

**Implementation and Adoption of Information and Communication
Technologies (ICT) in schools in the Ngaka Modiri Molema District**

Aobakwe Keebine

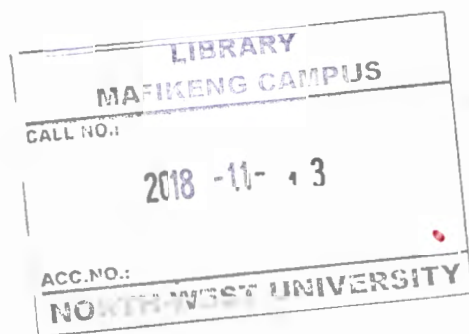
23308788

**Dissertation submitted in fulfilment of the requirements for the degree *Master
of Commerce in Information Systems and Computer sciences* at the (Mafikeng)
of the North-West University**

Supervisor: Dr M.E Jantjies

Co-Supervisor: Ms L.T Ditibane

November 2017





DECLARATION

I, Aobakwe Keebine, herein proclaim that this dissertation for the degree of Masters of Commerce in Information Systems and Computer Sciences at the North West University hereby submitted, has not been previously submitted by me for a degree at this or any other university. I furthermore affirm that this dissertation is my own work and design and that all material enclosed herein has been fully acknowledged.

SIGNED: _____

DATE: _____ 25/05/18 _____

ACKNOWLEDGEMENTS

I wish to put on record the contributions of the following:

- Dr Jantjies and Ms Ditibane, my supervisors, for their erudite remarks and professional guidance of this research. Their unequivocal and beneficial comments in the submission made, facilitated the completion of this study.
- Professor Awudetsey for his positive criticism and Mr. Moletsane for critical editing of the document.
- My brothers, Oreneilwe and Makgatswane for their unwavering support and love.
- My father and mother for being my strongest pillars of support and mentors

Lion of Judah!! You are Faithful and you are Good!!

ABSTRACT

Technology has been globally seen as an enabler to transform 21st century classrooms. A number of provinces in South Africa including the North-West Province have introduced the use ICT in classrooms to ensure the integration of technology in the process of teaching and learning. Some schools in the province piloted the use of tablets as platforms of teaching and learning with the intention of steadily replacing the conventional chalkboard with digital learning technology. This study sought to explore the views of teachers in sampled schools of Mahikeng in the Ngaka Modiri Molema District. Moreover, the study focuses on factors which are associated to the use of ICT for teaching and in sampled secondary schools in the Ngaka Modiri Molema District. Through a mixed methodology research approach, questionnaires and interviews, were used for collection of both qualitative and quantitative data from study participants based in these schools. Semi-structured interviews were used in imploring the teachers' views. A questionnaire was also administered to a representative teacher sample size of 30 teachers across four schools. Data collected was analysed through a thematic analysis. The conclusion of the research findings demonstrate that even if the substantial number of teachers accept and somehow support change, ideas and innovations in education, the integration of ICT can present both uncertainty and benefits in the teaching and learning environment. Some teachers maintain that, devoid of suitable training, computers will expose their inadequacies in the classroom. Contrary to this, the younger teachers were more permissive of the changes than their older counterparts who found the introduction of ICT overwhelming. The study's conclusions demonstrate that the achievement of digital technology in classrooms are also dependent on teacher expertise as well as adequate support and training towards ICT use in schools.

Keywords: ICT, implementation and adoption, teachers, ICT in education, paperless classroom, competency, knowledge and skills

TABLE OF CONTENTS

DECLARATION.....	i
ACKNOWLEDGEMENTS	ii
ABSTRACT	iii
LIST OF FIGURES.....	vii
LIST OF ACRONYMS	ix
CHAPTER 1: BACKGROUND OVERVIEW OF ICTS	1
1.1 INTRODUCTION.....	1
1.2 PROBLEM STATEMENT	3
1.3. JUSTIFICATION OF THE PROBLEM STATEMENT	4
1.4 RATIONALE AND OBJECTIVES.....	4
1.4.1 RATIONALE.....	4
1.4.2 OBJECTIVES.....	4
1.5 RESEARCH QUESTIONS.....	5
1.6 RESEARCH METHODOLOGY.....	5
1.7 POPULATION.....	8
1.8 CHAPTER OUTLINE	9
1.9 SUMMARY	10
CHAPTER 2: LITERATURE REVIEW.....	11
2.1 INTRODUCTION	11
2.2 BACKGROUND OVERVIEW OF ICT IN SCHOOLS	11
2.3 THE USE OF ICT IN SCHOOLS	13
2.3.1 GENDER.....	13
2.3.2 TEACHING AND TECHNOLOGY	14
2.3.3 ICT COMPETENCE	15
2.4 USING ICT TO ENHANCE TEACHING AND LEARNING	15

2.4.1 Teacher Mate	17
2.4.2 The iPad	17
2.5 SKILLS AND RESOURCES NEEDED TO IMPLEMENT ICTS IN CLASSROOMS	17
2.6 THE IMPACT OF USING ICT IN THE CLASSROOM	21
2.7 SUMMARY	22
CHAPTER 3: RESEARCH METHODOLOGY AND DESIGN	23
3.1 INTRODUCTION	23
3.2 RESEARCH PARADIGM	23
3.3 RESEARCH APPROACH APPLIED IN THIS INVESTIGATION	24
3.4 DATA COLLECTION	24
3.4.1 Population	27
3.4.2 Reliability	28
3.4.3 Validity	28
3.4.4 Variables	28
3.5 ETHICAL CONSIDERATIONS PERTAINING TO THE RESEARCH	28
3.6. COVERING LETTER	29
3.7 STATISTICAL PROCEDURES	29
3.8 LIMITATIONS	30
3.9 SUMMARY	31
CHAPTER 4: THEORETICAL FRAMEWORK	32
4.1 INTRODUCTION	32
4.2 THEORETICAL PERSPECTIVES	32
4.2.1 SCHOOL MANAGEMENT INFORMATION SYSTEM (SMIS)	33
4.2.2 TECHNOLOGY ACCEPTANCE MODEL (TAM)	35
4.2.3 SOUTH AFRICAN TEACHER DEVELOPMENT FRAMEWORK	36
4.2.4 TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPCK)	38

4.2.5 THE JUST IN CASE APPROACH (JIC)	39
4.2.6 THE ICT ADOPTION FRAMEWORK.....	41
4.3. BUILDING A FRAMEWORK FROM A REVIEW OF THE LITERATURE	41
4.4 PROPOSED THEORETICAL FRAMEWORK (ICT Adoption and Training framework).....	42
4.5 SUMMARY	47
CHAPTER 5: DATA ANALYSIS	48
5.1 INTRODUCTION	48
5.2 RESPONSE RATE	50
5.3 DEMOGRAPHICS	50
5.4 SUMMARY	79
CHAPTER 6: SUMMARY, FINDINGS, RECOMMENDATIONS AND CONCLUSION	80
6.1 INTRODUCTION	80
6.2 REVIEW OF RESULTS	80
6.2.1 Findings concerning the first research question	80
6.2.2 Findings concerning the second research question	81
6.2.3 Findings concerning the third research question.....	81
6.2.4 Findings concerning the fourth research question.....	82
6.3 CONTRIBUTION OF THIS STUDY	82
6.4 LIMITATIONS OF THIS STUDY	83
6.5. SUMMARY	84
6.6. CONCLUSION.....	85
6.7 RECOMMENDATIONS	86
REFERENCES.....	87
ADDENDUM A	107
ADDENDUM B	109
ADDENDUM C	123

LIST OF FIGURES

Figure 4.1: Sample-School Management Information System) SMIS (Telem and Pinto,2006).....	34
Figure 4.2 : Technology Acceptance Model (Davis and Venkatesh ,1969)	36
Figure 4.3 : Teacher Development Framework (adapted).....	37
Figure 4.4 : Technological Pedagogical Content Knowledge (TPCK) (Mishra and Koehler, 2006).....	39
Figure 4.5 : Just-In-Time Teaching (JiTT) Marrs and Novak (2004).....	40
Figure 4.6 : ICT Adoption and Training framework proposal (Aobakwe Keebine,2016)	43
Figure 5.1 : 5.3.1 Gender	51
Figure 5.2 : 5.3.2 Age.....	52
Figure 5.3 : 5.3.3 Level of education	53
Figure 5.4 : 5.3.4 Type of school.....	54
Figure 5.5 :5.3.5 Location of school	55
Figure 5.6 : 5.3.6 Learner enrolment.....	56
Figure 5.7 : 5.3.7 Teaching Category	57
Figure 5.8 : 5.3.8 Number of computers.....	58
Figure 5.9 : 5.3.9 Grades that use computers	59
Figure 5.10 : 5.3.10 Number of Computer Managers	60
Figure 5.11 : 5.3.11 ICT for teaching and learning	61
Figure 5.12 : 5.3.12 Proportion of Equipment.....	62
Figure 5.13 : 5.3.13 Supply of tablets.....	63
Figure 5.14 : 5.3.14 Brand of Tablet PCs	64
Figure 5.15 : 5.3.15 Installation of Computers.....	65
Figure 5.16 : 5.3.16 Computer Use	66
Figure 5.17 : 5.3.17 Frequent use of ICTs.....	67
Figure 5.18 : 5.3.18 Access to Computers	68
Figure 5.19 : 5.3.19 Availability of e-mail address	69
Figure 5.20 : 5.3.20 E-mail usage	70

Figure 5.21 : 5.3.21 Competency in computer usage.....	71
Figure 5.22 : 5.3.22 ICT training.....	72
Figure 5.23 : 5.3.23 Hours of ICT related training	73
Figure 5.24 : 5.3.24 Teacher competency.....	74
Figure 5.25 : 5.3.25 ICT coordinator.....	75
Figure 5.26 : 5.3.26 Availability of ICT coordinator.....	76
Figure 5.27 : 5.3.27 ICT courses.....	77
Figure 5.28 : 5.3.28 ICT use expectation in the classroom	78

LIST OF ACRONYMS

Department of Education (DoE)

Electronic Mail (E-mail)

Further Education and Training (FET)

Information & Communication Technology (ICT)

Just in Time Teaching (JiTT)

Personal Computer (PC)

School for Teacher Education and Training (STET)

School Management Information System (SMIS)

South African Teacher Development Framework (SATDF)

Technological Pedagogical Content Knowledge (TPCK)

The Just in Case Approach (JIC)

The Technology Acceptance Model (TAM)

Whole School Evaluation (WSE)

CHAPTER 1: BACKGROUND OVERVIEW OF ICTS

1.1 INTRODUCTION

This study intentionally and deliberately explores the extent to which Information and Communication Technology (ICT) has been adopted and implemented by teachers and principals in the Ngaka Modiri Molema District schools. Redwood *et al.* (2017) verify that Information Communication Technology commonly known as ICT is progressively becoming less of an option and more of a predictability. The term ICT denotes the manner in which knowledge and human interaction are combined and amplified through the use of computer technology (Department of Education, 2003; Redwood *et al.* 2017; Leung, & Zhang, 2017). ICT involves the interactive use of IT and modern digital communication in the human construction of social discourse. Put differently, ICT “facilitates the processing, management and exchange of data, information and knowledge” (DoE, 2003).

This research seeks to ascertain how well ICTs have been acknowledged by teachers and principals. We will endeavour to determine whether ICTs are applied in the classroom. If yes, how and which methods they use but if not, we will ask why and therefore suggest a framework to influence and improve ICT use in the schools concerned.

This chapter first presents a short and snappy impression of ICTs and outlines the problem statement and validation thereof. The research aim and objectives are discussed, followed by the research questions as well as a brief evaluation of literature in this field. The chapter concludes with the research methodology, population of the study and chapter summary.

Recently, the development and use of ICT have had a major impact on our way of life to the point where they have been approached by regulatory policies in the sphere of education (Cohen et al., 2007). Indeed, recent White Paper on e-Education has set out a number of standard objectives for ICT:

1. The construction of an education and training system introducing ICT systematically in teaching-learner classrooms.
2. The creation of a skeleton of teacher competencies for ICT use in formal education (or schools).
3. Providing internet access to classroom learners, and
4. Enabling effective use of ICT amenities by school communities.

As the White Paper points out, Gauteng province and its department of education have needed to accrue close to R17bn to roll out paperless classrooms (DoE 2015; Dlamini & Na'Allah, 2015). Furthermore, tablets are being used as gadgets in classrooms throughout the province. The Department of Education (2015) thus recognises that public school learners are being formally provided with free tablet computers connected to the internet to undertake digitally configured schoolwork.

Gauteng's MEC for Education, Panyaza Lesufi, confirms that these tools are officially part of Gauteng Education Department policy (Dlamini & Na'Allah, 2015). Meanwhile, the North West Provincial Department of Education has embarked on the process of purchasing books for paperless classrooms which, owing to technical difficulties or load-shedding, has become of great interest in the country of late (DoE, 2015). However, the White Paper has only begun to be implemented and its impact cannot yet be evaluated in the North-West Province (Cassim, 2010; Cohen et al., 2002).

Some research has revealed deficiencies in the present use of ICT in South Africa's education system, including the failure to offer institutions the right to persuade people to use ICT at an early age (Cassim, 2010). Furthermore, learners in regular communal schools are not exposed to elementary computer skills. Finance seems to be the major hurdle in providing these schools with ICTs (DoE, 2015). In the worst case, higher learning institutes are not providing any work experience to accompany student learning (Cassim, 2010). The curriculum should hence be adjusted to ensure school programmes make reference to ICT use in a professional or working context. The statement of the problem is expounded in the next section.

1.2 PROBLEM STATEMENT

There is a comprehensive intuition that even if the majority of teachers and principals in schools admit that technology is an effective contrivance which can advance teaching and learning and thus downsize soaring failure rate and number of drop-outs, the most significant stakeholders (teachers and principals) do not want to participate in related training. Most of them are thus far still not competent and confident enough to put ICT into practice so as to smooth the progress of teaching and learning (Department of Education, 2015).

As Tella et al. recognise (2007), information is deficient about how to measure the impact of ICT in classroom learning or evaluate the effect of its being absent. Most researchers and teachers are aware that teacher programmes are not necessarily geared towards deal with fundamental computer skills. For instance, Sladit and Berta (2007) have established that hindrances such as nonexistence of tutors, time strains and unavailability of equipment, as well as the limited availability of ICT work placements have restricted classroom ICT use. Most teachers and principals in some of the sampled schools used in this research experience the similar challenge. The proverbial inclination in the contemporary education system is that parents are expected to offer support and backing to their children (Sladit and Berta, 2007). The furthestmost challenge facing parents and teachers is their lack of enthusiasm to get into children's technological world or social media which could put in the picture what their actual needs are. This research is consequently conducted to authenticate the institutionalized ICT use and to find out the extent to which ICT has been adopted and executed by principals and teachers of the selected schools in the area of Mafikeng, Ngaka Modiri Molema District (Tella et al., 2007).

1.3. JUSTIFICATION OF THE PROBLEM STATEMENT

There is now a grave scarcity of full time ICT (computer) managers to offer training to the teachers in these schools. Thus, examination of the school files and reports compiled by evaluators of Whole School Evaluation (Quality Assurance Chief Directorate) and intended consultations carried out by the researcher during the pilot and main study have confirmed that teachers and principals need vital proficiency to implement ICTs in the fortification of endeavours relating to the teaching-learning process.

1.4 RATIONALE AND OBJECTIVES

1.4.1 RATIONALE

The principal aim of this research is to determine the scope of principals and teacher ICT use by in the sampled schools of Mafikeng, Ngaka Modiri Molema District.

1.4.2 OBJECTIVES

This research follows a clear set of objectives:

1. To determine the extent of ICT (Mobile tablets) use in the teaching-learning process in the Ngaka Modiri Molema schools
2. To establish the impact of ICT use on teacher development and learner performance
3. To examine skills and resources teachers need to implement ICT use in schools, and
4. To establish the standards, the Department of Education used to supply schools in Ngaka Modiri Molema with ICT gadgets.

1.5 RESEARCH QUESTIONS

We have selected 4 research questions to structure this study:

1. How have schools in the Ngaka Modiri Molema District adopted mobile tablets to support mobile learning in schools?
2. How do teachers in the Ngaka Modiri Molema District use ICT to improve teaching and learning?
3. What essential skills and resources should teachers have in order to put ICTs into service in their own classrooms?
4. Which standards did the Department of Education use to supply schools in Ngaka Modiri Molema with tablets for use in teaching and learning?

1.6 RESEARCH METHODOLOGY

Research method constitutes a plan according to which the researcher engages in, opts for data gathering tools and analysis process to explore a precise research problem (McMillan and Schumacher, 2014). Data may be obtained through both primary and secondary sources using a qualitative, quantitative or mixed method (McMillan and Schumacher, 2014). This research has used a mixed method or qualitative and quantitative data collection method.

Research paradigm

The research theory used in this research is pragmatism. According to Shusterman (2016), this theory offers an outstanding theoretical associate for mixed methods research. The theory also supplies a sketch for manipulating and carrying out mixed method research. It is largely a method of resolving metaphysical differences of opinions that or else may be incessant (Shusterman, 2016, Goldkuhl, 2012). Logically prone theorists recommend that we can attain concurrence concerning the significance of numerous principles as this takes a well-defined value adjusted emergence to research (Shusterman, 2016).

Pragmatism furthermore permits the researcher to be free of intellectual and practical restraints stirred by the mandatory favourite dichotomy amongst post positivism and constructivism (Shusterman, 2016). Taking a practical and impartial or pluralistic pose will aid improve association amongst researchers from diverse paradigms as they endeavour to advance knowledge (Goldkuhl, 2012). As outlined above, the two principal research paradigms are qualitative and quantitative research methodology while a mixed approach combined the two (De Vos et al., 2011) and they are examined briefly in the subsequent section.

The qualitative research methodology

The qualitative research methodology is an anti-positivistic loom which throws-out the proposal of a peripheral goal assertion. This methodology tries to recognize authenticity by discovering the significance attached by populace to situations. Qualitative researcher's performance is premeditated, inventive and can only be explicated and not envisaged (De Vos et al., 2011) It is defined as a "multi-perspective advance" (making use of dissimilar qualitative methods and information gathering methods) to collective communication in terms of the meanings that the issue is appended to it (De Vos et al., 2011). These methodologies give rise to an explanatory data-commonly, people's personal printed or oral words (Brynrd & Hanekom, 2006). This directs to understanding the findings and the prospect of varying research strategies in reaction to in advertent findings.

The quantitative research methodology

According to Sukamolson (2010), a quantitative research method is the statistical expression and management of clarifications. The underlying principle of this method is to articulate and elucidate the occurrence that those comments disclose. These methodologies are relevant to both the natural and social sciences. Creswell (1994) refers to the quantitative paradigm as a type of research that amplifies observable fact by accumulating statistical data through the employment of scientifically based methods (primarily statistics).

Mixed Methodology: The quantitative methodology and qualitative methodology

According to Blaxter et al. (2010), the fundamental distinction connecting the qualitative (i.e. words) and the quantitative (i.e. figures) may be accepted. These differences have a major control on how information may be analysed and above and beyond reveal the diverse customs, theorists and traditions of dissimilar social science disciplines. The distinction between words and numbers is not as accurate as it may perhaps appear at first sight (Blaxter et al., 2010). Both offer demonstration of what we as persons perceive as veracity. It may be that qualitative information suggests more detail about the subject under deliberation, while quantitative data seems to offer supplementary correctness, but both grant only a one-sided explanation.

De Vos et al. (2011) stress that quantitative and qualitative approaches are inclined to shade into each other, such that it is very rare to find reports. When applying these approaches, qualitative methods are easily determined through the use of written language to describe qualities and procedures; in turn, quantitative methods are numerical in their presentation of research findings (Thomas, 2003).

Comparing quantitative to qualitative data analysis, Opie (2004) signifies that quantitative data analysis is more-or-less undeviating as the alternative of analysis is, more often than not, dictated by the type of data collected, whereas qualitative data analysis does not seem to have such requirement. Dey (2003) disagrees with the notion that qualitative data analysis does not only have specifications of information collected but rather the process of forming a perception of something which in this context, he explicates necessitates reasoning and distinguishing between facts and statistics.

For the purpose of this research, our investigation has employed both quantitative and qualitative data on ICT integration at four schools of Ngaka Modiri Molema district. A self-administered questionnaire consisting of five sections was dispensed at those schools. Part 1 focused more on demographics, while Part 2 has centred upon the issue of teacher's proficiency in using ICTs. Part 3 concerns the level and regularity of ICT use in schools, Part 4 on examining teacher awareness of ICTs and the final part focuses on training and support desires of ICT's.

Random selection has been used to select two resourced schools and two less-

resourced schools. The information attained from the questionnaires was then used to sketch out an objective analysis regarding the challenges of ICT within the District. The data collected was analysed using the statistical software analysis called SPSS together with MS Word to document the results, MS Excel to store data.

1.7 POPULATION

We selected our research participants through the use of purposive sampling determined by location and gender. For the purposive sampling used here, all elements have the similar opportunity of being incorporated. Brundrett and Burton (2014), define sampling as the process which the researcher can use to surmise the qualities of a large body of people even if only a small number of persons or part of the populace is dealt with or talked to.

The purposive sampling method

Purposive sampling in qualitative enquiry is the cautious seeking out of participants with fastidious features, according to the needs of the developing analysis and rising assumption (Lewis-Beck et al., 2003 & Hay, 2017). The nature of the sample is not always predetermined but, often in the middle of the course of data analysis.

