospective teachers to have knowledge of how to use assistive technologies to teach content, especially to people with disabilities.

Table 5.9: Acquisition of Pedagogical Content Knowledge

THEME 7	ISSUES EMERGING FROM THEME
Pedagogical Content Knowledge (PCK)	<ul style="list-style-type: none"> • Strong understanding of different teaching methods • Understanding of different learning strategies • Instructional media design • Understanding of different assessment strategies • Using assistive technologies in the classroom

This theme relates to Shulman’s (1986: 8) notion of how teachers should plan and present lessons which are relevant and can meet the interests of learners in the classroom. It refers to the accumulation of teachers’ knowledge in relation to content and pedagogy. This knowledge empowers teachers to facilitate learning that will accommodate diverse learners’ needs (Shulman, 1986; Mishra & Koehler, 2006).

5.2.7 Findings of theme 7: Pedagogical Content Knowledge (PCK)

Individual interviews

All the participants indicated that their student teachers are exposed to this kind of knowledge. This is because it DoEs not emphasise the use of technology; hence all the participants were sure that student teachers were exposed to this knowledge.

The respondents, especially those responsible for the lecturing of subject methodologies, indicated that students were exposed to this as it was a requirement of the revised MRTEQ.

Document analysis

In response to this question, all the documents emphasise the importance of pedagogical content knowledge, especially in education. Most documents emphasise that the teacher education programmes should enable prospective teachers to be conversant with the school curriculum. They should also have the knowledge to use subject specific resources that can help them to easily teach their respective content. Prospective teachers, according to these documents, should demonstrate abilities to plan, design and pace suitable learning activities for their respective subjects.

Student teachers should be trained on selecting and teaching the content which is relevant to their subject(s). They should again be able to determine the sequence of concepts within their subject(s) and pace the presentation of content in response to their learners’ needs.

The revised MRTEQ document further mentions that prospective teachers should also be able to set the required subject specific assessment tasks and activities. They should demonstrate that they are able to design assessment tasks that are consistent and tasks that vary for assessing different cognitive levels of their learners (DHET, 2015).

The revised MRTEQ refers to this dimension of knowledge as specialised pedagogical content knowledge. This knowledge is part of the 50% of the total credits of the degree programme that is the part of the 240 credits mentioned above. This document furthermore stipulates that inclusive education should form a significant aspect of both the general pedagogy and the specialised pedagogy of the content. In most cases, this knowledge is referred to as the subject methodology of specific subjects, for example Mathematics Education / Methodology, English Education / Methodology, Economics Education / Methodology, etc.

Table 5.10: Acquisition of Technological Pedagogical Knowledge

THEME 8	ISSUES EMERGING FROM THEME
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Technological Pedagogical Knowledge (TPK)	<ul style="list-style-type: none"> • Instructional media design • Differentiation pedagogy • Differentiation assessment strategies • Using assistive technologies in the classroom
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5.2.8 Findings of theme 8: Technological Pedagogical Knowledge (TPK)

Individual interviews

In responding to this question, most of the lecturers, particularly those responsible for computer/digital literacy, could not provide a satisfactory response to this question. They all mentioned that when they lectured on computer applications, they are generalizing in their approach. This means there is no difference between teaching a student teacher and, for instance, a cashier, clerk, doctor, lawyer, artist etc. The computer applications were not taught in the context of education.

The respondents that are responsible for subject methodology responded well to this question. Some indicated that they use certain technological equipment or software for specific pedagogical practices.

LM 1: Students are taught how to use GeoGebra to teach geometry.

LM 2: I am in the maths, so I tried to do a lot of GeoGebra and also tried to intergrade GSP, geometry sketch pad.

LM 6: I use WhatsApp to communicate with my students on projects I have given them.

LM 3: I have an interactive whiteboard there, so I use it to teach computers.

Document analysis

In providing a response to this question, most documents assent to the fact that the student teachers should be exposed to as many as possible technologies to help them in the classroom. Even though these technologies are not named, generally all the documents do mention that technology should be incorporated so that student teachers can teach effectively across various contexts to ensure a conducive learning environment.

Assistive technologies are also mentioned here to assist student teachers with differentiated pedagogy. The documents indicated that differentiation is important for inclusive education.

Table 5.11: Acquisition of Technological Pedagogical Content Knowledge

THEME 9	ISSUES EMERGING FROM THEME
Technological Pedagogical Content Knowledge (TPACK)	<ul style="list-style-type: none"> • Deep learning • Depth and breadth of subject knowledge • Using teaching and learning support materials • Supplementing subject knowledge to get better content knowledge • ICT complementing content knowledge • Knowing how to use audio media, visual media, audio visual media, multimedia • Computer literacy, computer technology, mobile technology • Internet • Strong understanding of different teaching methods • Understanding of different learning strategies • Instructional media design • Understanding of different assessment strategies • Using assistive technologies in the classroom

	<ul style="list-style-type: none">• Instructional media design• Differentiation pedagogy• Differentiation assessment strategies
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This knowledge dimension refers to meaningfully accurate, deep, skilled teaching that can be performed with technology or without it. This knowledge is about the simultaneous use of content, pedagogy, and technology (Mishra & Koehler, 2006, 2008). It requires a profound understanding of how content, pedagogy and technology all work together to bring about effective teaching and learning that ensures the easy conceptualization of content (Mishra & Koehler, 2006, 2008; Koehler, Mishra & Cain, 2013).

5.2.9 Findings of theme 9: Technological Pedagogical Content Knowledge (TPACK)

Individual interviews

None of the respondents indicated that they were able to expose student teachers to the relations among technology, pedagogy, and content. Lack of policy specific directives was mentioned by one respondent as a barrier to this question.

LM 6: Universities only cater to funded programmes and if we put something beyond the minimum, then students need to pay for these extra modules or credits.

Document analysis

Even though these documents are not explicit in providing answers to this question, the researcher believes this theme has been covered somewhat by all the documents. The big challenge is to equip student teachers with the knowledge that will embrace technological knowledge, pedagogical knowledge, and content knowledge simultaneously. The interpretation depends on individual universities on how the credits can be manipulated to accommodate the required knowledge. This will be seen in the application framework that the researcher will be proposing in the next chapter.

5.3 CONCLUSION

The chapter presented the findings of the study. First, methods of data analysis used in the study were briefly described. Second, findings of the study from individual interviews, focus groups and document analysis, were thematically presented. Third, the views and opinions were represented verbatim. Interviews focused on three research questions together with subsequent themes re-stated at through this chapter. Document analysis focused on the policies relating to requirements for teacher education qualifications, inclusive education, post-school system in SA, ICT, and education in general.

The next chapter discusses the findings of the study, draws conclusions, and makes recommendations based on the findings.

CHAPTER 6

DISCUSSION OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

This chapter discusses the findings, recommendations, and conclusion of the study. The chapter integrates arguments, themes and facts that emerged from all the chapters. It further presents recommendations regarding the research problems. Lastly, this chapter draws conclusions from the study.