Cited in Hay's (2017) study, Lewis-Beck et al. look at types of purposive sampling; namely, nominated or scheduled sampling (participants are referred by members of the same group who have already been registered in the study) and theoretical sampling (participants are purposely sought according to information required by the analysis as the study progresses which is established).

The number of primary and secondary schools in both the rural and semi urban areas of the Ngaka Modiri Molema Education District is very huge, presenting the possibility of major financial challenges. The participants selected are thus restricted to schools in Mafikeng Area Office. For the pilot study a sample of 15 students from the School for Teacher Education and Training (STET), North West University Mafikeng who are also teachers in training and 10 senior teachers selected from 2 schools of which 1 was resourced school and the other un-resourced was used. As a result, for the main study, a sample of 26 teachers and 4 principals selected from 4 schools of which 2 were resourced schools and the other 2 un-resourced was used. The structured

interview questions are of low cost, administered by the researcher himself and thus easy to apply (Babbie and Mouton, 2009)

This assisted the researcher to understand the inexplicable demeanour from the respondents. The interaction between the researcher and the respondents, enhanced provision for required justifications. The interview questions were read out in the similar tone of voice to eliminate bias. This research has also utilised scrutiny of records and questionnaires, case studies as well as comprehensive interviewing of key informants, (Babbie and Mouton, 2009).

1.8 CHAPTER OUTLINE

This research is well-ordered into six chapters. Each of the chapters has a disparate focal point. A synopsis of the contents of these chapters is as follows:

Chapter 1: Background overview of ICT's

This chapter start with a preamble on the research topic, then presents a statement the problem, justification of the research and its rationale and objectives, as well as the research questions. This chapter concludes with research methodology, target population and summing up of the chapter.

Chapter 2: Literature Review

Chapter 2 covers the main findings, opinions and conclusions of relatable literature reviewed.

Chapter 3: Methodology and Design

This discussion tackles the research methods used, including population samples, the sampling method and data gathering tools, along with how data was presented and analysed.

Chapter 4: Data analysis and findings.

The focus here is on how we analysed the data and determined findings.

Chapter 5: Theoretical Framework.

The chapter presents the major findings, points of view and conclusions of pertinent speculative perspectives reviewed and the theoretical structure as predicted by the researcher.

Chapter 6: Findings, recommendations and conclusion.

The chapter presents the rundown of the research findings as well as the proposition for development and future work pertaining to the research.

1.9 SUMMARY

It is of significant value to introduce computers into education as envisaged by the North-West Province. The 21st century necessitates that people place an emphasis on classroom proficiency in ICT/digital skills with the responsibility left with schools to apply these educational priorities. This study recommends types of teachers of sufficient quality and expertise because schools will need very proficient classroom teachers, especially in the orientation of the education system towards ICT use.

This chapter discussed in detail the research topic and key issues in connection, including the research rationale, its objectives, the methodology employed and a synopsis of the provisional chapter divisions for this research.

The subsequent section (chapter 2) centres on the literature review conducted on ICT and the impact of ICTs for a teaching-learning environment. In this chapter, the researcher looks deeper into the outset of ICT and ICT in the education process.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The presentation here begins with a general survey to evaluate the positive or negative contributions of agents to the introduction of classroom ICT to the North-West Province. Hence, we have reviewed research documents, articles, books and journal papers relating to the research topic to obtain a clear overview of the integration of ICT in curriculum offerings. We can thus present ICT as a “combination of networks, hardware and software as well as the means of communication, collaboration and engagement that facilitate the processing, management and exchange of data, information and knowledge” (Lim, 2007). Effective ICT provision in education entails the optimal transmission of information electronically through hardware and software in schools as much as the general population (Mostert and Nthetha, 2008).

2.2 BACKGROUND OVERVIEW OF ICT IN SCHOOLS

Studies have confirmed that students with experience and knowledge of classroom ICT use will have progressed considerably beyond their colleague’s once entering higher education (Look, 2005; Becta, 2006). A head-start in ICT gives students heightened motivation towards learning which is reciprocated by a focus of technological advances in their own schools (Barak, 2004).

At the same time, Becta’s study (2006) reveals a significant disadvantage that student’s ICT learning potential may be limited because the majority of teachers are still not yet ICT compliant and therefore refrain from using it in the classroom,

Teachers require subject matter competence to be up-to-date with today’s knowledge revolution. According to Sladit and Berta (2007), the expectation of learners is that teachers will go beyond a traditional classroom approach. Yet Dlamini and Na’Allah (2015) emphasise that these teachers are frequently lacking the requisite ICT skills.

Hodgkinson-Williams (2005), Dlamini and Na’Allah (2015) also stress that when ICT is introduced in a school and teachers are expected to use it positively in a classroom

context, their short-comings in ICT tend to affect them very negatively. On the other hand, Sladit and Berta (2007) offer abundant proof that technology is a great advantage for the classroom. Today, many South African teachers use ICT to obtain a better classroom performance using in particular interactive processes to encourage students within and beyond the classroom (DoE, 2015; Dlamini and Na'Allah, 2015; Huyer, 2005).

Hodgkinson-Williams (2005) mentions the continuing achievement in teaching and learning of schools still using out-dated computer labs. Yet most researchers dispute that old technology can produce positive improvements or results. The reality is that, contrary to the view of some researchers, the white paper on ICT and e-education has a huge influence on ICT use in education in South Africa (John & Sutherland, 2004; Hodgkinson-Williams, 2005).

Certainly, many weaknesses have been identified in schools' use of ICT. Yet researchers are in agreement that ICT is now essential to education to enable young learners to pursue their ambitions and adapt to technological change in a globalised economy (Mostert & Nthetha, 2008).

According to Wims and Lawler (2007) ICT solution in the educational context may assist to overcome the learning obstacles presented by the school system such as a high rate of teacher shortage, sky-scraping drop-out rates, lack of opportunities in teaching and learning, and stumpy achievement.

Here we will present a comprehensive literature review to reveal that personal characteristics have insignificant impact on teacher attitude toward computers (Wims & Lawler, 2007). This chapter offers particular viewpoints on varied sub-topics which are related to the stated research objectives and questions. The chapter additionally looks at the literature affecting the use of ICT in schools, how ICT creates diversity in a classroom and the adoption of ICT tools to improve the teaching and learning environment. The next subdivision discusses how features such as teacher's experience, ICT competency and sexual category, affect the adoption of ICT in schools.

2.3 THE USE OF ICT IN SCHOOLS

A study of the literature in this field should focus on how aspects such as teachers experience, ICT proficiency and sexual category have major impact on the teaching-learning environment. The next section hence presents a short overview of how gender, teachers experience and ICT proficiency influence ICT use in schools.

2.3.1 GENDER

Gender is a crucial determinant of how well ICT is used by teachers (Buabeng-Andoh, 2012). In comparison to male teachers, research frequently takes female teachers to be less progressive in their classroom ICT use, if they use it at all (Kay, 2006; Wozney et al., 2006; Volman & van Eck, 2011).

The findings for undergraduate teacher trainees support this perspective (Burke, 1986; Koohang, 1987). Here, scores or ratings for ICT competence proved higher in males than females (Buabeng-Andoh, 2012). A study by Jamieson-Proctor et al. (2006) produced similar findings in Australia. Yet Breisser's research (2006) into US Midwest schools found that females had better results in males in ICT classroom use, particularly in factors of self-discernment and self-awareness. Breisser's conclusion here is in agreement with the studies of Yukselturk and Bulut (2009), Buabeng-Andoh (2012) and later Adams (2013).

According to Surty (2010), ICT may serve as a self-regulating instrument without sexual category or edifying devotions, thus facilitating unreserved communication and interaction between human agents. Learners whose learning styles and unstable capacity differ can thus be easily encouraged to foster a superior approach to classroom activities. ICT and connected software promised to help poorer students find a personalised approach as they do not have the means to afford an expensive campus education (DoE, 2004). Some studies, on the other hand, demonstrative that there is no connection between gender and ICT integration in teaching (Norris et al., 2003).

Additionally, Kay's (2006) as well as Norrisset et al.'s (2003) studies, reported little or no variation in teacher attitudes to ICT use according to gender in a broad-spectrum. Yet years of teaching and age factors are seen to have an impact on teacher attitudes toward computers similar to the capacity of the level of knowledge about computers and enthusiasm to use computers to influence teachers in using ICT in education (Mitchell, 1985).

2.3.2 TEACHING AND TECHNOLOGY

Studies reach different conclusions in their evaluation of the role of student's foundational learning when adapting to using ICT both in the classroom and the wider education system. One group of researchers deny there is a relationship (Niederhauser & Stoddart, 2001), but the second group perceives a strong positive relationship (Hernandez-Ramos 2005; Giordano 2007; Wong and Li, 2008 and Gorder, 2008). A third group of studies is then concerned with teachers who are uninterested or unconvinced of ICT use (Chin & Hortin, 1993; Gardner et al., 1993; Samak and Tawfik, 2016).

Studies also focus on age as a crucial factor, seeking to determine the relationship between age and effective ICT classroom use. Again, one group of researchers failed to find a positive relationship (Handler, 1993; Massoud, 1991; Woodrow, 1992; Samak & Tawfik, 2016), while a second group were sure of a positive connection between age and effective ICT learning use (Chio, 1992; Kendel, 1995; Blankenship, 1998; Russell et al., 2007). Other findings revealed that there was as much enthusiasm for ICT amongst the young learners as young teachers (Buabeng-Andoh, 2012; Samak & Tawfik, 2016).

2.3.3 ICT COMPETENCE

Summers (1990), Na (1993), Berner (2003) and van Braak et al. (2004) conclude that teachers' adoption of ICT is greatly aided by its effective application to the classroom. Where teachers make "informed decisions" about ICT use (Al-Oteawi, 2002).

Similar conclusions have been reached not only by researchers in Europe and the United States but elsewhere in the world. But any emphasis on competence should focus on technical skills, first introduced to trainee teachers via work experience (Jones, 2004; Peralta and Costa, 2007; Buabeng-Andoh, 2012).

2.4 USING ICT TO ENHANCE TEACHING AND LEARNING

According to Wims and Lawler (2007), the potential to make effective use of ICTs is of tremendous importance. ICTs support people by incessantly developing and fine-tuning to the skills associated with lifelong learning. These researchers also refer to ICT solutions in the educational context which might help to resolve education related problems such as low achievement, high drop-out rates and a lack of opportunity, as well as teacher shortages (Wims & Lawler, 2007).

In the research conducted by Lau & Sim (2008) regarding the application of ICT in the classroom, it was discovered how ICTs have a potential to ensure that content is acquired rapidly and precisely while also accelerating the development of skills like mathematics. In contrast, certain researchers remain dubious that all teachers are willing and able to use ICT effectively and profitably with the younger generation who demand greater use of computer technology in classroom learning (Ya'acob et al., 2005; So & Paula, 2006)

ICT can therefore help to improve the realisation of curriculum goals because it can help teachers in their own professional development (Barak, 2006). Lau and Sim (2008) have studied how teaching and learning in Malaysia has been supported through ICT using laptops, Liquid Crystal Display (LCD) projectors and software. In some schools, schools have employed ICT in the learning process to keep up with

developments in modern education. It is also recommended by Lau and Sim (2008) that, if at all feasible, teachers are further admonished to be prepared to use ICT in ensure classrooms keep up with the contemporary curriculum. Alnahdi (2014) recommends ICT use alongside existing multimedia resources to improve both teaching and learning.

It should thus be a priority for the Department of Education to develop progressive programmes to foster modern learning processes in schools via resources available to well-trained and up-to-date teachers (Dlamini & Na'Allah, 2015; DoE, 2015). In addition, Walsh et al. (2014) explain that to identify the specific learning culture in South-Africa, it is incredibly imperative to be acquainted with the country's education system.

Classroom learning requires teachers who both understand the use of classroom teaching while willing to achieving progressive outcomes using ICT (Buabeng-Andoh, 2012). Hence, we should believe that technology is of great worth but laments only in the hands of a skilled teacher, meaning that spending and application of ICT should be guided by clear pedagogical considerations (DoE, 2015).

In addition, according to Buabeng-Andoh (2012), there is nothing wrong with using itinerant tablets in the classroom. However, schools should be helped to use them effectively as a learning platform in several developing countries and the schools under study. The role of mobile platforms in learning has thus been appraised hereto conclude that they contribute greatly to learning. Buabeng-Andoh (2012) confirms that itinerant platforms improve both learning and research support. The main features afforded by mobile learning such as teachers mate and iPad are discussed below (Srivastava & Gulati, 2014):

2.4.1 Teacher Mate

Teacher Mate is a mobile computer from the United States intended to help teacher (Goundar, 2011). Its Chicago designers conceived it for the purpose of supporting individual teachers (Weinberger, 2011). This computer is acclaimed to:

1. Support original modes of classroom teaching.
2. Present the schools with an instructional support in classroom lessons.
3. Make it possible for teachers to talk to students one on one by means of the software.

However, the cost of educational ICT presents a challenge for the Ngaka Modiri Molema district.

2.4.2 The iPad

The iPad is a consumer ICT device changer which also has instructional value both in group learning (Thissen et al., 2013) and individual self-directed learning, encouraging and motivating students in their learning. For ease of use, iPads are in use in schools in each province of South Africa, comprising of 140 primary and secondary students and teachers (Goundar, 2011).

Lohr (2014) is of the belief that iPads help learning to become easy and fun, motivating teachers to use new curriculum resources that may be new to them. Hence, we will next explore how ICTs should be implemented in classrooms.

2.5 SKILLS AND RESOURCES NEEDED TO IMPLEMENT ICTS IN CLASSROOMS

According to Nchunge et al. (2012), ICT plays a critical role in effective and useful, education service delivery. The pace of ICT adoption is however often affected by a perception the users have that ICT is difficult technological as a result of lack of digital

literacy, lack of eagerness to use this technology, as well as inadequate policy guidelines (Nchunge et al., 2012). Research argued that both inadequate psychological and technical awareness hampered attitudinal and behaviour changes, which, have delayed the use of technology in schools (Nchunge et al., 2012; Dlamini & Na'Allah, 2015). Kamau (2012) believes that training and amplified investment in ICT amenities are significant for the obligatory psychological and technical expertise, as well as eagerness of teachers.

Analysts have argued that new educational models which emphasize ICT be searched and integrated into the instructional practice (Amutabi, 2004; Macharia & Pelsler, 2012). In other words, the focal point ought to move from production based ICT programmes to product-based programmes that connect ICT to improving teaching and learning (Amutabi, 2004; Macharia & Pelsler, 2012). This change would have the benefit of preparing potential citizens for lifelong learning. Even though vigorous learning can be facilitated by ICT, minor agreement exists as to which educational models must be implemented. Additionally, the supporting hardware has analogous concerns: Some teachers have advocated for movable and multi-purpose devices, while others prefer immobile equipment, such as desktop and laptop computers (Hennessy et al., 2010).

As stated by Hennessy et al. (2010), various challenges such as personnel development and improvement have hindered the integration of instructional change and ICT. According to research, classroom teachers are the main agents of innovation and diffusion of skills. It is further articulated that the role of head teachers in ICT program implementation at the level of the school cannot be underestimated (Njoroge & Kibaru, 2012). Ngololo et al. (2012) reported teachers' negative attitudes regarding ICT and also argued for the need to focus on pedagogical uses of ICT. Research explaining differences in the position of certain characteristics of the learning environment reports assorted results. For instance, teachers in urban school's express greater knowledge about computers than do those in rural schools (Mitchell, 1985). However, teacher attitudes towards computer in urban schools do not differ significantly from those of teachers in rural schools.

It is often the case that rural regions fall behind on technological advances and South Africa is no different where schools and community life appear distant from ICT

developments (Pelgrum, 2008). In fact, computers themselves are barely present in the education system and have not been adequately applied at schools (Gulati, 2008).

For Back (2012,) there is a clear lack of teachers with the pedagogical approach necessary to apply ICT to classroom teaching. Moreover, where classroom innovations are sought, then modern ICT is not made available or teachers are ill-equipped to use it. In conclusion, this makes teachers seem inadequate to apply pedagogical innovations and advances in connection to new ICT approaches (Goktas et al., 2009; OECD, 2010).

These conclusions are borne out by the researchers Bradley and Russell (1997), Preston (2000), Bramald et al. (2000), Granger et al. (2002), Lim et al. (2006), Richardson (2000), Ward (2003) and Cassim (2010). In the worst cases, classroom only have access to one or two computers or have a single ICT lessons each week lasting merely 30 minutes. Meanwhile, there is much evidence that many teachers make do with only basic knowledge of computers.

ICT has been extensively used to aid teachers' instruction in the classroom, in fact, research proposes that the use of technology-interrelated systems can produce prospects to amplify connections and interactions flanked by teachers and students (Chou, 2003; Jang, 2009 & Wang, 2008).

Teachers need to keep abreast with developments to be able to influence technology use as it revolutionises education. Although the positive impact of technology in education has not been fully realised, most teachers report substantial developments in learning outcomes (Wilson-Strydom et al., 2005). Furthermore, the same researchers stress that pockets of excellence exist which confirms the imminent connotation of ICT use in education, although it is currently unavailable to the majority of North-West Province's institutions of education where technology has had no brunt on education outcomes (Wilson-Strydom et al., 2005). ICT together with fitting pedagogical tactics may smooth the advancement of the expansion of sophisticated order thinking dexterities (South Africa, 2004).

Teachers and students should thus be given access to the resources and processes enabling them to work efficiently with content, such as information-gathering recalling, analysing, incorporating and appraising skills.

According to Lim and Chai (2008), orientation initiative to support learner independence and integrating ICT in teaching and learning may possibly assist in generating valuable orienting deeds. Innovative approaches to classroom learning and teaching should also develop advanced collaborative skills to increase learning outcomes outside the classroom.

For Valente (1997), traditional classroom teaching is not automatically compatible with well-organised and ingenious ICT classrooms, as the application of technology requires learners to be prepared for more advanced learning approaches (DoE, 2004; Lim & Chai, 2008). Valente (1997) views traditional classroom teaching as producing passive learners who need the skills to assess information in a more contemporary classroom.

Castells (2000) concludes that education today is effective in making learners more conscious of learning process but adds that in spite of the redundant behaviour as an attribute of drill and rehearsal programmes, the curriculum for skilful and professional education presently necessitates the realisation of fundamental professional skills for student's chosen sector. Advanced pedagogy through exposure to new and varied ICT may motivate learners to become lifelong learners (Surty, 2010).

Aside from developments in ICT use, teachers are in constant contact with new approaches to pedagogy and human interaction. McLoughlin and Oliver (1999) outline what the correct teacher responses to classroom activity should be. They are certain that ICT training activities to improve approval and acceptance by school communities should be well thought-out to persuade full stakeholder involvement in ICT policy development. One solution is the development of in-service education for all participants using ICT (Galanouli et al., 2004; Vanderlinde et al., 2010). South Africa would then be required to support the idea of comprehensive education, providing everything necessary for its success, while meeting the challenge of cost and sustainability (Da Ponte et al., 2010; Rodrigues et al., 2003; Sutherland et al., 2004; Kandasamy and Shah, 2013; Chou, 2003; Jang, 2009, 2010 & Wang, 2008).

2.6 THE IMPACT OF USING ICT IN THE CLASSROOM

It is vital to emphasise the importance of ICT in advancing classroom pedagogy, especially learner centeredness, which has become “inclusive and integrated” as a practice (Surty, 2010). ICT enables education to be restructured easily and innovative classroom approaches to be developed (Ertmer & Ottenbreit-Leftwich, 2010). Some researchers focus on young learners; for instance, Becta (2008) who has, “initiated a key research programme covering the education and their success in the classroom.

According to Higgins (2014), ICT can augment the practice of both learners and teachers. He also clarifies that when computers and technology are used by learners and teachers in a classroom, there is an enormous difference such as enhanced teaching and learning. Generally, ICT is recognised as being a successful educational tool. Yet Ndibalema (2014) believes its impact is negligible for both learning strategies and classroom pedagogy. Again, Chigona et al. (2014), may view ICT positively but Sabanci and Ozyildrims (2014) are more cautious, believing that it will only be effective if delivered by trained teachers.

ICT in classrooms makes it possible for learners to be more active and enthusiastic in approaching lessons (Al Harbi, 2014). According to Al Harbi (2014), skilled teacher's competence are crucial to delivering ICT successfully.

Other researchers (Rosen & Weil, 1995; Winnans & Brown, 1992; Dupagne & Krendl 1992; Loveless & Dore. 2002) have explored why teachers are opposed to using ICT in schools, finding general deficiencies in understanding how to deliver ICT on the part of teachers and other people involved in the school system. In the mind of these researchers, they lack monetary support, in-service education and general commitment.

More positively, Blackberry and Woods (2014) recommend the delivery of in-service education by coach or mentor for effective implementation of ICT by teachers. In turn, Huyer (2005) upholds that there is sufficient substantiation that technology can make a very big discrepancy in education.

Meanwhile, Castano-Munoz et al. (2014) stress that the internet is crucial to ICT in education. Similarly, Alnahdi (2014) is clear that, “Technology has changed and

continues to modify the way people deal with things in their lives, both in private and in practical life, so the natural extension of that is to see the impact and the integration of technology in education for students with disabilities in a similar manner. It has been in other areas of life”.

Thus, ICT is generally regarded positively as having helped develop greater and more imaginative thinking skills and learning diversity. It also provides a more holistic understanding of the teaching-learning process and learner centeredness within education (Kay, 2006; Wang, 2008; Ertmer & Ottenbreit-Leftwich, 2010; Alnahdi, 2014).

2.7 SUMMARY

So far, this study has emphasised the value of ICT as an educational tool and how it has proved positive in a teaching-learning environment. Applied correctly, ICT has the potential to transform teaching and learning.

Nonetheless, ICT may have advanced pedagogy, but in classroom terms many improvements can be made to ensure quality and consistency in skills (Barak et al., 2007; Ertmer & Ottenbreit-Leftwich, 2010).

Researchers have pinpointed a series of current problems for teachers in ICT use: attitude towards and commitment to technology; comprehensive in-service support in schools; consistent technical knowledge, correct use and flexibility application (DoE, 2004; Tella et al., 2007; Harris & Hofer, 2009; Becta, 2008; Kandasamy & Shah, 2013).

In conclusion, ICT can be extremely positive for classroom education, in-service training, teacher skills and communication etc. as verified by all the current researchers in the field. The next chapter (chapter 3) presents the research method and design followed in the study.

CHAPTER 3: RESEARCH METHODOLOGY AND DESIGN

3.1 INTRODUCTION

This study's third chapter presents a comprehensive explanation of the research methodology and design employed in this research. A definition of research methodology and information pertaining to the data compilation process as well as measures used in capturing information are given. The population, sampling, the research instruments, the tools and procedures used in the research are also discussed. Questionnaires and interview questions that were used as methods of data gathering instruments are also explicated. The justification for the picking of the research methodology used is also provided in this chapter. The chapter ends with an expression of the limitations of the research and the ethical considerations taken into account in the study. The subsequent section presents the research paradigms and how they are used in this research.

3.2 RESEARCH PARADIGM

Research seeks better knowledge and understanding of the world, with researchers hoping to expose deeper truths about man's way of life. Research findings are then the basis for new laws (Cohen et al., 2007), although personally, our belief is that scientific laws do not govern every part of human life.

Most researchers often choose a paradigm with which to observe actuality. Although there are diverse types of research paradigms which can be used when conducting a research, only the post positivism paradigm was adopted for the purpose of this research. The post positivist paradigm, also known as pragmatism, was used in this research as it provides a framework for designing and conducting mixed method research. With this paradigm authenticity is seen as a tangible structure, where one-sided perceptions have no power on authenticity (Collins & Hussey, 2003).

3.3 RESEARCH APPROACH APPLIED IN THIS INVESTIGATION

The principal approaches in this research leaned towards: the quantitative, qualitative or mixed methods. The mixed method approach was used in this study, wherein philosophical suppositions steer the course of the gathering and analysis of data. In other words, mixed-method research uses both quantitative and qualitative research approaches. This means that, the discussion employs mixed-method in relation to measurement issues as well as diverse approaches to collecting data.

According to De Vos (2011), the mixed method helps make research as coherent and acceptable as possible because the use of more than one data collection methodology improves the validation of the research being conducted. It can be employed within and across research strategies and possibilities can provide a flexible way of approaching research questions, though with disadvantages relating to time and cost. The mutual use of such methods represents for some authors a superficial integration of irreconcilable approaches (Verma & Verma, 2004).

Social sciences frequently use a mixed-method approach. Combining quantitative and qualitative research increases the validity and acceptability of the results and outcomes of the research (Bryman, 2001). But to improve reliability still requires finding the correct application of a combined method (Dey, 2003). Moreover, the mixed method requires the triangulation of the collected data which can produce undesirable consequences during the analytical phase (Deacon et al., 1998).

3.4 DATA COLLECTION

Data collection requires data gathering instruments comes from a number of sources. Verma and Verma (2004) specify questionnaires and interview as the fundamental data-gathering instruments.

Questionnaires:

A questionnaire is a research tool that presents questions to participants in the study and so gathers data according to the research objectives (New Dictionary of Social

Work, 1995). The questionnaires used in this research were cautiously planned in advance to make certain that the data collected could be objectively analysed thereafter.

Wayne and Melville (2001) explain that the advantages of the questionnaire over interviews are that the respondents can respond or complete the questionnaire at times that are fitting to them. Machado (1999) also clarifies that, "questionnaires are easier and far less expensive to control and can be dispatched to probable respondents". It is also a procedure that enables the researcher to survey an extremely large sample that is uniformly distributed geographically. The shortcomings of questionnaires are that, most researchers find it hard to construct them and end up using ones that have previously been used. Low response rate could introduce partiality into the data since it is not representative of the sample planned to be reviewed. Furthermore, questionnaires are not dependable since they do not stop respondents from giving any information other than that required by the researcher.

Interview:

Interview is a form of qualitative data gathering method which can be used only on a petite group of people. According to Goddard and Melville (2001), interview entails a one-on one verbal interface between the researcher and the respondent. The advantage of interviews over questionnaires is that the researcher can request the respondents to streamline vague responses and follow up on appealing answers. A semi-structured interview which is normally completed in the presence of the researcher by respondents was carried out to obtain qualitative data.

According to De Vos (2002), the process of face-to-face interviewing reinforces the researcher's discretion and assists them in comprehending the interviewee's position. Semi-structured interviews have the ability to merge elements of the structured and unstructured interviews. Reid and Smith, (1981) assert that, semi-structured interview guidelines deal with both unchanging option and open-ended questions. As, open-ended questions from sem-structured interviews are highly value in qualitative data collection, we decided to employ them in this study.

In developing data collection instruments, the researcher referred to the proposed framework in chapter 4 to design a structured questionnaire and interview guide. As mentioned, the data collection instruments which were used in this research include face to face, structured interviews and questionnaires. For the first two research questions, individual face-to-face interviews were conducted and thus made it possible for the researcher to discuss even those concerns that are sensitive:

- How have schools in the Ngaka Modiri Molema District adopted mobile tablets to support mobile learning in schools?
- How do teachers in the Ngaka Modiri Molema District use mobile tablets to improve teaching and learning?

In responding to question numbers three (3) and four (4), the researcher used questionnaires:

- What essential skills and resources should teachers have in order to put ICTs into service in their own classrooms?
- Which standards did the Department of Education use to supply schools in Ngaka Modiri Molema with tablets for use in teaching and learning?

The researcher ensured that the questionnaire comprised open-ended and close-ended questions to collect data from the selected sample. Triangulation of data collected was carried out to test the reliability of the questionnaire and semi-structured interview guidelines on the same research participants at different times and to assess the extent of correlation.

The interview and questionnaire were subjected to a pilot study to highlight any errors in advance. Our pilot study helped us to keep close to the rationale behind the research (Huysamen, 1993). The use of more than one research instrument in research is called triangulation. Triangulation is critical in research because it ensures validity and trustworthiness of the data collected and the methods used (Maree, 2010). Data collection is defined as gathering information applicable to the research subject.

3.4.1 Population

The term 'population' refers to the respondents or participants in an interview study (McMillan and Schumacher, 2001). In this study, participants include ICT teachers, school principals and ICT (computer) managers at schools of Mafikeng area office of Ngaka Modiri Molema district. According to Brundrett and Burton (2002), sampling is the process by which the researcher can deduce the features of outsized body of people even though only a small number of people or fraction of the population is dealt with or talked to. Shaugmessy and Zechmeister (2000), on the other hand, describe sampling as a process by which the researcher can infer the features of a large body of people even though only a small number of people or part of the population is dealt with. Since there is a huge number of schools in both the rural and semi urban areas of the Ngaka Modiri Molema Education District, the issue of tax has permitted -only schools to come under the Mafikeng Area Office.

For this research in particular, the survey population was drawn from 4 randomly selected schools of Mafikeng Area Office (APO) in Ngaka Modiri Molema district. Two well-resourced and two under resourced schools were sampled for partaking in the research. A list of all teachers, from the four randomly sampled schools was drawn. Purposive sampling was used to choose 26 teachers and 4 principals. The researcher made arrangements to conduct structured face to face interview with principals of the 4 schools and the remaining 26 questionnaires were distributed among sampled teachers to complete during their free periods or breaks.

A realistic due date (2 weeks) was given. Principals were requested to collect the questionnaires from other respondents on behalf of the researcher. Respondents had to answer all the questions. A letter of participant consent from the director of Whole School Development and Research at Quality Assurance Directorate (Addendum A) was attached. Hence, the researcher used this small sample because of monetary, human and time constrictions.

3.4.2 Reliability

Leedy and Ormrod (2005) explain reliability in terms of presenting solidity and competence in repeat research findings over time, so carrying out the research with a comparable sample and setting to produce consistent results. Reliability is obligatory to research and to qualitative studies in particular (Cohen et al., 2007) because “Derived data generally have a pre-established degree of validity and reliability, which need not be re-examined by the researcher who is reusing the data” (McMillan & Schumacher, 2001).

3.4.3 Validity

As indicated by Cohen et al. (2007) and Leedy and Ormrod (2005), “validity is the capability of any research tool to measure precisely what it professes to measure”. Validity may be either internal or external (McMillan & Schumacher, 2001), although research can never claim complete validity, “because of standard errors inherent in all measurements” (Cohen et al., 2007).

3.4.4 Variables

McMillan and Schumacher (2001), describe a “variable as a higher level abstract concept that is not directly observable and has dissimilar principles or a feature that embodies a construct”. For this research, the variables recognize the educational application of ICTs in the classroom. However, the use of variables required concentrated reassessment with the North West University (NWU) statistical consultation services before this approach was ready for use.

3.5 ETHICAL CONSIDERATIONS PERTAINING TO THE RESEARCH

Every researcher should adhere to the ethical basis of investigative research. Codes of ethics focus centre on the rights of research participant, ensuring their consent and safety in an open process (Piper & Simons, 2000; Smith, 2006; Cohen et al., 2007).

For this study, ethical clearance was needed from the North West Department of Education and University of North West. Both applications obliged the researcher to explain the nature of the research and what the researcher hoped to achieve, that is, exploring the problem of ICT use by teachers, how teachers perceive ICTs and to suggest a model or framework which the Department of Education can use to advance the implementation of ICT's in the Ngaka Modiri Molema District (Piper & Simons, 2005).

Ethics usually deal with viewpoints regarding what is correct or erroneous, acceptable or unacceptable or excellent. Ethical issues in this research stem from how the researcher acts towards human subjects. Following the theory of complete exposé, the aim and objectives of this research were well explained to the participants. Confidentiality was ensured by conducting interviews behind closed doors at times when the participants were free. Endeavours were made to guarantee the respondents' anonymity at all times. Cautious preparation and justification were done prior to data collection. The researcher informed the participants what was to be done with the information they supplied.

3.6. COVERING LETTER

A covering letter is an apparatus used to inaugurate the questionnaire to the respondents. Its substantiation is to spot the individual conducting the research and to explicate the importance of the research as well as to request respondents to partake in the research. It further confers surety to the respondents that their responses will be treated with prudence.

3.7 STATISTICAL PROCEDURES

All research concerns data to varying simple or complicated degrees. Hence, researchers use statistics to approach and then fulfil research objectives. Leedy and Ormrod (2005), justify that Statistics serve to assist the human brainpower in grasping compatible data as a prudently planned whole. In terms of statistical software, we used

SPSS software (SPSS, 2011) while the Independent Database Analyser IEA's software enabled the researcher to combine data and conduct analysis.

3.8 LIMITATIONS

According to Creswell and Clark (2007), limitations are deterrents that the researcher might come across and which have, the ability to affect the results. This research in particular, was restricted by the restraints of the mixed method research. Hence, statistical analysis was conducted along with detailed interpretation and the reviewed frameworks assisted the researcher in developing a healthy understanding of ICT pedagogical practices of ICT teachers in classrooms.

Thill and Bovee (2007) define limitations as features beyond the researcher's control that have effect on the quality of the research. These features may include restricted access to populace and information, budget and time constrictions. The limitations of this research are:

Fiscal constrictions: The research was restricted to only one of the four education districts in the North West Province due to time and funding. The research was conducted in the Ngaka Modiri Molema District. The same limitations obliged the researcher to sample only 4 schools in the Mafikeng Area Office.

Reluctance of respondents to participate: some teachers were hesitant to complete questionnaires; several principals did not want to be interviewed. Since the research design that was adopted for this research is survey, data were collected through the use of interview schedule and questionnaire in some instances

Questionnaires: These may be mislaid, may vanish or be intentionally ignored by respondents. This may cause inconvenience and the goal may not be reached. This research used individual face-to face interviews. Interviews were used to reinforce the clause of privacy. Since interviews permitted respondents to articulate their belief in their own words and organization and allowed the researcher to gain more insight into the research problem.

3.9 SUMMARY

We have covered research methodology comprehensively in this chapter, commencing with a discussion of the terms fundamental to this research. Subsequently the research methodology discussed focused on participants and research instruments. The presentation included the limitations of this research. In the next section (chapter 4), the researcher focuses on and investigates other ICT implementation and adoption theoretical frameworks.

CHAPTER 4: THEORETICAL FRAMEWORK

4.1 INTRODUCTION

The theoretical framework anticipated by the researcher of this study is discussed in this chapter. Theoretical frameworks make available a situation from which researchers make and view knowledge (Agherdien, 2007). Frameworks are to some extent, the intellectual fact in which a researcher moves and partially intentionally follows to comprehend and clarify phenomena. According to Agherdien (2007), “frameworks are epistemological instruments that account for knowledge that is formed and the type of design of an investigation in a study”.

Law et al. (2008) and SITES (2006) study state the five broad features that should be well thought-out in the development of a model for ICT incorporation and acceptance as School features, System features, Teacher features, Pedagogical exercise and Student features.

4.2 THEORETICAL PERSPECTIVES

Educational researchers have developed different competing theoretical frameworks for technology incorporation in the classroom. In this study, the researcher has identified a few of these theoretical frameworks that have been used to research about the use of technology in education. Some of the identified theoretical frameworks include:

- (1) School Management Information System (SMIS) (Telem, 1999)
- (2) The Technology Acceptance Model (TAM) (Davis, 1989),
- (3) South African Teacher Development Framework (SATDF) (DoE, 2007)
- (4) Technological Pedagogical Content Knowledge (TPCK) (Mishra and Koehler, 2006)
- (5) The Just In Case Approach (JIC) (Kester et al., 2001), and

(6) The ICT adoption framework (ICTAF) (Gatwiri, 2013).

4.2.1 SCHOOL MANAGEMENT INFORMATION SYSTEM (SMIS)

Researchers especially Telem (1990) believe that the introduction of a management information system into a school setting provides an enhanced performance, fortified instructive management, and goal attainment. This helps the school in overcoming unproductivity. Telem (1999) again sees (SMIS) as a system designed to match instructional processes, management tasks, and unique requirements of the school that offer support to the decision system. An all-inclusive SMIS manages a school or district's key and well-designed data together with but is not restricted to, student and staff demographics, class schedules, disciplinary actions, special programmes, standardized assessments, and health information (Telem, 1996).

The information presented in figure 4.1, (Telem & Pinto, 2006) represents a sample framework for the execution of any school management information system. This system shows the day to day operations of an SMIS in a school. The framework developed by Telem and Pinto (2006) integrated the technical, structural, psychosocial objectives and principles components over and above administrative components. These five components point out that adoption requires the special consideration of a multiple approach, arguably with a focus on management rather than pedagogical process.

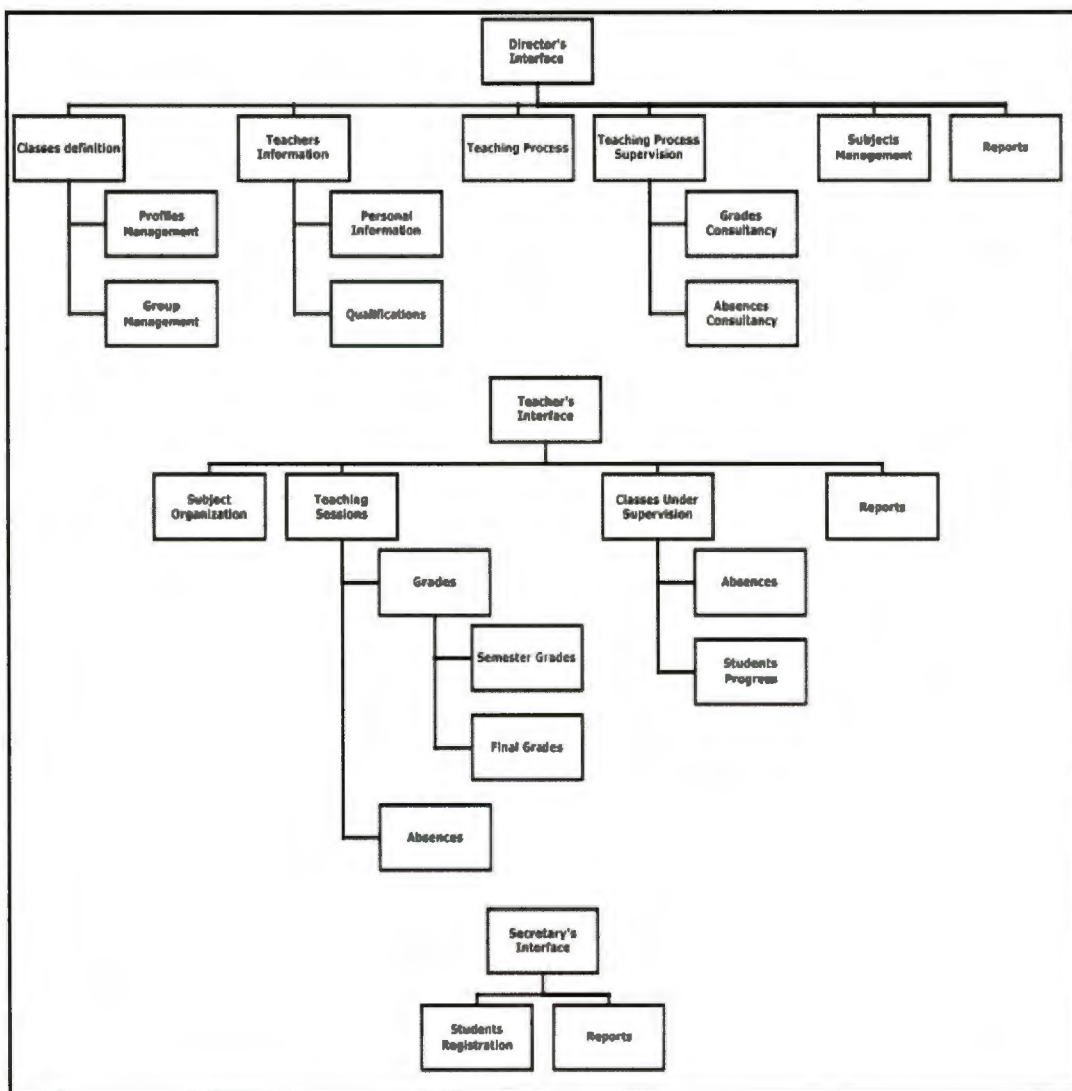


Figure 4.1: Sample-School Management Information System) SMIS (Telem and Pinto,2006)

Telem and Pinto (2006) insist that the execution of any technical innovation into a school system can be tricky as well as challenging because of the sluggish dual nature of schools. Teachers and staff members labour in relative seclusion all the way through their daily school sessions through with a certain level of professional self-sufficiency. But this isolation or seclusion experienced daily helps to sustain the organizational status quo and thwart the carrying out and employment of technical originality. According to Zaltman and Duncan (1977), poor communication channels in

many organizations lead to limitations in the measures for distributing new technologies within those organizations and because the principal basis of confrontation to technology.

4.2.2 TECHNOLOGY ACCEPTANCE MODEL (TAM)

TAM is an extremely quoted theoretical framework designed by Davis (1989) (see Figure 4.2 below). This framework is a well-known model based on human behaviour psychology and user approval information technology in a business work setting (Chuttur, 2009; Cassim & Obono, 2011; Teo et al., 2008, Tella et al., 2007, Dishaw & Strong, 1999, Fishbein & Ajzen, 1975).

Davis (1985) developed an additional model aimed to develop understanding of user acceptance processes and supply the theory that supports any practical methodology for researchers to appraise innovative ideas prior to their implementation. The framework was subsequently modified to integrate other variables such as perceived effortlessness of use and apparent expediency (Davis, 1989). In figure 4.2 below, Al-Azawei, Parslow and Lundqvist (2017) assert that all have the same opinion that professed value (PU) comes from the conviction of the user that a particular technology can help him/her advance job performance, however, apparent effortlessness of use initiates from the beliefs of users that technology is, to some extent, free from mental endeavour (Davis, 1986). Preceding studies illustrate that the recognised straightforwardness of use has an optimistic outcome on attitudes of the consumers and the perceived usefulness of using systems (Hong, Suh, & Kim, 2009).

In Figure 4.2 below, PEOU is defined as, “the level to which imminent user expects the target system to be free of endeavour” (Davis et al., 1989). Researchers recognise that in the TAM, PU and PEOU influence the behavioural intent to use a system, which in turn affects both first hand and ICT use (Gupta, Dasgupta & Gupta, 2008).

Recommended additions for TAM theoretical framework have also been utilised by researchers such as Cassim and Obono (2011), Tella et al. (2007) and Teo et al. (2008). These academics have used this framework in mathematics education to study ICT-usage in schools by focusing on aspects that affect the adoption of ICT perceived

expediency, the easiness of use of computers and the upcoming applications of computers (Chuttur, 2009).