6.2 SUMMARY OF THE STUDY

6.2.1 Purpose of the study

The purpose of this study was to explore the integration of ICT in pre-service teacher training, at universities in South Africa. The study also investigated the way in which pre-service teachers are exposed to the Technological Pedagogical Content Knowledge (TPACK) needed by teachers to cope with 21st century teaching.

6.2.2. Restatement of the research questions

The following research questions from the statement of the problem guided the inquiry.

Main research question

What knowledge is needed by prospective teachers studying for a B.Ed. degree so they can integrate ICT in their teaching, and enable them to provide quality education that is geared towards the promotion of social justice?

The following are the subsidiary questions:

- How does ICT promote the advancement of quality education and social justice in education?
- How are student teachers trained to acquire TPACK critical in the integration of ICT in undergraduate courses?
- To what extent have universities in SA incorporated TPACK in their B.Ed. curriculum to ensure that prospective teachers are trained to integrate ICT into their teaching?
- Do teacher education qualification policies in SA provide adequate guidelines for universities to develop a curriculum that trains prospective teachers to infuse ICT into their teaching?

6.2.3 Restatement of the objectives

The objectives of this study are to:

- Examine the importance of ICT in advancing quality education and social justice.
- Establish how student teachers are trained to acquire TPACK.
- Determine the level to which universities in South Africa have incorporated TPACK in the curriculum of their teacher education and training programmes.
- Establish the adequacy of the guidelines provided by teacher education qualification policies in determining the teacher education curriculum at universities.

6.2.4 Restatement of the propositions

- ICT is indispensable to the realisation of quality education that ensures social justice.
- The current B.Ed. curriculum at universities in South Africa does not adequately infuse ICT to equip student teachers with the required knowledge and skills to integrate ICT in their own teaching.
- The current curriculum of B.Ed. programmes provided by universities has not sufficiently incorporated TPACK that prospective teachers need to integrate ICT in their teaching.
- Teacher education qualification policies in SA should provide universities with adequate guidelines to infuse ICT into their curriculum.

6.3 Theoretical Framework

This study is guided by three theories that are relevant to the topic. These are Basil Bernstein's theories on curriculum structure, social constructivism and connectivism. These theories were chosen because of the three core themes that emerged from the topic, namely, curriculum, ICT and teacher education. The theories were deemed relevant in the sense that they guided this study and made it focus on appropriate arguments.

6.3.1 Basil Bernstein's theories on curriculum structure

The topic of this study is about how the teacher education curriculum is structured at universities in South Africa (SA). Also, it revolves around how this structured curriculum equips student teachers with the appropriate knowledge to infuse ICT in their teaching. Its focus is whether, upon completion of their studies, student teachers can cope with the demands of the 21st century classroom. Consequently, this study investigates the structure and content of the curriculum of teacher education at universities in South Africa.

Basil Bernstein's (1973a, b, 1975) theory and concepts arguably tell us more about the curriculum than most educational researchers. Hence its relevance to this study. His theory provides concepts and criteria for understanding the structure of the curriculum at education institutions. This theory directed the researcher to examine the organization of time in terms of the relative status of content at different universities. The content that the researcher focused on was that of ICT in relation to other content. This examination enabled the researcher to determine the boundaries between the different types of content. When determining these boundaries, according to Bernstein (1973a, b, 1975), content can either be well-insulated from each other – that is, they stand in a closed relation, or they are in a reduced insulation - that is they stand in an open relation to each other (Bernstein, 1973a, b, 1975; Hoardley & Jansen , 2012). With guidance from this theory, interviews conducted revealed that the content at universities is not in an open relationship but rather a closed relationship. This is because of the insulation that has been put around different content, the researcher found.

Second, Bernstein (1973a, b) presented two characteristics, as discussed in chapter 3, to be used to understand the structure of the curriculum, namely “Classification” and “Framing”. The study discovered that at most universities, there was strong classification between teacher education subjects/modules. This characterizes a collection code, as opposed to weak classification which characterizes an integrated code. Again, when analyzing the framing, this study discovered that there was strong framing among subjects at most universities. This simply means that the lecturers are in control of the content, in the sense that they have predetermined the order of the content and the content must be done or completed within a specified time. This control does not allow for individualised learning, varied pace and different intelligences which are strong characteristics of ICT in education.

Again, according to Bernstein (1973a, b, 1975), the way “Classification” and “Framing” is structured helps to determine as to whether a curriculum is a collection type or an integrated type of a curriculum. If there is a strong insulation of subjects, this indicates a collection type of a curriculum. The study discovered that the subjects, especially ICT content, is kept apart from other content. Hence, this approach does not encourage an integrated type of a curriculum. By using this kind of analysis, this study found that most universities in SA do not show signs of having an integrated kind of a curriculum.

This study was also about how a teacher education curriculum is structured for it to adequately integrate ICT in the training of prospective teachers, as well as how the curriculum is structured to influence the future infusion of ICT in their teaching. The findings, using this theory, were that student teachers were not appropriately taught how to integrate ICT in their teaching. This was evident when interviewing subject methodology lecturers. These lecturers could not provide evidence on how student teachers were taught how to use different ICT resources or equipment, practice differentiated teaching, operate in a learner-centered curriculum, and how to bring about an alteration in the balance of power between teacher and content (Bernstein, 1973a, b).

Again, from the interviews conducted, the researcher discovered that student teachers were not appropriately trained on information skills and critical skills in learning as these are the characteristics of an integrated type of a curriculum (Bernstein, 1973a, b). Therefore, Bernstein's (1973a, b) theory on curriculum structure was helpful in this study because it enabled the researcher to evaluate the different curriculum structures at universities in SA, and to evaluate the content that was presented to student teachers and how this content was presented, i.e. the mode of delivery (Bernstein, 1973a, b).

6.3.2 Social constructivism

To understand the epistemic engagement view of learning in the 21st century and the educational vision driving educational technology, this study used social constructivist theory. Because social constructivism is arguably a philosophy of learning not of teaching, it was used in this study to investigate how student teachers are trained at universities in SA, to facilitate learning. Again, learning in the 21st century is reliant on the use of ICT; hence this study used this theory to explore how student teachers are trained to facilitate learning that is characterized by using ICT. The other reason for using this theory is because ICT emphasises the evolutionary tendency for curiosity, discovery, sharing and understanding in the use of technological tools (Hoardley & Jansen, 2012). These are strongly associated with social constructivist learning theories, hence the choice of this theory.