Critics of TAM provide counter argument that the model fails to focus on learning tasks. For instance, Dishaw and Strong (1999) saw no task focus in the TAM framework and instead proposed an alternative *task-technology fit model* (TTF). TTF attempts to tackle the problem by appraising how information technology directs to performance, assessing usage impacts, and judging the match between the task and technology characteristics as stated by Wu and Chen (2017). Since its original proposal, TTF has been dynamically researched and applied to an extensive range of information systems (Aljukhadar, Senecal & Nantel, 2014).

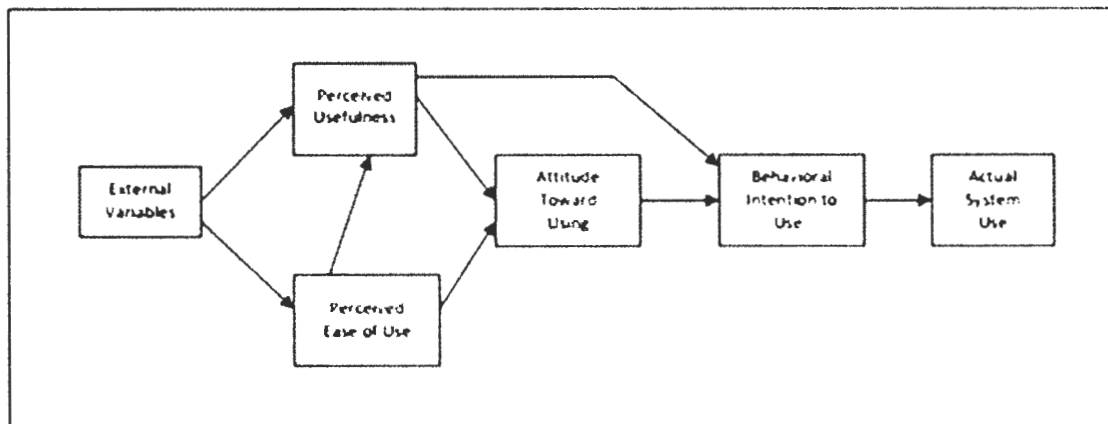


Figure 4.2 : Technology Acceptance Model (Davis and Venkatesh ,1969)

4.2.3 SOUTH AFRICAN TEACHER DEVELOPMENT FRAMEWORK

Education professionals remain concerned about the introduction of ICT to classrooms, particularly their level of competency skills even though they have ready access to the relevant skills and training (Dlamini & Na'Allah, 2015; DDE, 2015). Every school now requires ICT use even in poorer areas. Hence, an effective teaching and learning process must integrate ICT use (ETS, 2002; New Walton & Archer, 2004; Horizon Report, 2006).

Having considered these concerns and deliberations, this study now examines how education professionals are tackling problems around the use of ICT in teaching and learning (Department of Education, 2015). ICT affords probable answers to the question; but what fundamental measures should the Department of Education take to inspire teachers to make use of the accessible ICT resources to advance the quality of teaching?

Hence, the necessary resources seem to be available but their selection and use depend on teacher competence in their application (DoE, 2015). A capable instrument known as South African Teacher Development Framework (DoE, 2007) in Figure 4.3 (*Teacher Development Framework*) below provides the answer.

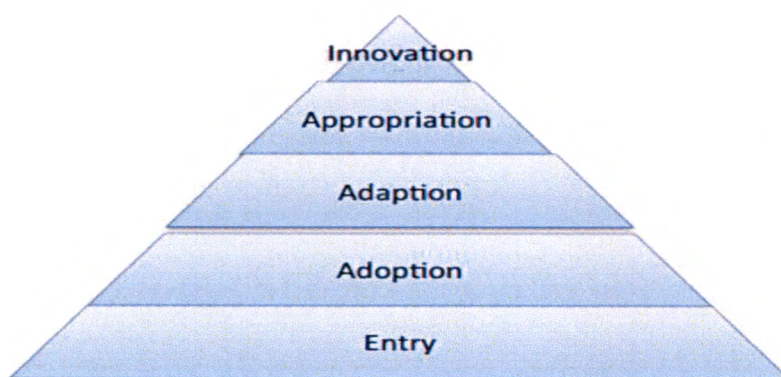


Figure 4.3 : Teacher Development Framework (adapted)

The diagram above (*Figure 4.3*) shows the five levels necessary for application of the Teacher Development Framework. In terms of innovation, teachers, for example, develop sturdy pedagogical and content knowledge which they use to convert classrooms into exhilarating and rich environment for learning. What is at question is the correct use of ICT technology and appropriate pedagogical approaches necessary for competent classroom use (DoE, 2007; Ndlovu & Lawrence, 2012).

In terms of South African education, most teachers sadly operate at the lowest levels or bottom two stages (Wilson-Strydom and Thomson, 2005) without the skills to introduce ICT competently to the classroom (Hennessy et al., 2010; Ndlovu & Lawrence, 2012).

It is anticipated that the imagined developed framework will help the Department of Education to:

1. Institute a centre offering ICT certification to maintain high standards of ICT skills and attainment
2. Persist in e-skills development to keep up with changes in technology
3. Kindle fiscal investment in providing grants, scholarships for e-skills development
4. Engender continuous awareness among the people about the need of e-skills
5. Certify commitment to institutional structure and support through necessary legal and financial framework; this will sustain multi-stakeholder interest and motivation.

4.2.4 TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPCK)

The TPCK framework presents the elements necessary for effective ICT classrooms. The right principles of pedagogy must thus be applied to achieve the mental learning process identified by Mishra and Koehler (2006) as “Technological Pedagogical Content Knowledge (TPCK)”.

Hence, education professionals must be helped to integrate ICT classroom pedagogy through practical training including clarifications, demonstrations and examples. Figure 4.4 shows how Mishra and Koehler (2006) have developed this model from a combination of intellectual categories.

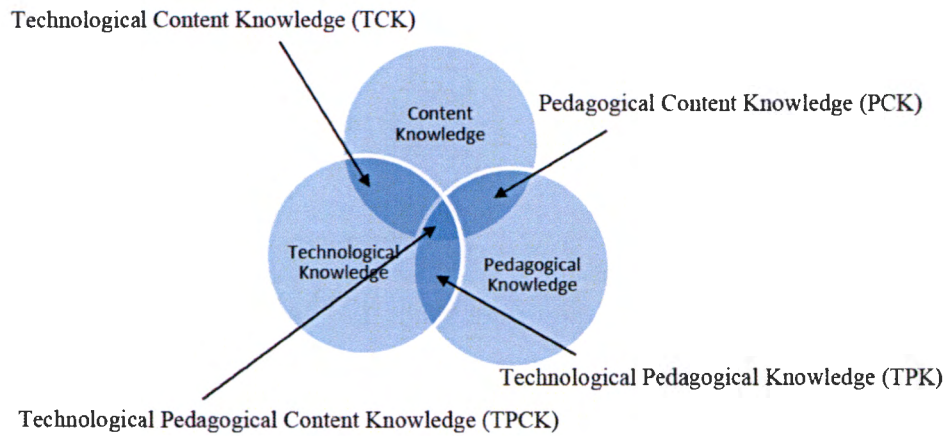


Figure 4.4 : Technological Pedagogical Content Knowledge (TPCK) (Mishra and Koehler, 2006)

This model thus emphasises technology at the expense of introducing PCK. Moreover, it does not put emphasis on the significance of introducing teachers to technology hence explaining why teachers have not applied themselves to the levels laid out in Figure 4.4.

According to Shulman (1987), an teacher knowledge base augmenting TPCK and facilitating classroom mode of learner-teacher interaction in the classroom, including knowledge of a pedagogical nature taking into account learner needs and content. Competent classroom teachers will thus begin contact with all three spheres of education.

4.2.5 THE JUST IN CASE APPROACH (JIC)

The use of JIC in teacher education focuses on teachers ICT use of in classrooms. Different to the Just-in-Time Approach, JIC limits such training to the content of particular learning topics (Kester et al., 2001).

Just-in-Time Teaching (JiTT)

For Marrs and Novak (2004) (JiTT) is one of the strongest classroom approaches. Moreover, JiTT presents formative assessments, vigorous learning and constructivism:

Novak et al. (1999) indicate that JiTT may be used as a framework following three main goals:

1. It may be used to make the best use of the efficacy of the classroom sitting, where the teacher may interrelate with the students
2. To structure the time for maximum learning advantage when the learners are out-of-class
3. To generate and uphold peer communication

Students work as a team with instructors as coaches in place of computer managers. This in turn helps all students to pass the irrelevant subjects with the maximum amount of retainable knowledge.

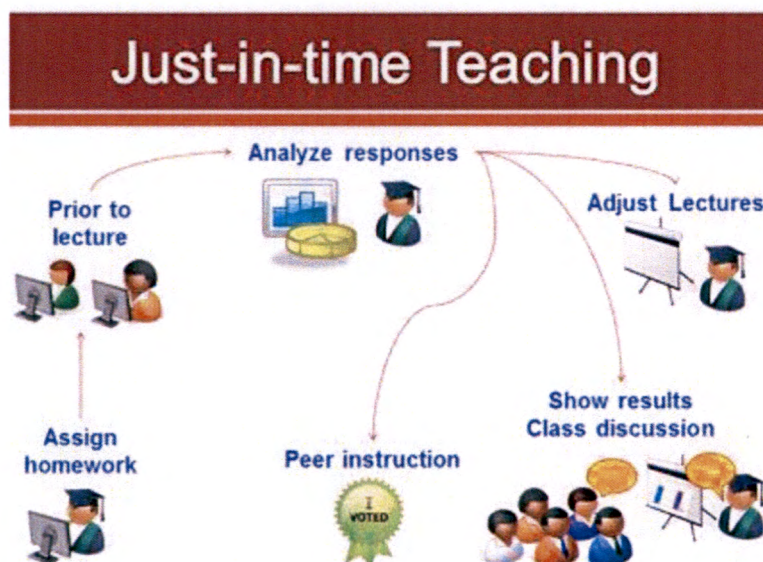


Figure 4.5 : Just-In-Time Teaching (JiTT) Marrs and Novak (2004)

4.2.6 THE ICT ADOPTION FRAMEWORK

In preparation for ICT integration and adoption in education, policymakers need to commence by illuminating the overall national education policy, objectives and approaches, as this should serve as the underlying principle and roadmap for technology incorporation and acceptance in their education systems (Gatwiri, 2013).

Farrell and Wachholz (2003) found three approaches being used in Asia Pacific countries for ICT integration in teaching and learning. In all three approaches ICT teaching is the focus, at secondary school level where the recommendation is that ICT be incorporated across the curriculum to ensure that all learners are ICT literate by the time they reach adulthood.

Gatwiri (2013) exemplifies the ICT adoption framework as an approach represented in five proportions namely: teacher professional ICT attributes Students 'Learning environment attributes, school ICT capacity and school environments. Additionally, Gatwiri, (2013) authenticates that this ICT adoption structure was tested in one of the schools in Imenti-North District, Meru County, where by the teachers and the school managers were taken through each stage, allowing them develop escalating potential to use ICT as a natural part of the daily life of the education system geared to better learning outcomes.

4.3. BUILDING A FRAMEWORK FROM A REVIEW OF THE LITERATURE

For 30 years, academics have sought a relationship between ICT and learning. Certain found none (Newhouse and Clarkson, 2008), but some discovered a relationship (Bransford et al., 2000). The researchers who found a relationship recommended that usable information be made available to learners and teachers (Newhouse and Clarkson, 2008). Nonetheless, research is still required to analyse the entire impact of ICT on education (Newhouse & Clarkson, 2008).

4.4 PROPOSED THEORETICAL FRAMEWORK (ICT Adoption and Training framework)

As much as the framework seeks a criterion for ICT to be implemented in classrooms, its benefits are most pertinent to how individual's schools use ICT and their particular application. CT implementation thus requires the pedagogical, learner and content knowledge (that researchers have presented (Mishra and Koehler; 2006 and DoE, 2007).

To recapitulate, *The ICT Adoption Framework*, in a study conducted by Gatwiri (2013), identified large impacts of the use of ICT on teachers, students, learning surroundings, schools provision of ICT capability, policy and practice. The study suggests a framework which will work hard to make South African teachers from less affluent communities prioritise the subject here and demand control over how ICT is applied to learners and teachers' pedagogy (Hennessy et al., 2010).

Learners of today are enabled by ICT to be less dependent on the specialist knowledge of the teacher (Ndlovu and Lawrence, 2012). However, the reputation of the teacher as channel in schools necessitates advanced research (Wilson-Strydom and Thomson, 2005). Research is required to determine how teachers should transmit knowledge in the classrooms of today.

The framework was proposed to the Whole School Evaluation, Ngaka Modiri Molema District (Mafikeng Area Office), as an experimentation product to be used for ICT adoption in learning processes through teacher training and support. From the pilot study, the researcher has learnt that teachers are lacking the skills required to implement ICT competently integration in classrooms. The proposed framework therefore deals with these results accordingly.

FRAMEWORK PROPOSAL DIAGRAM: ICT Adoption and Training framework

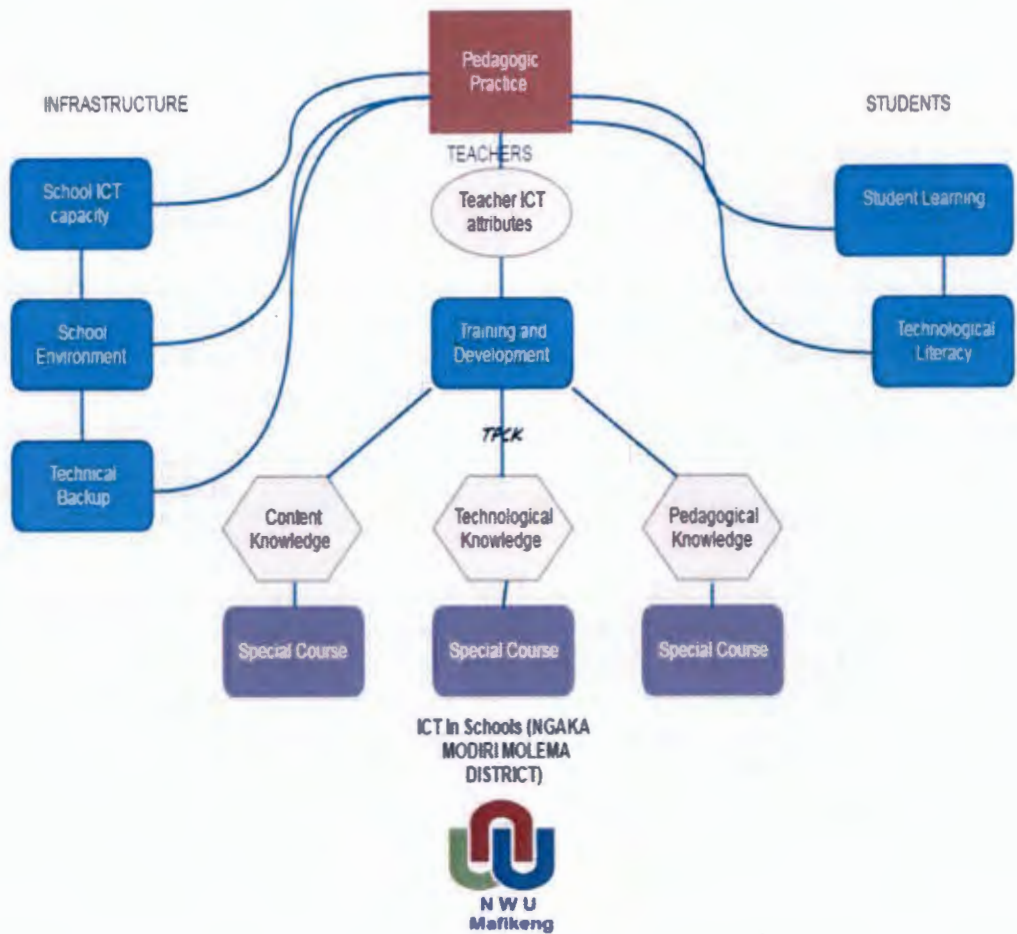


Figure 4.6 : ICT Adoption and Training framework proposal (Aobakwe Keebine,2016)

Framework proposal Outcomes

The greatest challenge for education is thus the implementation of ICT in classrooms. ICT is required for teachers and learners to benefit from the full implementation of technology in classroom teaching and learning regardless of how wealthy or deprived a school may be (New Horizon Report, 2006; Walton & Archer, 2004)

The framework above principally consists of three categories namely students, teachers and infrastructure. According to the TPCK (Mishra and Koehler, 2006), researchers take technical, content and pedagogical knowledge to contribute to the teacher *training and development* of ICT. The same training is one of the focal points

and of The South African Teacher Development Framework (DoE, 2007). The framework stresses the significance of *technological literacy* as well.

According to Gatwiri (2013), the framework proposal was tremendously influenced by *The ICT Adoption Framework*. The framework is used for the upgrading and adoption of ICT. It is also insinuated that the framework has fundamental impact on the use of *ICT on students, school environment, teacher ICT attributes, school's establishment of ICT capacity, and technical backup*. These impacts are stated below.

Outcomes for the Dimensions and Components

Every aspect might be represented by an outcome as illustrated beneath.

TEACHERS

1. Teacher ICT attributes

Teachers applying ICT technology, notably computers, need their skills and expertise to guide learners. Buabeng-Andoh (2012) and Jones (2001) give several examples of the willingness of teachers to integrate ICT into education particularly in the classroom. These support Russell and Bradley's findings in 1997. Teachers' support for ICT in the classroom is thus highly influential in the installation of ICT in education (Buabeng-Andoh, 2012).

2. Training and development

A preponderance of teachers still overlooks the elementary stage being "trained despite all the advances in ICT interconnected frameworks". The training of teachers may perchance add significantly to the development of ICT development. From the beginning, training could transform the way teachers perceive ICT's.

It might ignite interest with regards to the content they teach and make it simple to incorporate it into learning (DoE, 2007). Acknowledgment in the form of certificates or admiration, promotion to higher post levels after receiving training could also add substantially to the endeavours shown by the teachers during and after the training

courses. Fulfilment in the training courses could also lead to less user's lack of enthusiasm.

Hence, TPACK effects a combination of professional change, educational content and pedagogical knowledge to manage classroom pedagogy and ensure universal access to ICT learning.

STUDENTS

3. Student Learning

Technology enables learners to develop of their full potential. Saar and Network (2005) stress that developing advanced ICT competence enables learners to achieve a higher level of education through my involvement. Saar and Network (2005) explicate that when young people can use technology to direct their knowledge and understanding towards audience outside the classroom, school work emerge to be far more persuasive.

Generating learning experiences call for research into how best to help learners develop good practices in new learning approaches (Saar & Network, 2005). They also become more sensible in their approach to learning especially in the areas of judgement and inventiveness (Saar & Network, 2005).

4. Technological Literacy

Saar and Network (2005) note that teachers frequently conclude that classroom technology helps learners operate in different ways to according to ICT innovations. Eisner (1998) hence recommends that schools to promote and expand further than support conservative ideas of reading and writing.

INFRASTRUCTURE

5. School ICT Capacity

Friedhoff, cited in Chen (2010), emphasises that schools should supply ICT capability to guarantee that all teachers and students have instantaneous right to use to all software that is essential to support school programmes of study and ample support to execute their use. Plomp, Anderson, Law and Quale (2009) list these elements to have a positive influence on classroom ICT use: ICT infrastructure, ease of use, user friendliness and perceptibility. These elements have been highlighted by researchers in Turkey (Yildirim, 2007; Usluel, Askar and Bas, 2008). Meanwhile, Buabeng-Andoh (2012) points to how both technological tools and support programmes are required for ICT adoption. Finally, Tondeur, Valcke, and van Braak (2008) have several recommendations to make on ICT classroom use.

6. School Environment

The school environment is where learners can be trained in ICT use. This environment should involve teachers and students using ICT to build a shared information society in close partnership with education authorities (Gatwiri,2013).

7. Technical support

Researchers have emphasised that technical support is required if ICT is to be successfully applied to education (Becta,2004; Jones,2004 &Buabeng-Andoh,2012). Meanwhile, other researchers in Britain and Netherlands have stressed that many problems will arise without technical support (Tong & Trinidad, 2005; Korte and Husing,2007; Yilmaz ,2011).

4.5 SUMMARY

Competent ICT classroom depends on the pedagogical competence of teachers who should acquire such skills through both training and continuing professional development (Selwyn, 1999; Marincovich & Prostko, 2004; Czerniewicz & Brown, 2007).

The ICT Adoption and Training framework endeavours to ascertain if the school environment in the sampled schools is ICT favourable and whether they have technical support available to assist and preserve these ICT devices. The student's technological learning and literacy is as imperative since they are the chief patrons of both sufficient ICT devices and the teacher's pedagogical knowledge, content knowledge and their attitudes. Moreover, Just-in-Time Teaching (JiTT) has been designed by Marrs and Novak for use in classrooms. In 2004, it was incorporated into the framework proposal (ICT Adoption and Training framework) for the only purpose of making the most of the effectiveness of the classroom session (Jones, Zenios & Griffiths, 2004).

Mishra and Koehler (2006) argue that teachers, in their particular subjects are key as it is imperative that they are fully recognizable and certain of the classroom competences required. The success of ICT integration into the classroom as per literature is mainly dependent on the training and development of teachers, thus the framework proposes extraordinary courses for teachers to facilitate a smooth shift from the customary classroom into the digital one. The next section (chapter 5) focuses on data analysis, including these same classroom teacher competences.

CHAPTER 5: DATA ANALYSIS

5.1 INTRODUCTION

This chapter discusses how data was generated from the 30 participants, including teachers and principals, who took part in the research and how it has been analysed. Here we present the commentary and interpretations of the findings. The study questions were directed by the anticipated framework in the preceding chapter. This research report follows the usual procedure where we discuss information from respondents or participants presented in figures and tables. We will then seek to reach findings and conclusions about the sizable quantity of data collected. We will use questionnaires as our main instrument of data collection.

FORMAT AND CONTENT OF THE QUESTIONNAIRE

The initial draft of the questionnaire was discussed with the research supervisors and, after further amendments were made, the second draft was drawn and used to conduct the main study. The first draft questionnaire was piloted in a number of schools to:

- i. Check the precision of the language used (English in this case).
- ii. Examine whether more than one language can be used.
- iii. Provide opportunities for respondents to make contributions which could be used to make adjustments to the questionnaire.

This literature review concerns CT adoption across the curriculum before its classroom use. The main interview then followed and the data collection research instrument are listed below.

Section 1: Demography

Section 1 asked interviewees for demographic information on gender, age, type, type of school and work experience.

Section 2: Teacher's Competencies

Section 2 asked respondents to indicate their level of education and teaching experience along with existing ICT classroom use.

Section 3: ICT Availability

This section required participants to indicate their frequent use of ICTs in teaching.

Section 4: Teacher's Perception of ICTS

Section 4 questions asked respondents to specify their perceived ease of ICT use, in line with the Likert scale:

“(1) Extremely confident, (2) somewhat confident, (3) confident, (4) not confident

Section 5: Training and Support Needs

The behavioural intent of respondents as well as ICT training and support received was determined in this section by trying to institute the respondent's perception of ICT use both personal and in the classroom. The researcher used the questions to evaluate the extent to which respondents could use ICT's in a similar manner. *Some questions are mentioned below:*

- i. How frequently do you use computers/tablets (or other general technology) at work?
- ii. Do you have an email address?
- iii. Do you feel certain to use a computer?
- iv. Do you have access to a computer at home?

How data was collected using the questionnaire

The data presented by 30 participants with the aim of congregating supplementary views on universal factors affecting and causing success or failure of ICT use in schools which was then scrutinised and analysed.

How data was collected using the interview schedule

The interview was used as a complement to the questionnaire. The findings of the pilot assisted us with the questions asked in the interviews. The quantitative and qualitative data collected through the investigation were summarized and discussed. This is

information which provided an answer to the question being followed. Before any conclusion could be drawn from data, it was condensed and arranged in utilisable form. The results from the data collected were analysed and the subsequent information describes the data collected from the respondents (Opie, 2009). Graphs and tables were used as a summary measure to reflect the data. The findings were interpreted, summarized and presented in a descriptive-narrative form (Opie, 2009).

5.2 RESPONSE RATE

Approximately 75% of the research instrument copies sent out were returned, then analysed with statistical inferences (Carter & Jones, 2000). The researcher attempted several times to show that he met the requirements for the sample. The statistical sample illustrated that the sample met stringent rules and that it was randomly selected. Nonetheless, we would concede that, should somebody else want the results, they first test the results before it is used to authenticate the results.

5.3 DEMOGRAPHICS

The research sample's demographic profile describes the age distribution, gender and level of education of the participants. Demographic data were requested from respondents in order to get a picture of the demographic characteristics of the respondents.

QUESTIONNAIRE

5.3.1 Gender

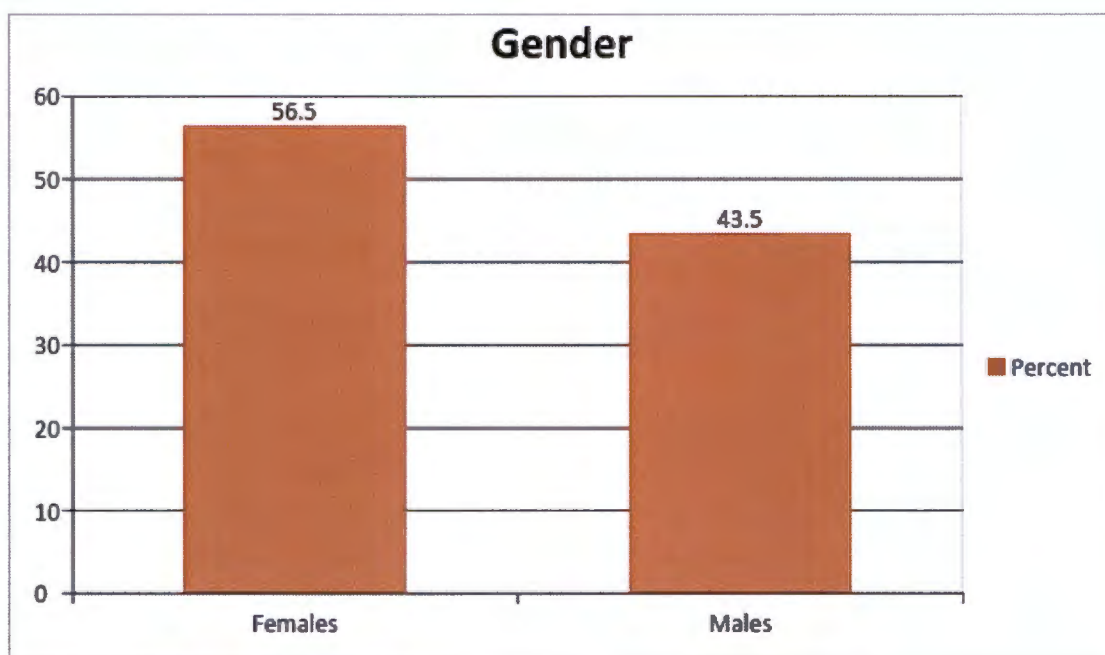


Figure 5.1: 5.3.1 Gender

The results of the questions on impeding integration of ICT varied, to some extent, between male and female teachers, computer managers and principals. Figure 5.1 signifies females represented 56, 5 % of the sample and 43, 5 % male. Showing that the majority were women.

5.3.2 Age



Figure 5.2: 5.3.2 Age

Figure 5.2 illustrates that the majority (40, 5 %) of respondents was in the 26-35 age group and 38, 7% of them in the 36-50 year group and only 20, 8% between 20-25 years of age.

5.3.3 Level of Education

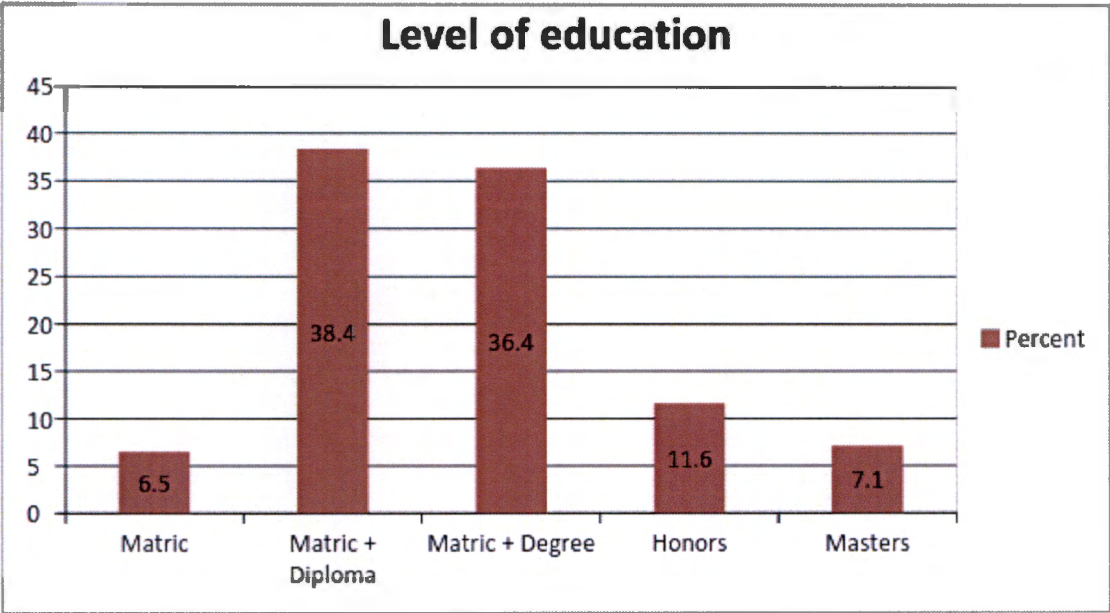


Figure 5.3: 5.3.3 Level of education

According to Figure 5.3 above, the majority of teachers hold a degree and diploma in their relevant disciplines, yet few have had ICT training for (Pelgrum et al., 2008). Teachers did not have adequate skills to use ICT in competently in classrooms.

5.3.4 Type of School

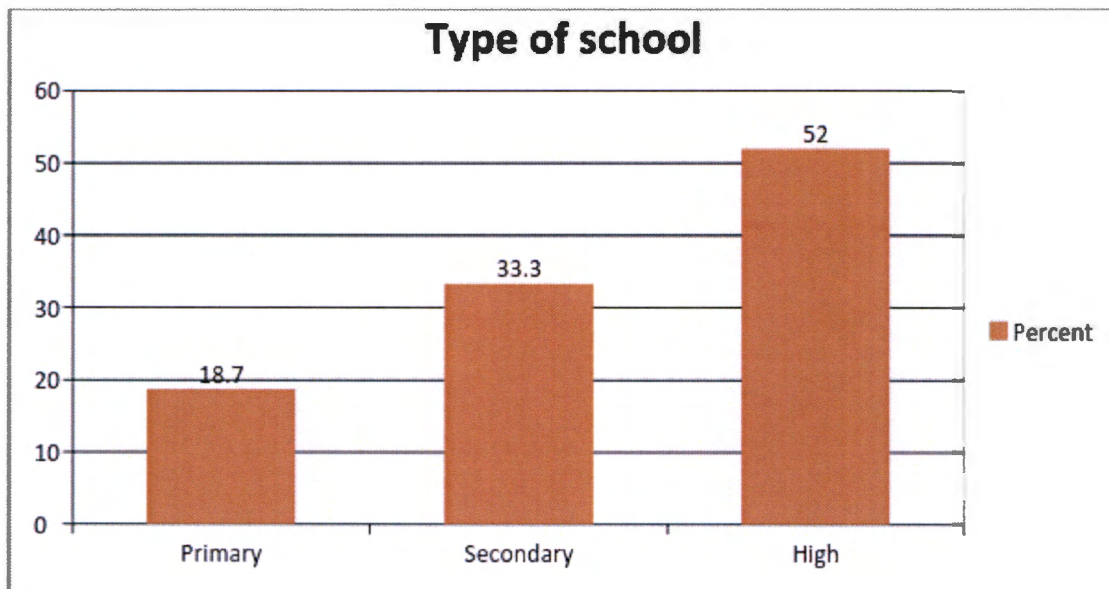


Figure 5.4: 5.3.4 Type of school

Figure 5.4 specifies that the majority of teachers (52%) work in high schools, with 33, 3% of them working in secondary schools and only 18, 7% working in primary schools. Classroom ICT use is vital for successful education. Hence, ICT implementation must take account of the different phases and grades of the school system.

5.3.5 Location of the School

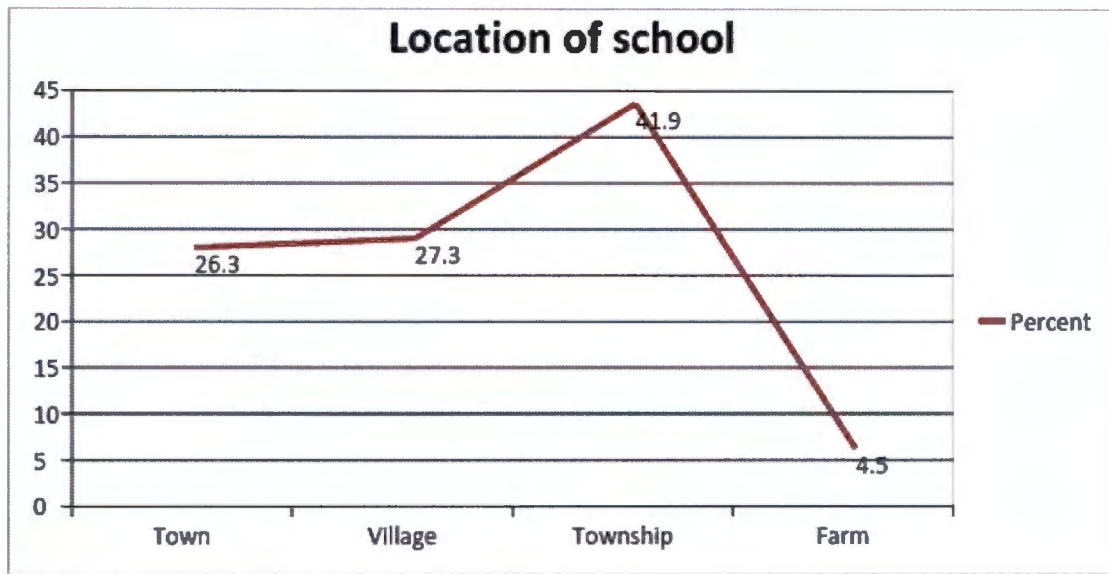


Figure 5.5:5.3.5 Location of school

The research was conducted in Mahikeng, the multilingual but principally Setswana speaking part of Mmabatho in the North West Province. Since the North West Province is largely rural Figure 5.5 shows that 41, 9% of the sampled schools are located in townships and 27, 3% in both towns and rural communities with a remaining 4,5% of the schools located in farms.

5.3.6 Learner Enrolment

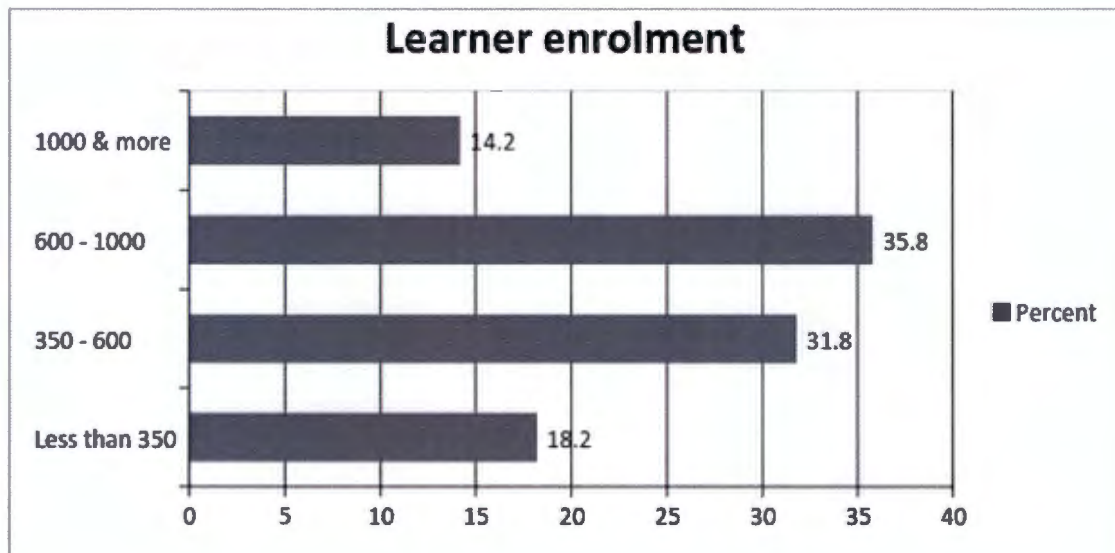


Figure 5.6: 5.3.6 Learner enrolment

Figure 5.6 shows the percentage of learners enrolled in sampled schools from 350-600 and 600-1000 is at 35, 8%. All other information on this subject is outside the scope of this study.

5.3.7 Teaching Category

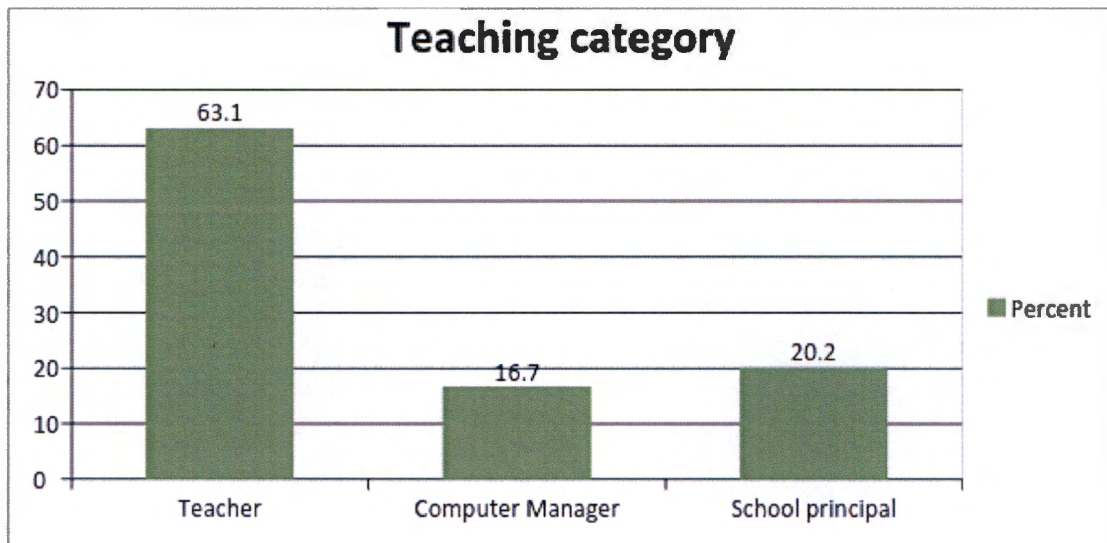


Figure 5.7: 5.3.7 Teaching Category

The majority of participants in the research held positions as teachers (63, 1%) in different schools. The majority of them are teachers whereas computer managers and principals are more or less the same number (16, 7% and 20, 2%) respectively. A significant number of participants interviewed said they used computers without any formal training.

INTERVIEW SCHEDULE

PRINCIPAL

(The following questions were directed to the principals of the schools)

5.3.8. Number of Computers

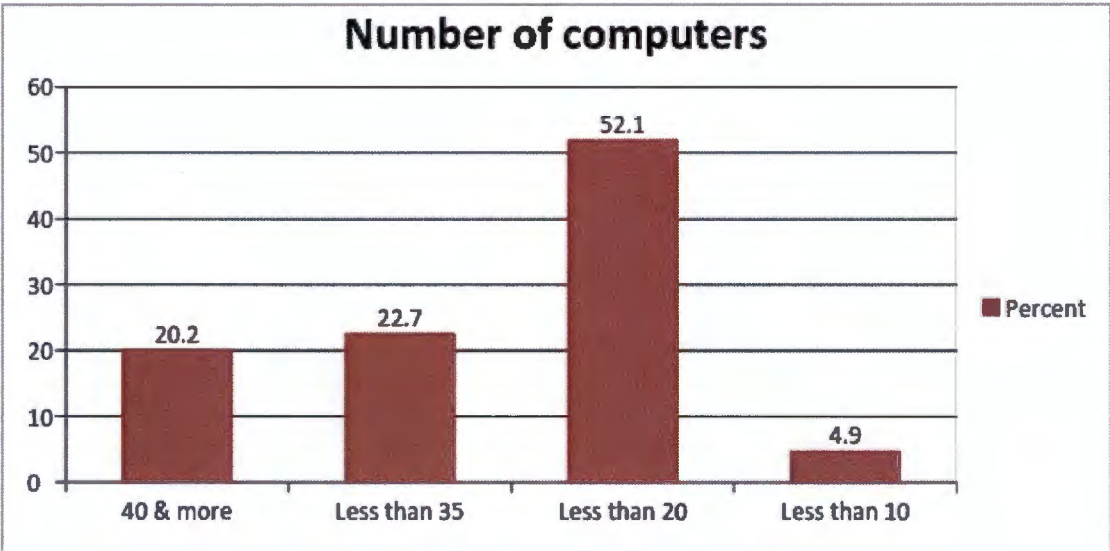


Figure 5.8: 5.3.8 Number of computers

The findings authenticate those reported in the literature that insufficient resources control the integration of ICT in the curriculum. Figure 5.8 indicates that 52,1% of the sampled schools have less than 20 computers. Although the results indicate that resources have been supplied, the majority of teachers still had a preference for the chalkboard and text books rather than utilising advanced ICT equipment.