The third reason for choosing or using this theory to guide this study is its appropriateness regarding the SA schools' learner-centered curriculum. The SA government after 1994 adopted a learner-centered curriculum which is characterized by, among other aspects, collaborative learning, cooperative learning and the realisation of outcomes that advance the needs of the society. The above are also the characteristics of social constructivism in the sense that this theory shares the understanding that individuals' construction of knowledge is dependent upon individuals and collective understandings, backgrounds and proclivities (Archer, 1996; Kanuka & Anderson, 1999; Larreamendy-Joerns & Leihardt, 2006).

Last, this theory was used because it stresses that in teaching and learning, context is important. This theory holds a view that learning happens smoothly and effectively when the activities and context are appealing and meaningful for learners. Therefore, it is the researcher's view that for effective learning to take place, ICT should be used in order make learning meaningful and pleasing to learners. Also looking at the discussions in chapter 3, this theory assisted this study to focus on the knowledge dimensions needed by student teachers for them to be effective in their classrooms. So, this theory was used to guide the investigation around what knowledge student teachers need for the kind of learners they will be teaching, the environment they will be operating in, and the kind of resources they need in the 21st century classroom.

6.3.3 Connectivism

The Internet is the indispensable part of ICT (Anderson & Whitelock, 2004). Therefore, this study would be incomplete without mentioning the value of the Internet in 21st century education. According to Anderson & Whitelock (2004), the Internet has three distinct features that makes it valuable to teaching and learning. These are, first, that the Internet offers the capacity of power to education. Second, the Internet creates a context of information abundance. Third, the Internet ensures that learners and teachers are actively involved in the classroom; they work autonomously; and they are free when gathering, aggregating, synthesizing and filtering the net for accessing content, and to communicate what they find appropriate to them (Anderson & Whitelock, 2004; Siemens, 2005).

The above background influenced the choice of this theory to guide this study. Because, according to the theory, teachers and learners use the Internet to form connections that enable them to know more and to become global participants in education. This theory proposes the use of nodes, which consist of learning resources and educational technology. This element is closely associated with technological knowledge (TK) as discussed in chapter 3, meaning that teachers must have the knowledge to use technology in the 21st century classroom.

Second, this theory was chosen because it requires that a learning environment equip learners with information skills. It emphasises that teachers should teach learners how to retrieve, filter, process, use technology and disseminate information for their individual learning (Siemens, 2005, 2006; Boitshwarelo, 2011).

Third, the theory was chosen to provide understanding on how millennials create new connections. This provided the researcher with an understanding on how prospective teachers should be trained to ensure that learners become members of the global learning space (Siemens, 2005; Boitshwarelo, 2011; Roberts, Newman & Schwartzstein, 2012). In a nutshell, this theory assisted the study to understand the value of the Internet in education, how the Internet can be used by both teachers and learners, and how the Internet adds value to the accumulation of subject content and knowledge in general.

6.4. DISCUSSION OF FINDINGS

This section discusses the findings from the participants' responses. The findings are discussed as per the themes identified in chapter 5.

6.4.1 Theme 1: The value of ICT on quality education and social justice

The first research question established why ICT is valuable to both quality education and social justice. This question is addressed by first establishing why education is important to all nations, then why the education to be provided should be quality education, and last, how the education to be provided is a requirement for social justice. This sequence will ensure that education institutions respond to the United Nations Sustainable Development 4: Quality Education, which states countries affiliated to the UN should provide inclusive and quality education to all their citizens and should promote lifelong learning among its citizens.

The literature presented in chapter 2 indicated that there is a global need for education. The United Nations has put education as one of its apex priorities. At first the UN called for member states to embark and commit to the “*Education for All*” movement; this was stated to ensure that education becomes a human right to all citizens of the world (UNICEF, 2007). This agreement is of the view that all children have the capacity to learn, all children can be provided with support to ensure that they learn, and education must be accessible to all (UNICEF, 2007).

Again, the literature indicated the expected characteristics of quality education. It further indicated how member states should provide quality education that ensures accessibility, inclusivity and the promotion of lifelong learning (UNICEF, 2007). Looking at these characteristics, one realizes that they are basically the prescripts of social justice (Tikly & Barrett, 2011). This study sought to establish whether the providers of teacher education, in this case lecturers at universities, basically understand what the global expectations towards teachers are in general – that is, what student teachers must be trained to do to meet the global expectations of the teaching profession. With regards to this issue, the findings showed that all participants were aware of the importance of education. However, it was noted that the participants were not clear about what quality education means.

Quality education, according to this study, means the ability of teachers to provide a quality learning environment, quality content, quality processes, and quality assessments, and all these should inspire learners to be happy and attend school (UNICEF, 2007). Other characteristics of this kind of education are that it should be equitable, i.e. not gender biased, it must provide lifelong learning opportunities for all, it must be inclusive, it must produce learners that are able to be global participants in education, and also produce learners that can contribute to global

sustainable development by promoting societal, economic and political change (Fraser, 2003; UNICEF, 2007; Tikly & Barrett, 2011).

With this background in mind, the findings revealed that even though most participants were aware of the “*what is*” of quality education and social justice, most of them were not aware of the “*how to*” part of achieving it. For example, the lecturers are aware that teachers are expected to practice inclusive education. But, when asked about how they train and prepare their student teachers for inclusive education, most of them were not able to answer this question. This simply means that most participants do not train student teachers to practice a differentiated pedagogy. Because of this the participants are also not aware that it is through ICT that pedagogy can easily be differentiated (Polat, 2011; Dalton, McKenzie & Kahonde, 2012). Again, when asked about how student teachers can easily promote individualised learning, most participants were not aware that this can be achieved by using ICT.

The researcher is of the view that ICT has become an indispensable part of 21st century teaching and learning. This is, first, because of the kinds of learners that teachers are confronted with, the so-called millennial generation. Second, this is because of the technology (including mobile technology) that is accessible to both learners and teachers. Third, it is because of the easy access to large volumes of content that has been made easily available by the Internet. The rise in these three elements has impacted education so much that teachers are required to possess ICT skills to cope with the demands of 21st century teaching.

With this background, it emerged from this study that all the participants were aware of the impact of technology in education. The study revealed that the participants knew most of the technological devices but most of them were not aware of how to use these devices. For example, some lecturers were aware that some schools/universities do have interactive whiteboards, but the lecturers did not know how to use these devices. Hence, they were unable to train student teachers on how to use them.

Another practical example is that of using cell phones in the classroom. Most participants were aware of the value of cellphones, but they were not aware of the educational value of them. The study discovered that even though student teachers were enthusiastic in using these devices, there is still a digital divide between them and their lecturers. Because of this, it made them to lose

interest in using the technological devices because they were not trained to use them in the classroom. Hence it the researcher's view that student teachers will find themselves faced with the digital divide. These prospective teachers will be confronted with the problem of not coping with the digital devices and the content generation that their learners are using. They will also not cope with the way their learners are generating knowledge using ICT.

6.4.2 Theme 2: ICT for knowledge on content, pedagogy, and technology

It is on this theme that the dimensions of social justice were investigated closely. The literature in chapter 2 provided information on the dimensions of social justice, and this enabled the researcher to investigate how universities in SA assisted student teachers to teach with the intention to advance social justice. Having studied the literature on the dimensions of social justice, the researcher was convinced that it is, in most cases, through ICT that these dimensions can be adhered to. The researcher is of the view that it is through ICT that teachers can provide the inclusive, relevance and democratic dimensions of social justice.

First, regarding access to education, using ICT, education can be easily accessible to the masses of the people, even to people that are in remote places. Higher education institutions can open access using MOOCS. MOOCS, as discussed in chapter 2, are ICT related modes for delivering free open higher education to most societies, even to societies that are in rural areas. This ICT mode ensures access to education as an element of the inclusive dimension of social justice and provides free equitable quality higher education to all global citizens. The study revealed that the participants were not aware how to maximize access to education in general, and how to maximize university education in particular. The researcher is of the view that if universities would like to open access to higher education, especially to provide life skills, then they can use MOOCS for this purpose because the MOOCS are free and open to societies to use. This in turn will contribute to an increase in the literacy levels of the societies and assist with social justice.

Second, ICT assists education institutions with diversity. ICT can help teachers to facilitate learning to learners with diverse learning needs. It is through ICT that education can be provided

to marginalised groups and/or learners in the rural communities. To do this, the Internet is a critical element in providing access to education. The Internet is the integral component of most of these processes and teachers are expected to have information retrieval skills to maximize the use of these ICT innovations. Most countries around the world and in SA have established community centers in rural areas. These community centers are equipped with ICT resources like telephones, computers, printers, and the Internet to assist the society with their diverse needs. Through this reasoning, ICT is an enabler of inclusivity, redistribution, and democracy. The study revealed that most participants were not aware of the recent technological innovations on how to use ICT for inclusivity. Hence, most lecturers could not provide evidence on how they train student teachers to provide inclusive education.

Furthermore, the study explored the extent to which the TPACK is packaged in the B.Ed. curriculum of universities in SA. The seven knowledge domains of the TPACK framework were individually explained. The researcher used a two-pronged approach. First, the study used Bernstein's (1973a, b, 1975) concept of curriculum design. The study established whether universities used the "Collection type" or the "Integrated type" of curriculum while integrating ICT for delivery of courses to student teachers. Second, the study looked at how student teachers were trained to possess TPACK, so that they can integrate ICT in their teaching. The following themes emerged.

6.4.3. Theme 3: Content Knowledge (CK)

All the participants of this study indicated that content knowledge should be mastered by their student teachers. The lecturers expected their students to master content so that they can effectively teach their respective subject specializations. Most lecturers indicated that they are aware of Shulman's PCK framework (Shulman, 1987). They indicated that they equip their student teachers with deep learning so that they can acquire a high level of content knowledge (Biggs & Tang, 2011). This deep learning, according to the lecturers, will enable student teachers to be an authority regarding the subjects that they teach.

The researcher supports the view that student teachers must have expertise and deep knowledge of the content of the subjects that they will be teaching. However, lecturers should ensure that there is a balance between content knowledge in depth and content in breadth. This balance can be easily achieved using ICT. The researcher agrees with Bernstein (1973a, b, 1975) that to have an integrated curriculum, subjects should no longer be insulated as in the past but the boundaries between subjects should be broken down. It is therefore using ICT that the balance between depth and breadth of content knowledge can be reached (Bernstein, 1973a, b, 1975; Biggs & Tang, 2011).

This knowledge domain has been allocated 50% of the 480 credits of the B.Ed. curriculum as proposed by the revised MRTEQ policy document, using the term disciplinary learning to denote both CK and subject knowledge pedagogy (DHET, 2015). Therefore, CK together with subject knowledge pedagogy should be accounted for by a minimum of 240 credits. There is no doubt that prospective teachers will have sound subject knowledge, as stipulated in the revised MRTEQ as basic competency number 1. However, this document does not mention any ICT related credits that should be aligned to CK. It is therefore the researcher's view that this policy document indirectly promotes the insulation of subjects and hence a "Collection type" of a curriculum (Bernstein, 1973a, b, 1975). Another point the researcher noticed is that the revised MRTEQ policy has put lecturers as the sole sources of CK and hence this has influenced the curriculum to be, at most universities, a "Collection type". According to the researcher, at least 8 credits should be allocated to subject specific ICT knowledge and/or resources. This specification would ensure that lecturers are influenced and able to easily break subject boundaries, supplement content acquisition with ICT resources, and ensure that there is a balance between content in depth and in breadth (Bernstein, 1973a, b, 1975; Biggs & Tang, 2011).

6.4.4 Theme 4: Pedagogical Knowledge (PK)

This knowledge base is covered by the revised MRTEQ policy document (DHET, 2015). The policy allocates 40% of the 480 credits of the B.Ed. curriculum to this knowledge domain. This

study has discovered that most universities have adhered to this requirement and most lecturers who participated in this study indicated that student teachers were equipped with this knowledge.

With the above in mind, the researcher noted that the policy makes provision for inclusive education as part of both the general PK and specialised PCK (DHET, 2015). However, when lecturers were asked how they prepare student teachers for inclusive education, none of them could provide a convincing argument about the strategy they use to that effect. From this finding, the researcher proposes that the revised MRTEQ policy should be explicit in prescribing differentiated pedagogy as part of this knowledge base. At least 8 credits should be allocated for differentiated pedagogy under this knowledge domain, to ensure that student teachers can teach in an inclusive classroom environment.

This again, according to the researcher, would make the teacher education curriculum respond to the requirements of social justice, as inclusive education is an important dimension of social justice (Polat, 2011; Tikly & Barrett, 2011).

6.4.5 Theme 5: Technological Knowledge (TK)

Technological knowledge, as explained in chapter 3, relates to the knowledge required to use different educational technological devices. The revised MRTEQ policy document categorizes this knowledge domain as part of a fundamental learning category. The policy allocates a minimum of eight (8) credits for either computer literacy or academic literacy. This study has found that most universities have allocated between eight (8) to twenty-four (24) credits for this knowledge base.

Most lecturers indicated that student teachers gain exposure to the use of computers. Their argument indicates that they think most student teachers have not used a computer before. So, students are given a tutoring computer programme to develop their end-user computer skills. When asked what happens to student teachers that already have end-user computer skills or have studied IT in their secondary school, or students that finish this tutoring programme before the

prescribed semester time, these lecturers indicated they did not have enrichment programmes that could put these students at a higher end-user computing level.

Again, it was also noted that the content of these end-user programmes was too general. This means that computer applications like Microsoft Word, Microsoft Excel, Microsoft Access, Microsoft PowerPoint, etc. are taught to student teachers as if they are taught to an ordinary end-user. These applications were not taught in relation to their education usage or application and their pedagogic importance or relevance. It is the researcher's view that these applications should be taught in relation to their use in education. For example, when teaching Microsoft Excel to student teachers, it should be taught by showing them that this is an application that can assist them with mark-lists. They should be shown that the teacher can enter the names randomly and this application can arrange the list in alphabetical order.