5.3.9 Grades That Use Computers

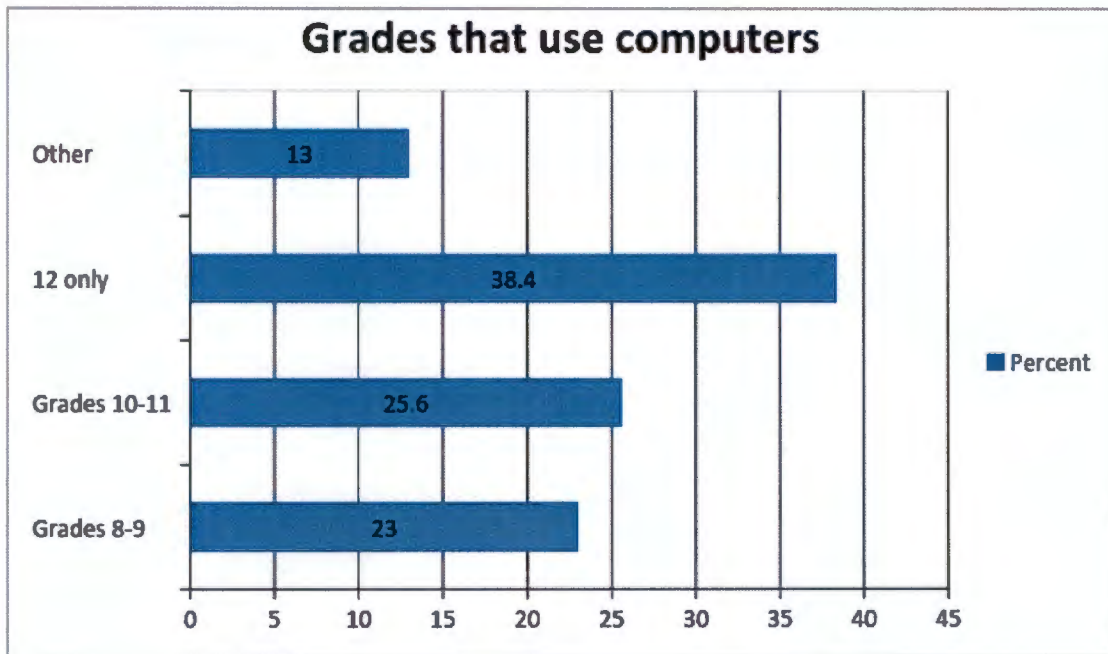


Figure 5.9: 5.3.9 Grades that use computers

Figure 5.9 represents the 23% of pupils in grade 8-9 using computer. Meanwhile; 25, 6% of grades 10-11 and 38, 4% of grade 12 learners use computers.

5.3.10 Number of Computer Managers

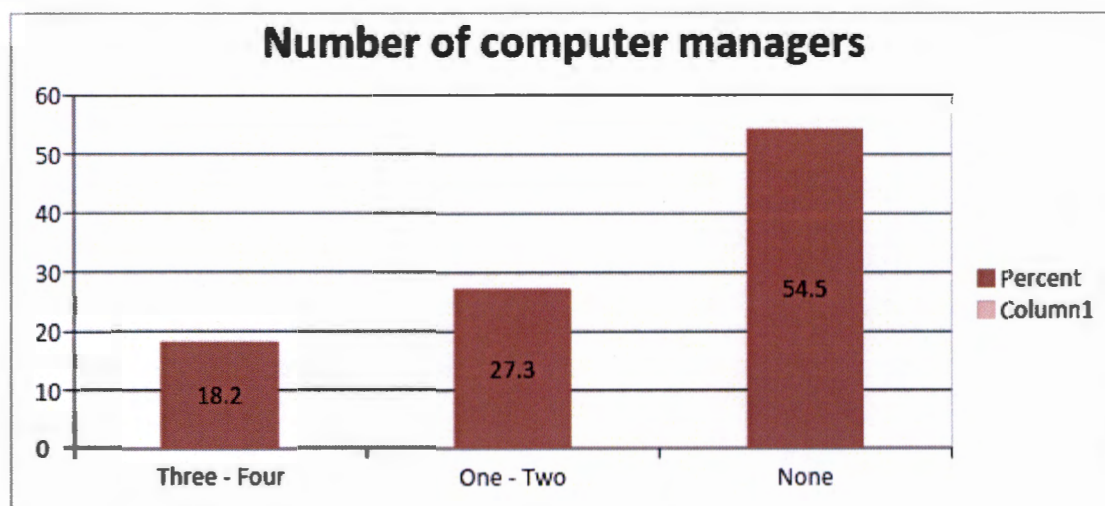


Figure 5.10: 5.3.10 Number of Computer Managers

Figure 5.10 shows that the majority of schools (at least 55%) do not have computer managers. The presence of computer managers, of course, gives added value to the teaching-learning environment. Every school should, perhaps have one. School managers can reassure teachers and motivate them towards success while also multiplying teacher's endeavour beyond their normal obligations.

5.3.11 ICT for Teaching and Learning

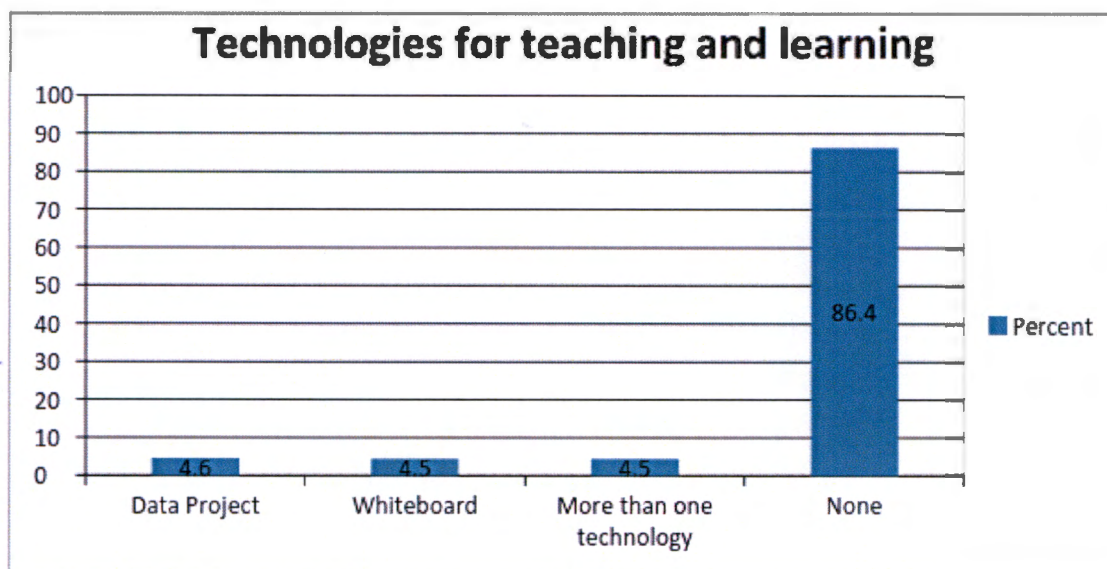


Figure 5.11: 5.3.11 ICT for teaching and learning

Figure 5.11 shows ICT use in classrooms. As seen in the diagram, 4, 6 % participants reported that they used data projectors while 4, 5% used the whiteboard and 4, 5% incorporated both the data projector and the whiteboard or rather more than one technology into their lessons. Approximately 86, 6% of teachers do not currently use ICT but prefer traditional and conventional ways of handling classroom activities.

5.3.12 Proportion of Equipment

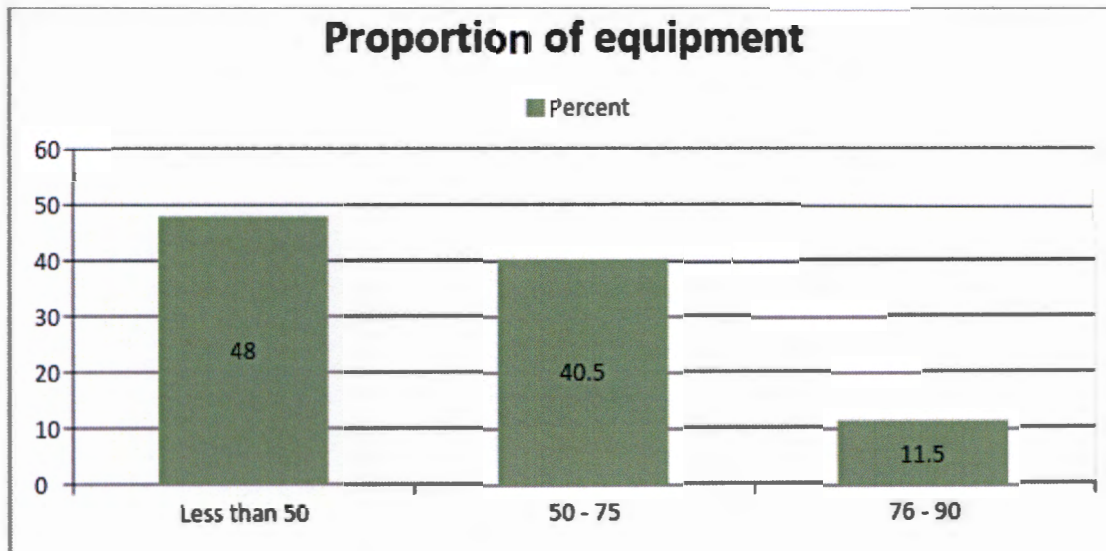


Figure 5.12: 5.3.12 Proportion of Equipment

As stated in Figure 5.12 above, schools have less than 50 PC's at 48%. Proportion of equipment (PC's) between 50-75 at 40, 5% and 76-90 at 11, 5% but whether it is adequate to understand the full potential of ICT incorporation into the classroom still needs to be further enquired into.

5.3.13 Supply of Tablets

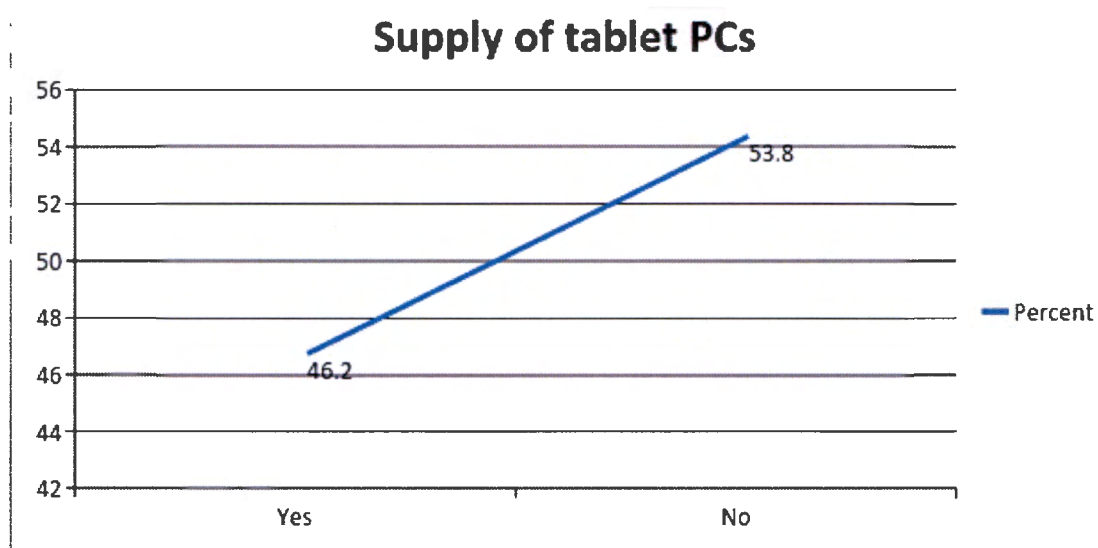


Figure 5.13: 5.3.13 Supply of tablets

Figure 5.13 illustrates that only 46, 2% of the sampled schools have been supplied with tablet PCs.

5.3.14 Brand of Tablet PCs

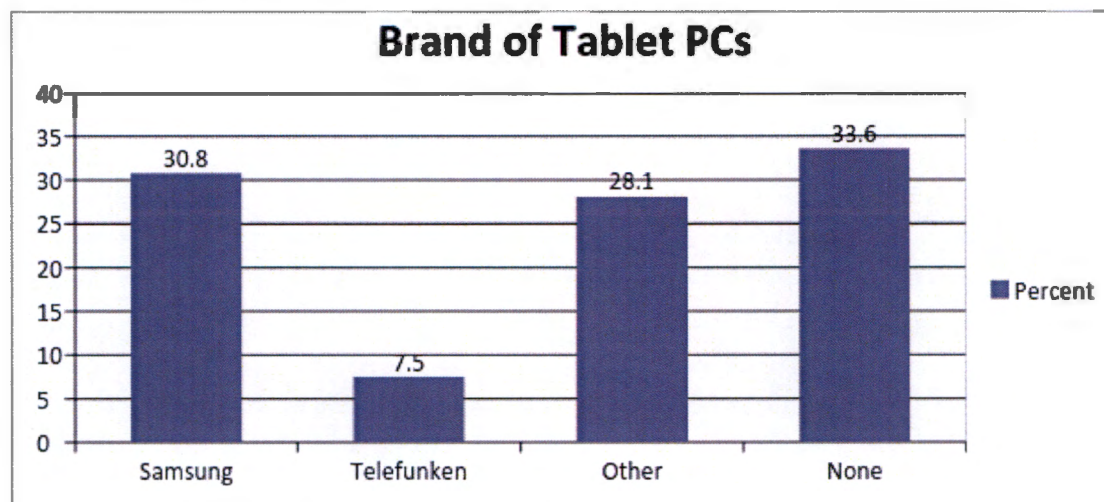


Figure 5.14: 5.3.14 Brand of Tablet PCs

Figure (5.14) shows that 33, 6 % of schools have not yet been supplied with tablets for teaching and learning, nonetheless those who have been supplied have been given Samsung brand (30, 8%), Telefunken (7, 5%) and other brands (28, 1%).

5.3.15 Installation of Computers

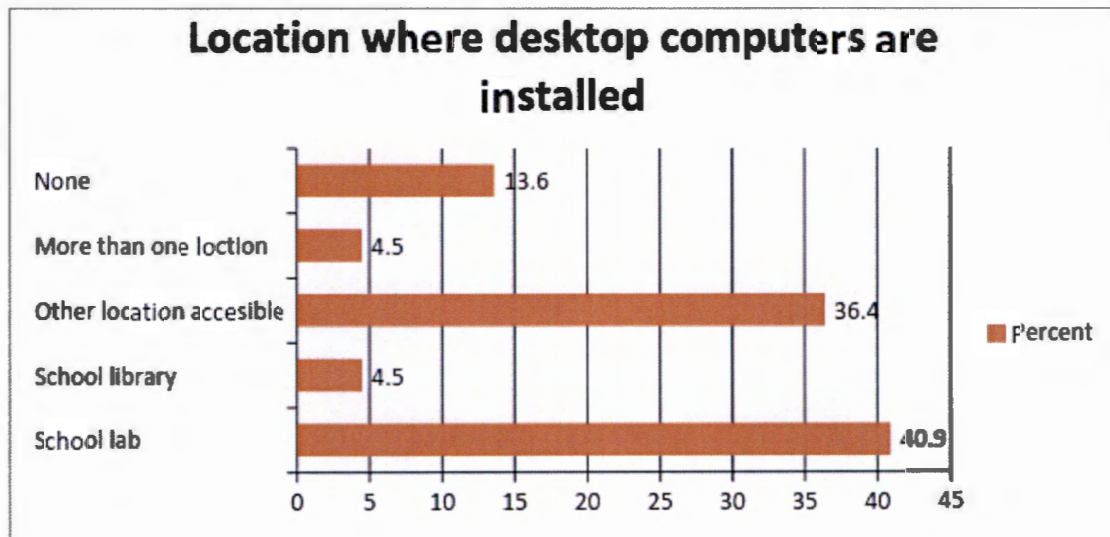


Figure 5.15: 5.3.15 Installation of Computers

In the above Figure (5.15), it is clearly illustrated that, although there are desktop computers installed for learner use in computer laboratories (40, 9%), 36, 4% of the computers are installed in classrooms and very few were located in the school libraries (4, 5%) of all the sampled schools.

QUESTIONNAIRE & INTERVIEW SCHEDULE

(The following questions were directed to the teachers and principals of the schools)

5.3.16 Computer Use

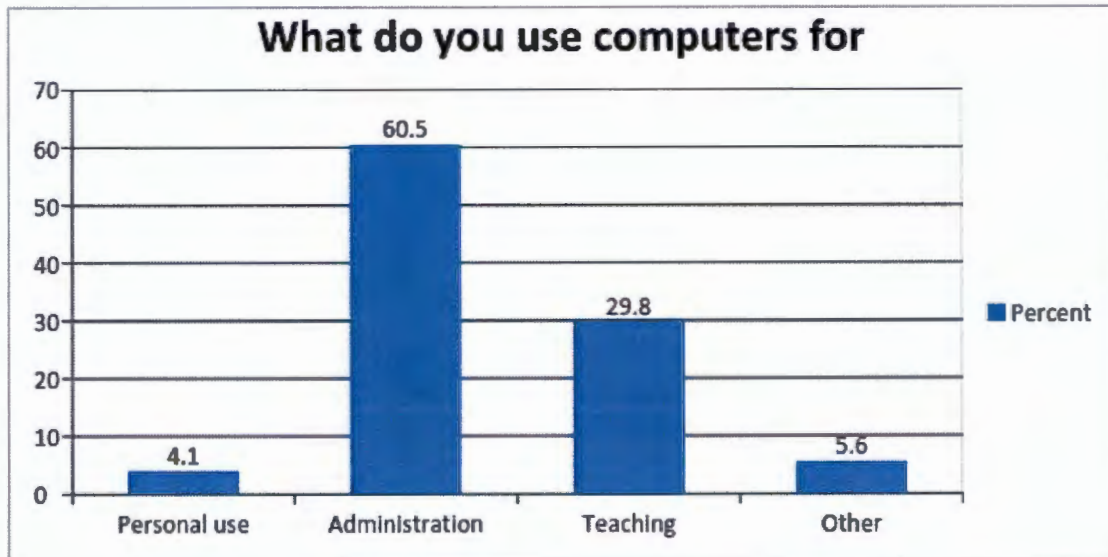


Figure 5.16: 5.3.16 Computer Use

Figure (5.16) shows that the majority of teachers and administrators (29, 8%) fail to use ICT competently in the classroom, while 60, 5% of computer use is for administrative duties. As the figure shows, a low 4, 1% of computers are devoted to private use and 5, 6% for other activities that the participants could not disclose.

5.3.17 Frequent use of ICTs

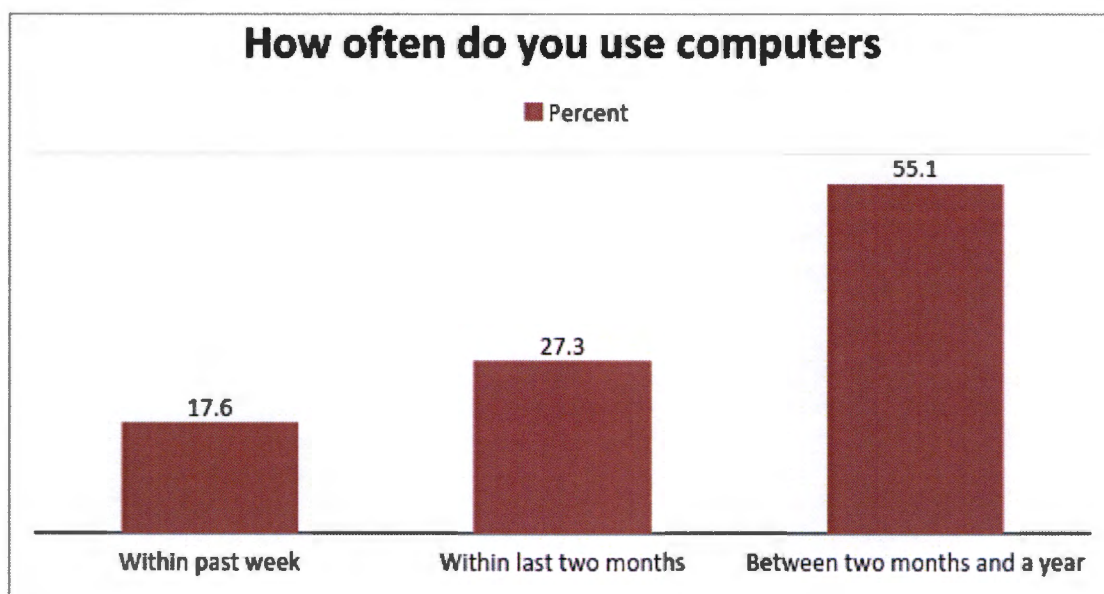


Figure 5.17: 5.3.17 Frequent use of ICTs

Figure 5.17 above points out that an average of 55, 1% of teachers report that ICT has not been applied in their classrooms.

5.3.18 Access to computers

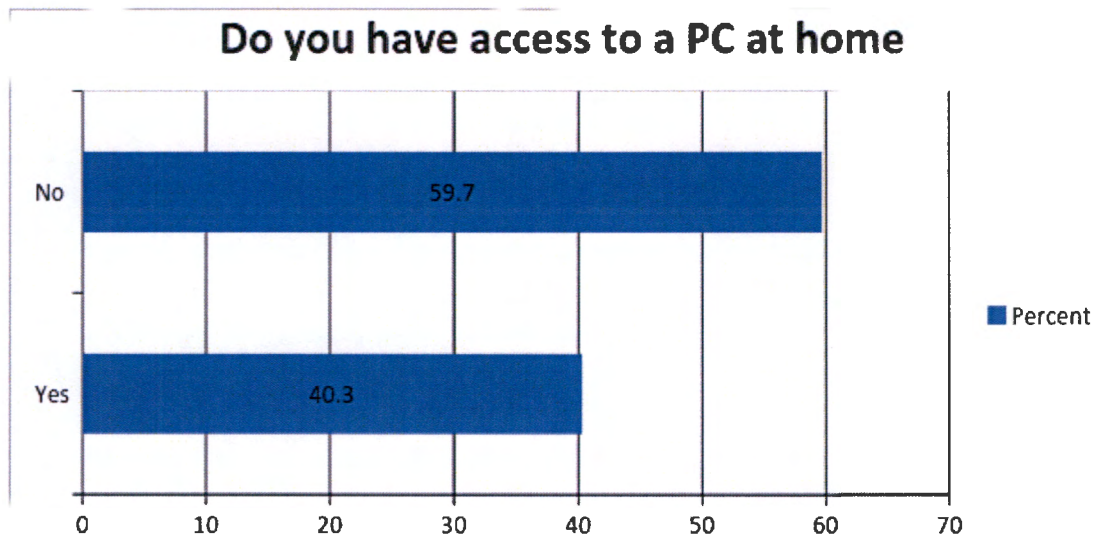


Figure 5.18: 5.3.18 Access to Computers

As specified in Figure (5.18) above; 40, 3% of the respondents do have access to a computer at home. Meanwhile, approximately sixty-six percent (59, 7%) lack access outside school.

5.3.19 Availability of e-mail address

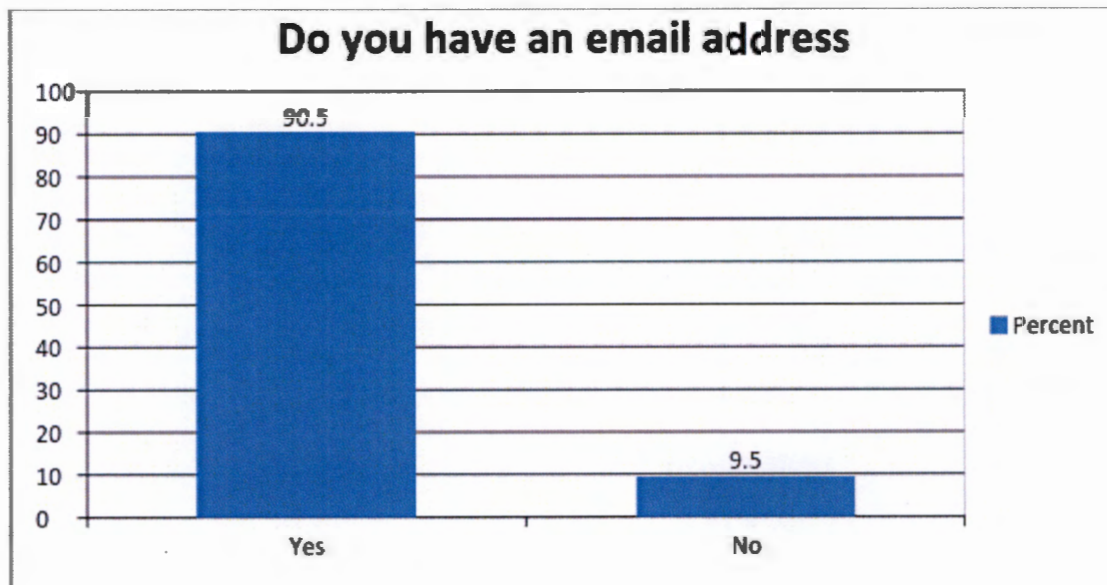


Figure 5.19: 5.3.19 Availability of e-mail address

As shown in Figure 5.19; 90, 5% of respondents have email addresses. About (9, 5%) do not have email addresses.

5.3.20 E-mail usage

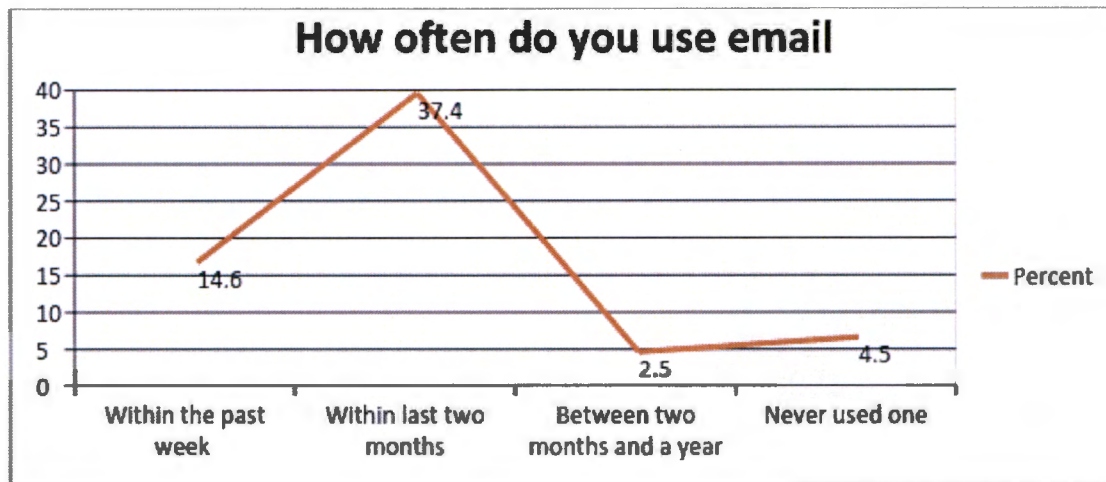


Figure 5.20: 5.3.20 E-mail usage

Only 14, 6% of the respondents pointed out that they used their email within the past week; 37, 4 % indicated that they used their emails within the last two months; 37, 4 % between two months and a year and a low 4, 5% stating they have certainly not used an email. Approximately 41, 75% stated they had no confidence while 32, 82% indicated they had confidence.

5.3.21 Competency in computer usage

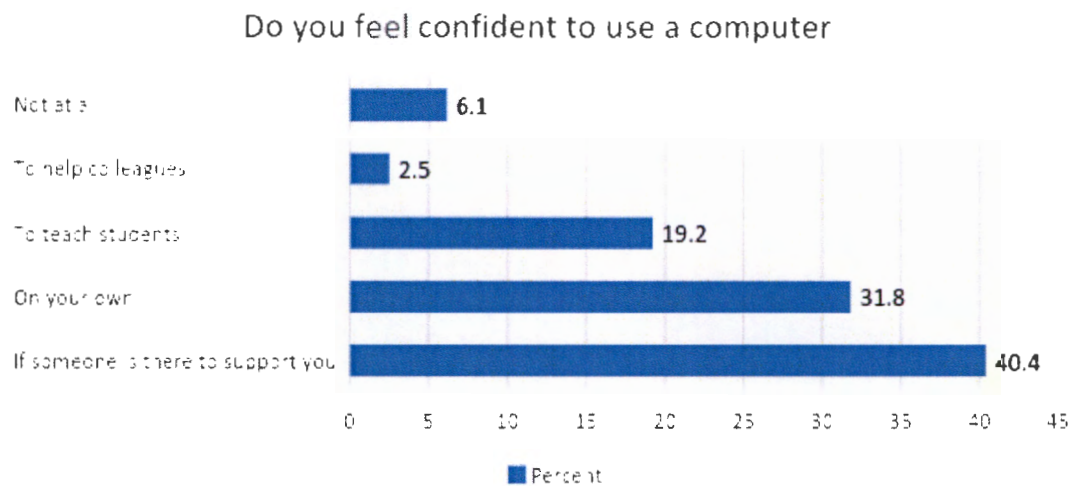


Figure 5.21: 5.3.21 Competency in computer usage

Figure 5.21 shows those with inadequate ICT skills as (19, 2%). Meanwhile, those with a confident skill level stood at 40, 4%.

5.3.22 ICT training

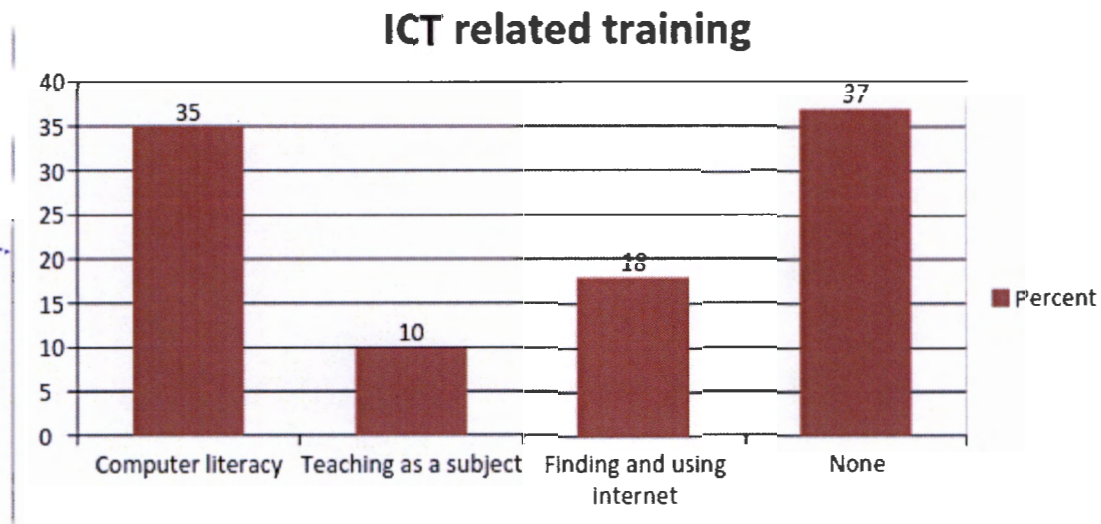


Figure 5.22: 5.3.22 ICT training

Teachers need training to understand how to teach in a different way. As seen in Figure 5.22 above computer literacy training is at 35% which is a bit low, giving reason as to why teaching ICT as a subject is at 10%.

5.3.23. Hours of ICT related training

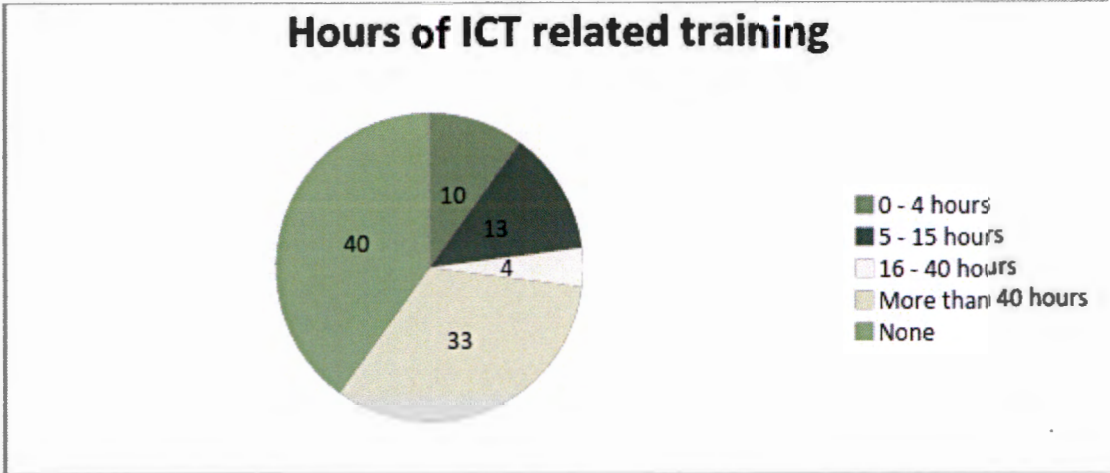


Figure 5.23: 5.3.23 Hours of ICT related training

Figure 5.23 above shows that 40% of the participants received no training at all, while 13% received (5 - 15 hours) of ICT training. 4% of the participants indicated that they received (16-40 hours) of ICT training, showing that there is a gap in relation to ICT training that needs some attention from applicable stakeholders.

5.3.24. Teacher competency

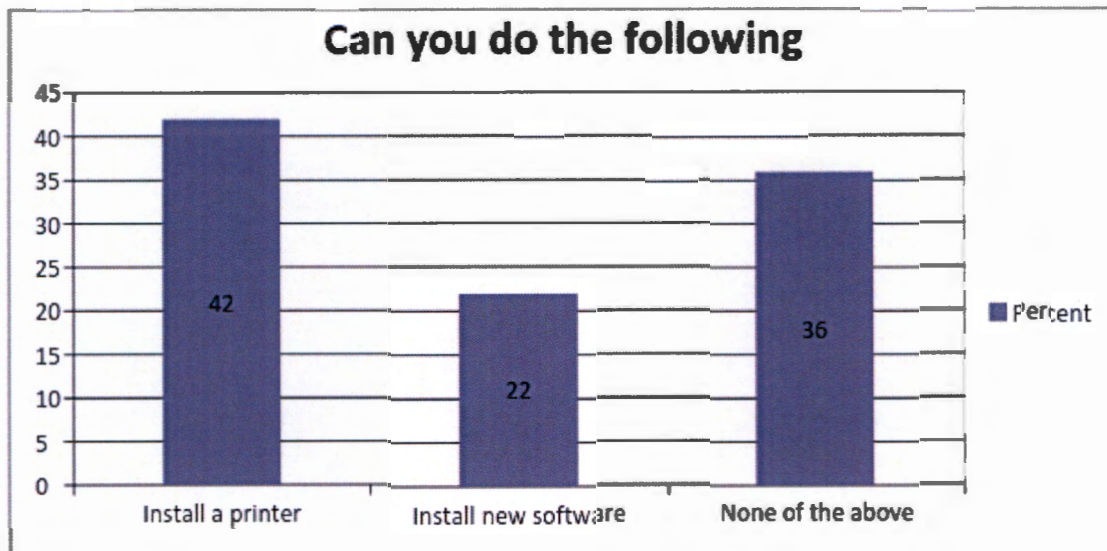


Figure 5.24: 5.3.24 Teacher competency

According to the Figure 5.24 above, only 42% of teachers are capable of installing a printer, while 22% has no knowledge of how to install new software and 36% do not have any computer skills.

5.3.25. ICT coordinator

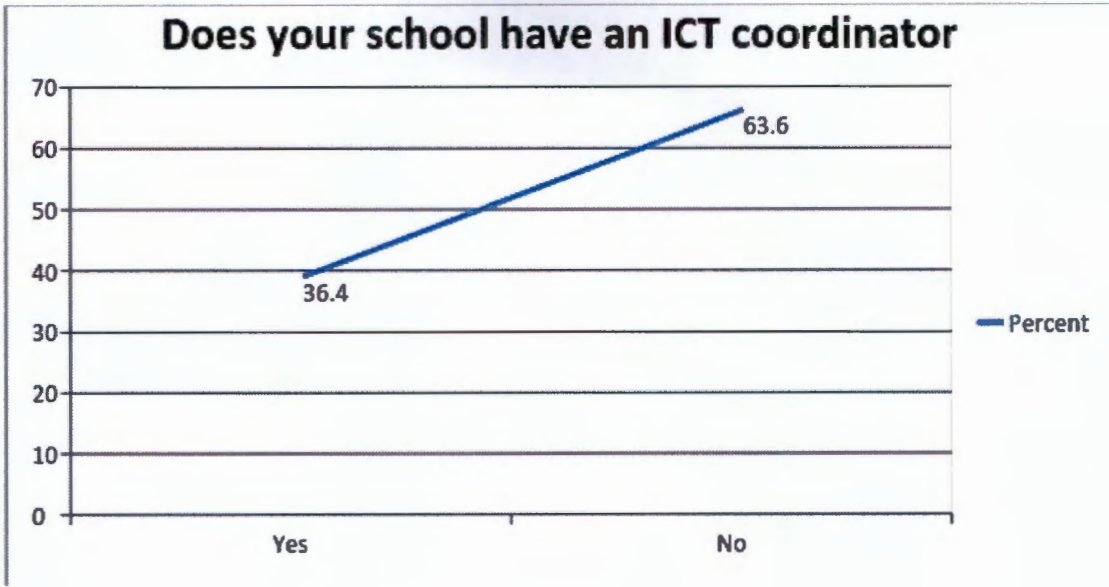


Figure 5.25: 5.3.25 ICT coordinator

From Figure 5.25 above it is clear that most schools do not have ICT coordinators (63, 6 %).

5.3.26. Availability of ICT coordinator

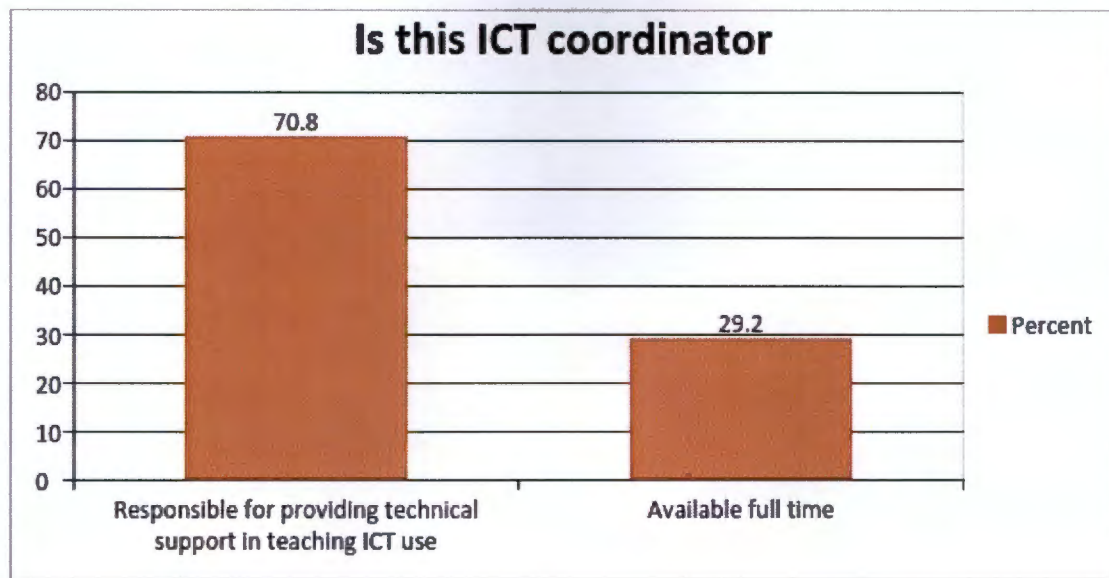


Figure 5.26: 5.3.26 Availability of ICT coordinator

Even though ICT coordinators are accountable for technical support as indicated in Figure 5.26 above, the technical support in almost all of the systems is insufficient having their availability to proffer proficiency limited (29,2%). Many teachers and technical staff do not have the requisite training.

5.3.27 ICT courses

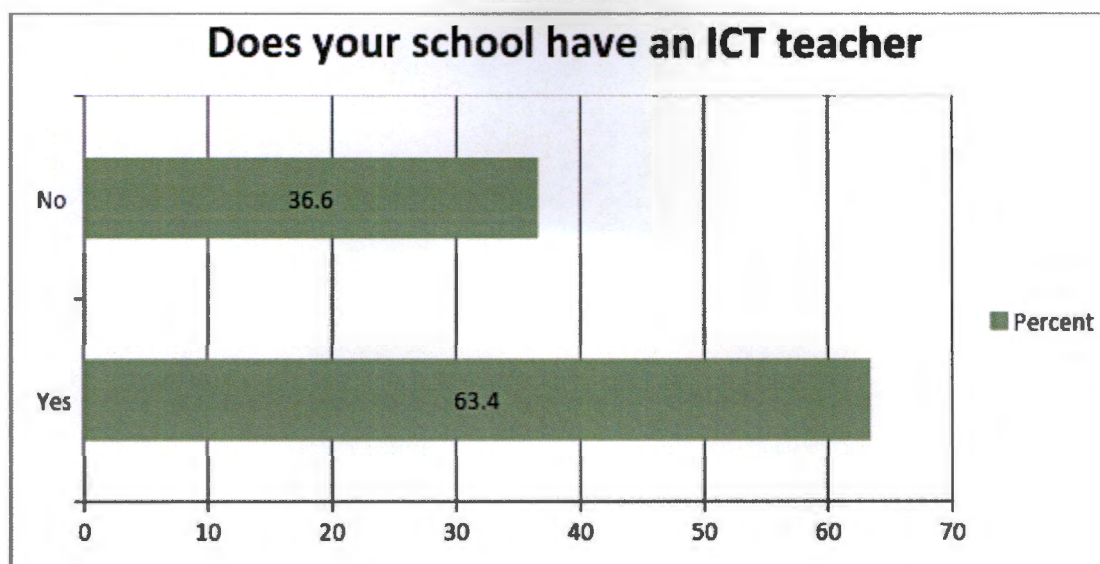


Figure 5.27: 5.3.27 ICT courses

According to Figure 5.27 above, the number of ICT specialists and teachers in most schools is pleasing (63, 4%) while organisational characteristics influence interrelated ICT professional development activities.