Also, on the same mark-list, a formula can be inserted to calculate the sum and averages, and a graph can be drawn to make an analysis of marks. These are some of the important educational uses of Microsoft Excel or spreadsheets. So, student teachers should be taught these computer applications in relation to their educational uses.

In addition to the above, this study has found that most lecturers only expose student teachers to the computer and two-dimensional technological devices like overhead projectors, tape recorders, DVD players, etc. There is little evidence that student teachers are exposed to multimedia resources like interactive whiteboards, Prezi, Blogs, Wikipedia, etc. Also, student teachers are not exposed to the use of mobile technology for classroom purposes. However, at some universities, lecturers have indicated that they have used mobile apps like WhatsApp to communicate to their student teachers, but they have not shown these student teachers how to use this application for their own classroom management.

6.4.6 Theme 6: Technological Content Knowledge (TCK)

The study has found little evidence regarding how universities advance the acquisition of this knowledge dimension. Not so many subject methodology lecturers indicated that they use

subject specific technologies to either teach with them or expose student teachers on how to use these technologies. The only evidence found was in mathematics, IT, and science where lecturers indicated that they use subject specific technologies to teach their respective specializations. This use of subject specific technologies was however restricted to the use of only computer technologies. Other technologies like mobile technologies were not used at most universities.

The researcher is of the view that student teachers should possess knowledge on how to use technological applications to assist them to teach their content (Mishra & Koehler, 2008). For example, gamification, as discussed in chapter 3, can be used to add an element of play and fun to content. For example, the GeoGebra application can be used to easily teach geometry and algebra in mathematics.

Furthermore, student teachers should be exposed to multiple devices, e.g. computer technology, mobile technology, and the Internet, so they can be relevant to their learners and know how best to teach their subjects. Lastly, student teachers should be exposed to multimedia design skills. Chapter 2 identified that teachers lack design skills and there was no evidence from most universities that student teachers are taught multimedia design skills. In the opinion of the researcher, the course *Instructional Media Design* should be incorporated in the teacher education curriculum at universities.

6.4.7 Theme 7: Pedagogical Content Knowledge (PCK)

The study found that most lecturers are training their student teachers to master PCK. This is because most of the lecturers are aware of Shulman's (1987) PCK framework for teacher knowledge. These lecturers, because of their lack of ICT skills, believe PCK is enough as the base knowledge for student teachers. The researcher agrees with Shulman's (1987) assertion that student teachers should be empowered to be true teaching professionals. This means they should have knowledge that is characterized by deep subject knowledge, skills, and positive attitudes for teaching, and understanding of the dynamics of the teaching (Shulman, 1987). This, however, is not enough, in the researcher's view, especially with recent technological advances. Prospective

teachers must be equipped with the ICT integration skills for them to cope with the demands of millennials and the 21st century classrooms. Prospective teachers should now know how they can integrate ICT into their teaching to bridge the digital divide between teachers and millennials (Mokoena, 2015).

Knowing the subject matter is imperative for student teachers before they teach it. They also must know what teaching and learning styles apply for a topic. These are the requirements of PCK and are important for teacher education. However, these are not enough as they only advance the theory of teacher knowledge and emphasize the rules of content. The researcher is of the view that this knowledge is necessary, but most importantly should be supplemented with ICT skills, media design skills and information retrieval and dissemination skills.

The revised MRTEQ policy document refers to PCK as disciplinary learning. This policy covers most aspects of this knowledge base, but still lacks the ICT element. As a result, the policy is lacking in terms of giving suitable guidelines regarding integrating ICT in teacher education curriculums. Most universities and lecturers indicated that they have met the minimum requirements, hence they neglect the incorporation of ICT in their curriculum.

6.4.8 Theme 8: Technological Pedagogical Knowledge (TPK)

There is little evidence in both the policies and the data collected from universities that student teachers are exposed to the bulk of this knowledge domain. Most universities expose student teachers to only computer equipment, neglecting other technological equipment and resources like tablets, interactive equipment, multimedia equipment, etc. that are recently used in education. Even with computers, student teachers are not taught on how computers are used in school environments specifically. Data collected revealed that student teachers are not appropriately equipped with skills on how to use ICT for pedagogic purposes. The digital literacy skills they are exposed to are just general and they are not shown how to use these for pedagogic purposes. Therefore, the researcher did not find any evidence that shows the difference between using

computers for general purposes and using computer equipment for teaching and learning purposes.

Second, the researcher found that student teachers were taught how to use computer applications. Again, the same trend was found, where student teachers were only exposed to the general use of computer applications. These applications were not taught in relation to their application to education. For example, student teachers were not exposed to the knowledge of technological tools for maintaining class records and analyzing results, or to discussions boards, chat rooms, instructional media design, etc. These, according to the researcher, are not IT expert's skills but basic skills that can enable a teacher to work smart not hard.

6.4.9 Theme 9: Technological Pedagogical Content Knowledge (TPACK)

TPACK is the form of knowledge that is required in 21st century classrooms. It is a combination of content, pedagogy, and technology knowledge. It involves the simultaneous application of content, pedagogy, and technology to meet the needs of learners in a diverse learning environment. It is also used to bridge the digital divide between teachers and learners and to make learning enjoyable to millennials (Mokoena, 2015). This study found that at universities in SA, the emphasis is only on pedagogical content knowledge for student teachers. In most universities, lecturers are still lacking in terms of using technologies in a constructive way to present their content. The revised MRTEQ policy, according to the researcher, has contributed towards this situation. This is because the policy document does not give clear direction on ICT integration and it encourages the insulation of subjects or courses. This situation encourages universities in a way to provide a teacher curriculum that is a "Collection type" (Bernstein, 1973a, b).

The study has found out that most lecturers at the universities are still techno-phobic and hide behind the revised MRTEQ policy. These lecturers do not feel compelled to integrate ICT into their teaching and, as a result, they do not adequately equip student teachers with skills to integrate ICT in their future teaching endeavors. Most lecturers claim that they have met the

minimum requirements as expected by the revised MRTEQ policy. In short, the study has found that there is little evidence for TPACK at universities as student teachers are mostly exposed to PCK. This is not a major problem; however, it limits the prospective teachers' functionality and makes them to be irrelevant to the millennial generation of learners (Mokoena, 2015). Also, it encourages the digital divide between teachers and learners in the 21st century classroom.

6.5. RECOMMENDATIONS OF THE STUDY

The researcher's recommendations are based on the literature review, data collected, the analysis of the data and discussions. They seek to assist the structure of the B.Ed. programme curriculum at SA universities. The recommendations advocate for a curriculum that is integrated in nature (Bernstein, 1973a, b, 1975) and suggest ways forward to ensure that student teachers can be taught how to provide quality education that responds to the prescripts of social justice and capacitates them with the knowledge and skills on how to integrate ICT in their teaching. The recommendations provide strategies on how to ensure student teachers at the universities acquire TPACK.

This study found that all the sampled universities in SA adhered to the requirements of the revised MRTEQ policy document as prescribed by the DHET. However, this guiding document still lacks clarity on how to integrate ICT into the curriculum of the B.Ed. programme. The researcher makes recommendations by supplementing the required minimum standards for teacher education qualifications as contained in the revised MRTEQ policy document.

The recommendations are to provide guidelines to ensure that universities respond to the integration of ICT in the teacher education qualifications programme. The approach is to provide additional information to supplement the different types of learnings provided in the revised MRTEQ policy document. The additional information will be in the form of ICT equipment, computer applications, computer programmes, mobile apps and courses and/or subjects that will ensure that the policy document responds to the prescripts of ICT integration.

Again, these recommendations are made to break down the subjects' boundaries and hence to influence the integration of the curriculum, and to ensure that student teachers will acquire skills on how to integrate ICT in their teaching (Bernstein, 1973a, b, 1975; DHET, 2015). Also, they will attempt to provide universities with guidelines on how to ensure that student teachers, upon completion of their qualification, can bridge the digital divide between themselves and their learners.

Furthermore, as much as possible, the researcher recommends additions that are in line with the TPACK framework. It should be noted however that these TPACK dimensions can be used in the number of learning types that are prescribed in the revised MRTEQ policy document.

It should be noted though that the proposed additions to the requirements of the revised MRTEQ should ensure that student teachers, upon the completion of their qualification, are able to use ICT tools to handle information. They should be creative in their approach to teaching and be able to foster in their learners the capacity to be reflective, collaborative, and problem solvers. These prospective teachers should be able to exploit the potential of digital resources to bring teaching alive (Koc, 2005; Mbodila, Jones & Muhandji, 2013).

They should take ownership of professional development by learning from others and learning from others on how best to use ICT resources in the classroom (Koc, 2005; Mishra & Koehler, 2008; Mbodila, Jones & Muhandji, 2013). Also, these recommended additions should enable student teachers to cater for different learning styles and to equip them with skills to teach within an inclusive education environment (Polat, 2011; Tikly & Barrett, 2011). Lastly, infusing these will enable student teachers to use different ICT resources and develop good design skills for creating learning activities and resources.

The recommendations are divided according to the learning areas as prescribed in the revised MRTEQ. From each learning area, the researcher provides additional information that must be included in the curriculum. Under each learning area, the researcher provides the relevant TPACK framework dimension for the learning area and then gives the required ICT related content and applications needed.

6.5.1 Disciplinary Learning

Regarding disciplinary learning, it is recommended that the content presented by the revised MRTEQ in this learning area should be aligned with CK, PCK and TPACK. In addition to these, universities should ensure that prospective teachers are trained in information retrieval skills, and skills to navigate the Internet using different search engines like Google, Yahoo, etc. They should also be trained to use Subject Specific Computer application programmes. For example, for English language teaching, they should be taught to use English Launch Pad, Culips ESL Podcast, Voxy, and Gramma Up. For mathematics they should be taught to use, among others, Geometry Pad, Khan Academy, GeoGebra, and Maths Training for Kids. For science and environmental studies, they should be taught to use among other geospatial technologies such as Google Maps, Google Earth, ArcGIS desktop, ArcGIS online, etc. (MaKinster & Trautmann, 2014)

6.5.2 Pedagogical Learning

It is recommended under this learning area that over and above what is prescribed by the revised MRTEQ, universities should align their courses to include PK, TPK and PCK. Because this study found that most teachers lack media design skills, in addition to the knowledge prescribed, Instructional Media Design (IT infused) applications should be incorporated in the courses, e.g. Authoring (Author Ware/Dreamweaver), WebQuests, Corel Draw, Discussion Boards, Chat rooms, etc.

6.5.3 Practical Learning

Practical learning should also be in line with the prescripts of TK and TPK as articulated in the TPACK framework. Universities should ensure prospective teachers are trained to use several

teachings and learning resources. They should begin by training them on the use of visual media (2D & 3D), auditory media and audiovisual media. In addition to these, prospective teacher should be exposed to the use of multimedia resources in the classroom, e.g. interactive whiteboard, use of tablets in the classroom, use of mobile technology in the classroom (m-learning), and Flipped learning. These can enable them to smoothly use different learning resources that they find at different schools regardless of whether the school is historically advantaged or historically disadvantaged, in an urban area or rural area, or the school is in a first world country or third world country. With these, teachers are enabled to be participants in the global communities of practice.

6.5.4 Fundamental Learning

Computer literacy/digital literacy at most universities is part of the fundamental learning area. Most universities sampled for this study taught student teachers basic computer skills. It is recommended that the content in this learning area should be in line with TK and TCK. In addition to this, student teachers should be trained to use computer skills that are in line with teaching, i.e. if they are taught Microsoft Word, the application should be taught in line with its use in the classroom. For example, they should be exposed to Microsoft Office or Lotus Office. The focus in each application should involve word processing for teachers, spreadsheets for teachers, databases for teachers, and presentation programmes for teachers.

6.5.5 Situational Learning

It is recommended that situational learning should be in line with the prescripts of TPACK. Student teachers should be trained to teach in different classroom situations. This should include teaching at historically disadvantaged schools, rural area schools, urban area schools, farm schools, advanced schools, etc. Under this learning area, universities should expose student teachers to differentiation using ICT, e.g. differentiating curriculum content, differentiating

teaching methods, differentiating learning environments and differentiating assessment. This will be to ensure that student teachers can operate in an inclusive education environment.

In order to bridge the knowledge gap that might have been created during the initial teacher education training. The researcher recommends CPD intervention strategies that can be developed in line with the proposed Annexure A as contained by this study. A knowledge gap can be identified at school by the school management team (SMT) through the teacher's appraisal process. The SMT can use the Annexure A to suggest the required CPD to enable the in-service teacher to gain the knowledge that will be needed at the time. Annexure A can also be used by teachers who would like to advance their knowledge of ICT integration.

6.6 CONCLUSION

Looking at the above discussions and analysis of the findings as based on the research questions, the research draws the following conclusions. First, universities in SA are not using ICT effectively and as a result, student teachers are not adequately trained to integrate ICT in their prospective teaching careers. However, this is not a deliberate act on the part of the universities. The problem is that the guiding policy, that is, the revised MRTEQ, does not provide the necessary minimum requirements for the teacher education qualification to enable prospective teachers to integrate ICT in their teaching.

Second, this guiding policy does not encourage integration but insulates subjects and makes the curriculum a "Collection type". Most lecturers, because of this policy, think that they have done enough when they have adhered to the minimum requirements. Some of them hide behind the policy and do not bother to develop their ICT skills.

Finally, because of the above literature review, data collection and findings, this study concludes that student teachers at SA universities finish their teacher qualifications with little Technological Pedagogical Content Knowledge. Hence, they require in-service training immediately after completing their teacher qualifications.

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ANNEXURE A

Proposed Continuous Professional Development in ICT Integration

This proposed CPD for ICT integration is to align teacher competencies outlined in the revised MRTEQ with the TPACK knowledge domains and the digital learning competencies (DLC). This Appendix A can be used as part of the teachers' appraisal system in schools. In case where more than one knowledge domain is proposed or where more than one DLC is proposed, teachers can be trained as per the level of complexity.

No.	Basic Competency (Revised MRTEQ)	TPACK Knowledge Domain	Digital Learning Competency
1.	Have sound subject knowledge.	CK	DLC1; DLC2; DLC4; DLC5
2.	Know how to teach their subject(s) and how to select and determine the sequence and pace of the content in accordance with both subject and learner needs.	PK, PCK	DLC2; DLC3; DLC4; DLC6; DLC11; DLC12
3.	Know who their learners are and how they learn – they must understand the learners' individual needs and tailor their teaching accordingly.	PCK	DLC3; DLC6; DLC8; DLC 10
4.	Know how to communicate effectively in general, as well as in relation to their subject(s), in order to mediate learning.	TPACK	DLC4; DLC5; DLC7; DCL13

5.	Have highly developed literacy, numeracy, and Information Technology (IT) skills.	TK, TPK, TPACK	DLC4; DLC5; DLC8
6.	Be knowledgeable about the school curriculum and be able to unpack its specialised content, as well as being able to use available resources appropriately, so as to plan and design suitable learning programmes.	PCK, TCK	DLC1; DLC3; DLC5; DLC6; DLC9; DLC11
7.	Understand diversity in the South African context in order to teach in a manner that includes all learners. They must also be able to identify learning or social problems and work in partnership with professional service providers to address these.	PCK, TPK, TPACK	DLC2; DLC4; DLC8; DLC9
8.	Be able to manage learning effectively across diverse contexts in order to ensure a conducive learning environment	PCK TPK, TPACK	DLC2; DLC6; DLC8; DLC9; DLC12
9.	Be able to assess learners in reliable and varied ways, as well as being able to use the results of assessment to improve teaching and learning.	PCK, TPK, TPACK	DLC3; DLC6; DLC9; DLC12
10.	Be able to reflect critically on their own practice, in theoretically informed ways and in conjunction with their professional community of colleagues in order to constantly improve and adapt to evolving circumstances	TPACK	DLC2; DLC3; DLC4; DLC7; DLC10; DLC13

ANNEXURE B

Group Interview Questions

1. Why should we integrate ICT in our teaching i.e. the value of ICT integration?
2. What have you incorporated in your continuous professional development CPD course outline to ensure that teachers acquire the knowledge to use ICT as a management tool ...?
 - a. for organizing their work and keep learners' records
 - b. for preparing lessons, activities, and worksheets
 - c. for finding and sharing digital learning materials / resources
 - d. for designing and / producing and / producing their own digital resources relevant to their context

According to the Revised Policy on Minimum Requirements for Teacher Education Qualifications (MRTEQ) 2015, newly qualified teachers are required to meet certain requirements upon qualifying as teachers.

In your opinion

3. Do newly qualified teachers use ICTs to have a sound subject/ content knowledge?
4. Do newly qualified teachers use ICTs to have the knowledge on how to effectively teach their subjects; how to select, determine the sequence and pace of their content in accordance with the subject, CAPS, and learner needs?
5. Do newly qualified teachers use ICTs to have highly developed literacy, numeracy, and ICT skills?
6. Do newly qualified teachers use ICTs to be knowledgeable about school curriculum i.e. CAPS and can unpack its specialized content, as well as being able to use available resources appropriately to plan, design, produce suitable learning activities / programme?
7. Do newly qualified teachers use ICTs to be able to manage learning effectively across diverse contexts?
8. Do newly qualified teachers use ICTs to assess learners in reliable and varied ways?
9. Do newly qualified teachers understand diversity in South African context to teach inclusively?
10. Do newly qualified teachers use ICTs to effectively communicate in various ways and form relations with other teachers in the same subject field?
11. Do newly qualified teachers use ICTs to be professional in their approach, have the necessary teaching skills, subject knowledge and digital literacy?

ANNEXURE C

INTERVIEW QUESTIONS 1

INDIVIDUAL INTERVIEWS FOR LECTURES RESPONSIBLE FOR COMPUTER/ DIGITAL LITERACY

1. In your opinion, is ICT capable of promoting quality education and social justice?
2. What has informed your course outline i.e. which policy or policies?
3. What technological equipment are registered students in this course/subject exposed to?
4. Which computer literacy skills/ applications would you like your students to have acquired or know at the end of this module/ subject/ programme?
5. What ICT knowledge would you like your students to have acquired at the end of this module?
6. What objectives in your course outline ensure that student teachers gain pedagogical competence related to ICTs?
7. What have you incorporated in your course outline to ensure that student teachers acquire the knowledge to use ICT for organizing their work and keep learners' records?
8. What have you incorporated in your course outline to ensure that student teachers acquire the knowledge to use ICT for preparing lessons, activities, and worksheets?
9. What have you incorporated in your course outline to ensure that student teachers acquire the knowledge to use ICT for finding and sharing digital learning materials / resources?
10. What have you incorporated in your course outline to ensure that student teachers acquire the knowledge to use ICT for designing and / producing and / producing their own digital resources relevant to their context?
11. How have you ensured that student teachers upon the completion of your course have the necessary subject knowledge and have the necessary design and digital skills?

ANNEXURE D

INTERVIEW QUESTIONS 2

INDIVIDUAL INTERVIEWS FOR LECTURES RESPONSIBLE FOR SPECIALISED SUBJECT METHODOLOGIES

1. In your opinion, is ICT capable of promoting quality education and social justice?
2. What technological equipment are registered students in this course/subject exposed to?
3. What ICT knowledge would you like your students to have acquired at the end of this module?
4. What plan have you put in place to influence student teachers' future integration of ICT to facilitate teaching specific concepts?
5. What plan have you put in place to influence student teachers' future integration of ICT to support various student learning styles and to personalize learning?
6. What plan have you put in place to influence student teachers' future integration of ICT to facilitate teaching pupils with disabilities/ barriers to learning (cognitive, physical, behavioral, etc.)?
7. What plan have you put in place to influence student teachers' future integration of ICT to support activities that facilitate higher order thinking and / or creativity?
8. What plan have you put in place to influence student teachers' future integration of ICT to support inclusivity i.e. the marginalised groups (rural communities, disadvantaged communities, refugees, etc.)?
9. What objectives in your course outline ensure that student teachers gain pedagogical competence related to ICTs?
10. What have you incorporated in your course outline to ensure that student teachers acquire the knowledge to use ICT as a management tool?

11. How have you ensured that student teachers upon the completion of your course can provide quality education in as far as been professional in their approach to teaching?
12. How have you ensured that student teachers upon the completion of your course have the necessary teaching skills to accommodate different contexts?
13. How have you ensured that student teachers upon the completion of your course have the necessary subject knowledge and have the necessary design and digital skills?

ANNEXURE E



RESEARCH ETHICS APPROVAL

Date: 2 September 2018

1.1.1 This is to confirm that ethical clearance has been provided by the Faculty Research and Innovation Committee in view of the CUT Research Ethics and Integrity Framework, 2016 with reference number [D.**FRC 18/16/2**].

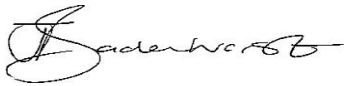
Applicant's Name	Mollo P
Student number	214130908
Supervisor Name for Student Project (where applicable)	Supervisor: Prof. I Ntsoe
Level of Qualification for Student Project (where applicable)	Doctor of Education (D.Ed)
Title of research project	Exploring integration of Information Communications Technology (ICT) in curriculum of pre-service teacher education and training in South Africa"

The following special conditions were set:

Ethical measures as outlined in the proposal and which have been endorsed by the Faculty Research and Innovation Committee have to be adhered to.

We wish you success with your research

project. Regards



Prof JW Badenhorst

(Ethics committee representative: Research with humans)

ANNEXURE F

Enquiries: KK Motshumi
Ref: Research Permission: PP Mollo
Tel. 051 404 9283 / 9221 / 079 503 4943
Email: K.Motshumi@fseducation.ov.za

PP MOLLO
12 Theo Potgieter Street
Langenhoven Park
BLOEMFONTEIN, 9301

Dear Mr Mollo

APPROVAL TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION

1. This letter serves as an acknowledgement of receipt of your request to conduct research in the Free State Department of Education.

Topic: Exploring Integration of Information Communications Technology in curriculum of pre service teacher education and training in South Africa

Schools involved: None

Target Population: 2 Subject Advisors from Motheo District and 2 from Xhariep District responsible for E-learning.

2. **Period:** From the third week of January 2019 until 30 March 2019. Please note the department does not allow any research to be conducted during the fourth term (quarter) of the academic year nor during normal school hours.
3. Should you fall behind your schedule by three months to complete your research project in the approved period, you will need to apply for an extension.
4. The approval is subject to the following conditions:
 - 4.1 The collection of data should not interfere with the normal tuition time or teaching process.
 - 4.2 A bound copy of the research document or a CD, should be submitted to the Free State Department of Education, Room 319, 3rd Floor, Old CNA Building, Charlotte Maxeke Street, Bloemfontein.
 - 4.3 You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.
 - 4.4 The ethics documents must be adhered to in the discourse of your study in our department.
5. Please note that costs relating to all the conditions mentioned above are your own responsibility.

Yours sincerely


DR JEM SEKO ANE
CHIEF FINANC A OFFICER

175

DATE: 25/09/2018

ANNEXURE G

Enquiries: KK Motshumi
Ref: Notification of research: PP Mollo
Tel. 051 404 9221 / 079 503 4943
Email: K. Motshumi@fseducation.gov.za



The District Director:
Motheo District
Xhariep District

Dear Messrs Moloï and Mothebe

NOTIFICATION TO CONDUCT RESEARCH PROJECT IN YOUR DISTRICT BY PP MOLLO

1. The above mentioned candidate was granted permission to conduct research in your district as follows:

Topic: Exploring Integration of Information Communications Technology in curriculum of pre service teacher education and training in South Africa

Schools involved: None

Target Population: 2 Subject advisors from Motheo District and 2 from Xhariep District responsible for E-learning.

2. **Period:** From the third week of January 2019 until 30 March 2019. Please note the department does not allow any research to be conducted during the fourth term (quarter) of the academic year nor during normal school hours.
3. **Research benefits:** This study will reveal how best can the department plan towards supporting teachers towards the realization of the pre-prescripts of the NDP, Action Plan 2019, CAPS etc.
4. Logistical procedures were met, in particular ethical considerations for conducting research in the Free State Department of Education.
5. The Strategic Planning, Policy and Research Directorate will make the necessary arrangements for the researcher to present the findings and recommendations to the relevant officials in your district.

Yours sincerely


DR JEM SEKOLANYANE
CHIEF FINANCIAL OFFICER

DATE 25/09/2018

ANNEXURE H



Central University of
Technology, Free State

ACADEMIC DEVELOPMENT AND SUPPORT

13 NOVEMBER 2018

TO WHOM IT MAY CONCERN

This serves to certify that Mr Paseka Patric Mollo, student number **214130908** is a registered student for a PhD **degree** the Central University of Technology. His topic of research is:

“Exploring integration of Information Communications Technology (ICT) in curriculum of pre-service teacher education and training in South Africa” Kindly grant him permission to conduct interviews at Nelson Mandela University. The interviews will be conducted with lecturers in the Faculty of Humanities / Education responsible for teacher education, preferably those teaching Computer literacy / Digital literacy and any teacher education subject specialisation.

The data collected will be used for educational purpose only, and therefore I, as the supervisor, am kindly requesting that he assisted accordingly. Your cooperation in this regard will be highly appreciated.

Kind Regards



Supervisor:

ANNEXURE I
TRANSCRIBER'S CERTIFICATE

I, the undersigned, hereby certify that insofar as it is audible, the foregoing is a true and correct transcription of the proceedings recorded by means of a mechanical recorder in the matter of:

CUT INTERVIEWS

<u>DATES HELD</u>	Various
<u>TRANSCRIBER</u>	C. DIAS
<u>DATE COMPLETED</u>	12/11/2018
<u>NO OF RECORDINGS</u>	1
<u>NUMBER OF PAGES</u>	128



This is to certify that the following problems were experienced with the above matter:

1. This is a verbatim transcript.
2. Due to the fact that this is a true reflection of the record, and it is transcribed as heard, grammatical errors may occur because of the way role players speak throughout.
3. Where names, places, esoteric terms etc are unknown they are spelt phonetically.

CONTRACTOR :	LEPELLE SCRIBES P O Box 73090 Lynwoodridge 0040 Tel. No.: (051) 436 – 8838 Fax: (086) 512 - 9211 Cell/Sel: (082) – 866 9707
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EDITING LETTER

21 August 2020

Re: Language editing of PhD thesis

This letter confirms that the thesis **Exploring integration of Information Communications Technology (ICT) in curriculum of pre-service teacher education and training in South Africa** by Mollo Paseka Patric was edited.

Cordially



Dr Karen Buckenham (PhD)

kbuckenham@mweb.co.za