5.3.28 ICT use expectation in the classroom

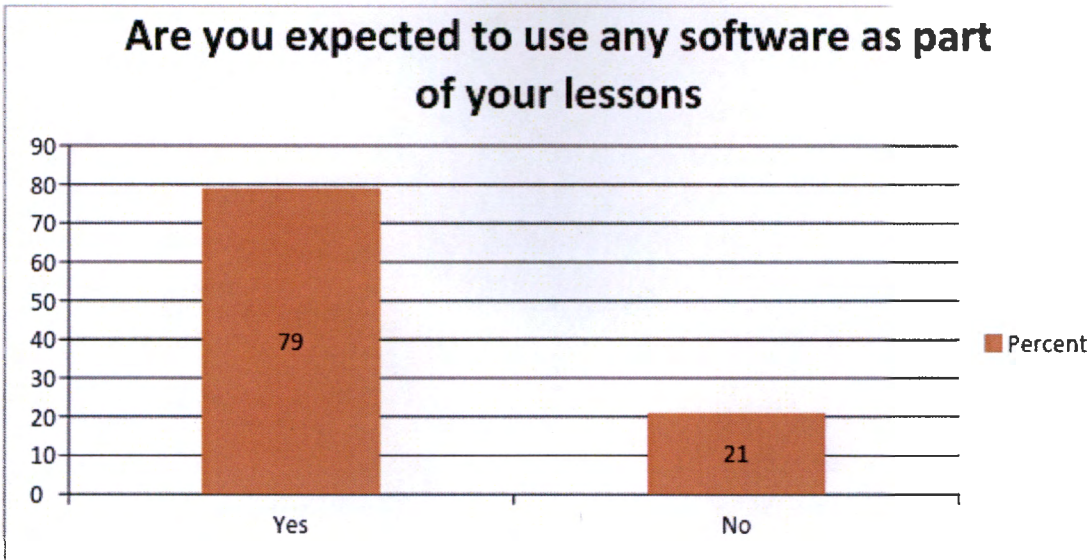


Figure 5.28: 5.3.28 ICT use expectation in the classroom

Figure 5.28 above demonstrates that though the expectation of the Department of Education for teachers to use computer software to facilitate teaching and learning is very high at (79%), the majority of teachers do not have the competency therefore need to upgrade their skills.

5.4 SUMMARY

Questionnaires were given to teachers then school heads were interviewed. The questionnaire and interview schedule interrogated participants on their classroom procedures. Participants needed 30 minutes to complete the questionnaires. The gender divide was 56, 5% female and 43, 5% male. The 27 questions investigated classroom practice and ICT use and with teachers' perspectives on both.

The respondent's views of ICT reflect that most teachers were over 35 years and unwilling or pessimistic attitudes ICT use, as most of them indicated that they never use ICT in their teaching.

The mixed methods approach was used in 2015 based on grounded theory (Strauss and Corbin, 1990). The quantitative data was collected and analysed using SPSS software programme (Version 16). The more negative conclusions are the teachers' incompetence in ICT use. The level of education of the supervisors, as well as absence of equipment and infrastructure. The schools selected had only 38% infrastructure in 2015, while sample schools had 12% computers in libraries and 16% elsewhere. The recommendations include provision of adequate technical support, raising the supervisors' skill level and providing mentor opportunities as well as ICT equipment access. The next section (chapter 6) deliberates on the summary, findings, recommendations and conclusion.

CHAPTER 6: SUMMARY, FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

The final chapter is a synthesis of the findings, recommendations and concluding remarks. It reviews the study of ICT use in the Ngaka Modiri Molema District schools of the North West Province of South Africa. Moreover, it recapitulates the main findings which comprise a succinct debate and offers proposals for additional research. As a conclusion to the study, this chapter presents the findings and makes recommendations for future research. A concluding summary looks at present and future ICT use in North West schools.

The literature review (chapter 2) was served to determine evidence evaluating of ICT use in the school system.

We discussed methodology earlier in chapter 3, such as the questionnaire utilised to collect data for this study. In chapter 5, the data collected was analysed and interpreted. From the data analysis it became clear that a good number of teachers who were 35 years and above are disinclined and have a negative attitude towards ICT use as most of them indicated that they never use ICT in their teaching.

6.2 REVIEW OF RESULTS

The findings were drawn from a detailed analysis of the collected data. The research questions guided the presentation's sequence.

6.2.1 Findings concerning the first research question

Research Question one: How have schools in the Ngaka Modiri Molema District adopted mobile tablets to support mobile learning in schools?

The findings of this research are illustrated in Figure 19, substantiate those reported in the literature by Pelgrum (2008), Gulati (2008) and Kamau (2012) to underline that ICT tools are important in the adoption of ICT for classroom use. Figure 19 illustrates that only 46, 2% of the sampled schools have been supplied with tablets.

Kamau (2012) affirms that, *“the training and increased investment in ICT facilities were crucial for the vital psychological and technical skill readiness of teachers”*. While Pelgrum (2008) recognises pedagogical challenges, Gulati (2008) sees as barriers thwarting and preventing the integration of ICT from taking place.

Even though the results show that resources abound, we concluded that teachers used conservative and traditional ICT tools in their classrooms rather than modern ICT equipment as illustrated on Figure 17 in chapter 5.

6.2.2 Findings concerning the second research question

Research Question two: How do teachers in the Ngaka Modiri Molema District use mobile tablets to improve teaching and learning?

Most respondents responded favourably to the items regarding attitude to ICT. Hence, a majority did not use ICT in the classroom because they lack the skills required. Figure 22 (in chapter 5 of this research) provides a summary illustrated that most teachers prefer conventional procedures to elicit passivity and not learner activity.

6.2.3 Findings concerning the third research question

Research Question three: What essential skills and resources should teachers have in order to put ICTs into service in their own classrooms?

Figure 30 indicates that, only 42% of teachers are capable of installing a printer, while 22% has no knowledge of how to install new software and 36% do not have any computer skills. Law et al. (2008) believe that although some teachers may have a positive view of computer use, many teachers feel they lack the skills to use ICT in their classrooms and seldom use ICTs in their classrooms as per Figure 23.

6.2.4 Findings concerning the fourth research question

Research Question four: Which standards did the Department of Education use to supply schools in Ngaka Modiri Molema with tablets for use in teaching and learning?

Interviews with school principals show that the Department of Education used purposive sampling to choose schools from quintiles 1-3 schools (less affluent communities) and quintile 4 schools (affluent communities) of the Ngaka Modiri Molema District. It was also being emphasized that teachers in the schools covered had insufficient access to the fundamentals of computer use but sufficient access to the resources.

6.3 CONTRIBUTION OF THIS STUDY

It is envisaged that this research hopefully, may assist the Department of Education in identifying existing knowledge gaps and training needs for teachers. The research could further be used as monitoring instrument to confirm the impact of ICT use in classrooms by the affected schools in the Ngaka Modiri Molema and the Department of Education.

Future training and developmental workshops may radiate from this study if the authorities use findings to direct an implementation plan according to in-service targets.

Theoretically, this study might largely add to the academic understanding of importance of certain concepts for e-skills policy-making by national key stakeholders (South African Ministry of Basic Education) derived from the appropriate literature but also of those identified empirically by this research. Now, this study can be used for a practical carrying out and also as a foundation for further academic researchers within and outside South Africa.

6.4 LIMITATIONS OF THIS STUDY

It is fitting to concede some limitations of this study. The fact that the interview sample consisted of 4 interviewees being the principals of the sampled schools does not limit the validity of this study. However, some pin down shows in the detail that 3 of the interviewees have fully participated in answering questions while one of them was not actually comfortable with questions regarding ICT implementation in their school. This unfamiliarity with the ICT implementation, however, did not prevent them from giving an important contribution to the validity of the elements of the anticipated framework.

Due to the smallness of the sample size, the findings cannot be generalised given that the study is restricted to a small number of teachers. On the other hand, it has provided an insight into research indicating factors that encourage teachers to use technology. A more wide-ranging sample is needed for generalizability. Perhaps a fascinating longitudinal study to establish factors that motivate teachers to acquire the requisite ICT use in schools.

Nonetheless, these limitations are not seen as flaws that might endanger the legitimacy of this study and its results. For this reason, this study is presented here with all its strengths and limitations.

6.5 SUMMARY

An expert teacher possesses classroom competence beyond ICT use. An able teacher commands competency in technology use to create innovative pathways towards learning. Involving teachers in identifying and developing ICT based learning resources would be relevant and effective in the long run. A combined exercise with educationalists and technology providers may result in positive measures to overcome the challenges of today (Gliksman, 2011).

The results also showed that most schools lack teachers with computer competence. Respondents gave views such as the lack of expert staff with expertise, an unwillingness to use ICT tools because it might upset the curriculum and unwillingness to explore new pedagogical possibilities.

Many teachers resent classroom ICT use mainly because they think they are sufficiently experienced and have enough teaching expertise. Thus, it tends to be teachers with some computer skills who situation employ ICT. More, the time restrictions cited can be resolved by advanced planning.

However, in many circumstances, non-technology confident school managers often see mobile phones as having an offensive influence, as a preponderance of them stated when they were interviewed. However, the researcher believes that these negative factors should not deter teachers from ICT use for a good cause.

6.6 CONCLUSION

White Paper 2 (E-learning) operates within the research area entailing that the education authorities will make ICT compulsory across the curriculum. Hence, implementation should emphasise integration and not the development of technical skills but civil servants appear be more concerned with integration than skills development.

The study as a whole brings to a close the wake-up call for the recognition of the benefits of ICT use. Mabe and West (1982) believed that another approach would fail to determine competent ICT use.

Teachers' attitudes are essential elements for new approaches to classroom work and teachers with the wrong approach will fail to bring about effective classroom change. Professional attitude is thus vital to effecting positive change in classrooms at any level.

Several findings from other studies show teachers' inability to identify the specifics of their knowledge weaknesses. The results of this study underscore and noticeably accentuate the need to position ICT use across the school system. These outcomes highlight the collective visualization of ICT in education culture.

6.7 RECOMMENDATIONS

Both the primary and secondary education system need to support evocative continuing teacher programmes that give power to principals and teachers. They should emphasise teacher performance to bring about improvements in the classroom. Teachers should appreciate that classroom competency goes beyond traditional methods, especially for teachers who do not value computer use for education.

Fortunately, many, projects exist which the Department of Education can employ to attend to the issues described below (DoE, 2007):

Capacity development for teachers to have consciousness in effective computer use linked to teaching-learning process.

Researchers, teachers, and policy makers should take these findings into contemplation to understand what type of ICT science teachers use the most in classrooms. This means that schools as organisations should play a key role to develop teacher's ICT aptitude and use educational technology to improve classroom practice.

Furthermore, teacher ICT competence should concentrate on competence and eagerness to use ICT in an undeviating and reliable manner. The use of ICT has turned out to be necessary for schools to perk up their teaching skills. It is an essential prerequisite for schools to help develop teachers' instructional skills of integrating technology for teaching efficacy. More pedagogical changes in instruction should involve teachers who will implement such changes.

Technology can serve as a supplementary device to provide bidirectional connections and interactions within classroom practice (Chou, 2003; Jang, 2009, 2010; Wang, 2008). Teachers' instructional practices can be influenced by teachers' ICT skills (Da Ponte, Oliveira, and Varandas, 2002).

REFERENCES

- ABBOTT, J. A., & FARIS, S. E. (2000). Integrating technology into pre-service literacy instructions a survey of elementary education students' attitudes toward computers. *Journal of research on computing in education*, 33(2), 149-161.
- ADAMS, N.B. (2013). Educational computing concerns of postsecondary faculty. *Research on Technology in Education*, vol. 34, no. 3, pp. 285-303.
- AFSHARI, M., BAKAR, K. A., SULUAN, W., SAMAH, B. A., & SAY, F. (2009). Factors affecting teachers' use of information and communication technology. *International Journal of Instruction*, 2, 77-104.
- AL-AZAWEI, A., PARSLOW, P., & LUNDQVIST, K. (2017). Investigating the effect of learning styles in a blended e-learning system: An extension of the technology acceptance model (TAM). *Australasian Journal of Educational Technology*, 33(2)
- ALLAN H.K. YUEN NANCY LAW K.C. WONG, (2003), "ICT implementation and school leadership", *Journal of Educational Administration*, Vol. 41 Iss2. BABBIE, E., & MOUTON, J. (2001). *The practice of social science research*. Belmont, CA: Wadsworth.
- ALNAHDI, G. (2014). Assistive technology in special education and the universal design for learning. *TOJET: The Turkish Online Journal of Educational Technology*, 13(2).
- ALJUKHADAR, M., SENECA, S., & NANTEL, J. (2014). Is more always better? Investigating the task-technology fit theory in an online user context. *Information & Management*, 51(4), 391-397.
- AMUTABI, M. N. (2004). Prospects and dilemmas of information and communication technology (ICT) in university education in Africa: The case of Kenya. Paper presented at the United Nations Educational, Scientific and Cultural Organization (UNESCO) Forum for Higher Education, Research and Knowledge: Colloquium on Research and Higher Education Policy, conference on "Knowledge,
- ARCHAMBAULT, L. M., & BARNETT, J. H. (2010). Revisiting technological

pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education*, 55(4), 1656-1662.

BABBIE, E. R., & HALLEY, F. (1995). *Adventures in Social Research: Data Analysis Using SPSS for Windows/Book and Disk*. Pine Forge Press.

BABBIE, E., & MOUTON, J. (2001). *The practice of social science research*. Belmont, CA: Wadsworth.

BABBIE, E., & MOUTON, J. (2009). *The principle of social research*. Cape Town.

BACK, S. (2012). *Ways of learning to teach. A philosophically inspired analysis of teacher education programs*. Rotterdam: Sense publishers

BAEK, Y.G., JONG, J., & KIM, B. (2008). What makes teachers use of technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample. *Computers and Education*, vol.50, no. 8, pp. 224-234.

BARAK, M. (2006). Instructional principles for fostering learning with ICT: teachers' perspectives as learners and instructors. *Education Information Technology*, 11:121-135, DOI 10.1007/s11134-006-7362-9.

BARAK, M., BEN-CHAIM, D., & ZOLLER, U. (2007). Purposely teaching for the promotion of higher-order thinking skills: A case of critical thinking. *Research in Science Education*, 37(4), 353-369.

BARAN, E., CHUANG, H. H., & THOMPSON, A. (2011). TPACK: An emerging research and development tool for teacher teachers. *The Turkish Online Journal of Educational Technology*, 10(4), 370-377.

BEAUDIN, L., & HADDEN, C. (2005). Technology and pedagogy: Building technopedagogical skills in preservice teachers. *Innovate*, 2(2). Retrieved May 9, 2014 from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.115.8647&rep=rep1&type=pdf>

BECTA. (2003). What the Research says about using ICT in Maths. *British Educational Communications and Technology Agency*. Available from http://www.becta.org.uk/page_documents/research/wtrs_maths.pdf

BECTA. (2004). A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers. *British Educational Communications and Technology Agency*. Available from http://www.becta.org.uk/page_documents/research/barriers.pdf

BECTA. (2006). What the Research says about Network Technologies in Teaching and Learning.

BEUKES-AMISS, C.M. & CHIWARE, E.R.T. (2006). The impact of diffusion of ICTs into educational practices, how good or how bad? A review of the Namibia situation. Available at: <http://www.dspace.unam.na:8443/dspace/bitstream/1995/244/impact+diffusionICTedu.pdf>

BIRCH, D., & SANKEY, M. D. (2008). Drivers for and obstacles to the development of interactive multimodal technology-mediated distance higher education courses. *International Journal of Education and Development Using ICT*, 4(1). Retrieved April 1, 2011 from <http://ijedict.dec.uwi.edu/viewarticle.php?id=375&layout=html>

BLACK, G., & SMITH, K. (2009). Hot topic: ICT in pre-service teacher training strategic ICT advisory service, Australian Government's Department of Education, Employment and Workplace Relations. Retrieved March 31, 2014 from http://dspace.edna.edu.au/dspace/bitstream/2150/54714/1/SICTAS_HT_pre-service.pdf

BLANKENSHIP, S. E. (1998). Factors related to computer use by teachers in the classroom instruction. Unpublished doctoral dissertation. Virginia Polytechnic Institute and State University, AAT 9831651.

BLAXTER, L., HUGHES, C., & TIGHT, M. (2010). *How to Research*: Maidenhead.

BLESS, C., & HIGSON-SMITH, C. (2000). *Fundamentals of social science research: an African perspective*. Juta.

BUABENG-ANDOH, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology*, 8(1), 136.

BORDBAR, F. (2010). English teachers' attitudes toward computer-assisted language

learning. *International Journal of Language Studies*, vol. 4, no. 3, pp. 27-54

BURTON, N., & BRUNDRETT, M. JONES.M. (2008). Doing your education research project.

BURNS, N., & GROVE, S. K. (2008). The practice of nursing research: Appraisal, synthesis, and generation of evidence. Saunders

BREISSER, S. R. (2006). An examination of gender differences in elementary constructionist classrooms using Lego/Logo instruction. *Computers in the Schools*, vol. 22, pp.7-19.

BRYMAN, A. (2001). Social Research Methods. Oxford, UK: Oxford University Press.

BRADLEY, G., & RUSSELL, G. (1997). Computer experience, school support and computer anxieties. *Educational Psychology*, 17(3), 267-284.

BRANSFORD, J. D., DARLING-HAMMOND, L., & LAPAGE, P. (2005). Introduction. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 358-389). San Francisco: Jossey-Bass.

BRAMALD, R., MILLER, J. & HIGGINS, S. (2000). ICT, Mathematics and effective teaching. *Mathematics Education Review*, 12: 1-6, July 2000.

BRYNARD, P., & HANEKOM, S. X. (1997). Introduction to research in Public Administration and related academic disciplines. JL van Schaik Academic.

BRYNARD, P., & HANEKOM, S. X. (2006). Introduction to research in management-related fields. Van Schaik.

BRZYCKI, D., & DUDT, K. (2005). Overcoming barriers to technology use in teacher preparation programs. *Journal of Technology and Teacher Education*, 13(4), 619-641.

CAMPBELL, D. T., AND FISKE, D. W. (1959). Convergent and discriminant validation by the mixed trait-mixed method matrix. *Psychological Bulletin* 56: 81-105.

CASTAÑO-MUÑOZ, J., DUART, J. M., & SANCHO-VINUESA, T. (2014). The Internet in face-to-face higher education: Can interactive learning improve academic

achievement? *British Journal of Educational Technology*, 45(1), 149-159.

CASSIM, V. (2010). The pedagogical use of ICTs for teaching and learning within grade eight mathematics in South African schools/V. Cassim (Doctoral dissertation, North-West University).

CASSIM, K. M., & OBONO, S. E. (2011). On the factors affecting the adoption of ICT for the teaching of word problems. In *Proceedings of the World Congress on Engineering and Computer Science* (Vol. 1, pp. 19-21).

CHIO, Y. K. (1992). Attitudes toward and knowledge of microcomputers used for instruction among commercial high school teachers in Korea. Unpublished EDD dissertation. University of Georgia. AAT 9316322.

CHOU, C. (2003). Interactivity and interactive functions in Web-based learning systems: A technical framework for designers. *British Journal of Educational Technology*, 34, 265-279.

CHIN, S. S. F., & HORTIN, J. A. (1993). Teachers' perceptions of instructional technology and staff development. *Journal of educational technology systems*, 22(2), 83-98.

CHUTTUR, M. Y. (2009). Overview of the technology acceptance model: Origins, developments and future directions. *Working Papers on Information Systems*, 9(37), 9-37.

CLARK, R. E. (1994). Media will never influence learning. *Educational Technology, Research and Development*, 42(2), 21-29.

COCHRAN-SMITH, M. (2005). Teacher teachers as researchers: Multiple perspectives. *Teaching and Teacher Education*, 21, 219-225.

COHEN, L. M., & MANION, L. L. & MORRISON, K. (2007). *Research methods in education*, 6.

COHEN G., SALOMON I. & NIJKAMP P. (2002). Information Communications Technologies (ICT) and transport: does knowledge underpin policy? *Telecommunications Policy* Volume 26, Issues 1-2, February-March 2002.

- COX, M., COX, K., & PRESTON, C. (2000). What motivates teachers to use ICT?
- CRESWELL, J. W. (1995). *Research Design: Quantitative and Qualitative Approaches*. Thousand Oaks, CA: Sage.
- CRESWELL, J.W. & CLARK, V.L (2007). *Designing and conducting mixed Methods Research*. SAGE Publication. London.
- CZERNIEWICZ, L., & BROWN, C. (2007). Disciplinary differences in the use of educational technology. In *International Conference of E-Learning*.
- DA PONTE, J. P., OLIVEIRA, H., & VARANDAS, J. M. (2002). Development of pre-service mathematics teachers' professional knowledge and identity in working with information and communication technology. *Journal of Mathematics Teacher Education*, 5, 93-115.
- DAVIS, F. D., & VENKATESH, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: Three experiments. *International Journal of Human-Computer Studies*, 45(1), 19-45.
- DEACON, D., BRYMAN, A., AND FENTON, N. (1998). Collision or collusion? A discussion of the unplanned triangulation of quantitative and qualitative research methods. *International Journal of Social Research Methodology*
- DENSCOMBE, M. (2003). *The good research guide: for small scale social projects*. Maidenhead, PA: Open University.
- DEPARTMENT FOR EDUCATION AND SKILLS (2002). *Qualifying to teach*. Professional Standards for Qualified Teacher Status and Requirements for Initial Teacher Training. C.A.: Allyn & Bacon.
- DE VOS, A. S. (1998). *Research at grass roots*. Pretoria: Van Schaik.
- DE VOS, A. S. (Ed.). (2002). *Research at grass roots: For the social sciences and human services professions*. Pretoria: van Schaik.
- DE VOS, A. S., DELPORT, C. S. L., FOUCHE, C. B., & STRYDOM, H. (2011). *Research at grass roots: A primer for the social science and human professions*.

- DEY, I. (2003). *Qualitative data analysis: A user friendly guide for social scientists*. London. Routledge.
- DISHAW, M. T., & STRONG, D. M. (1999). Extending the technology acceptance model with task-technology fit constructs. *Information & Management*, 36(1), 9-21.
- DLAMINI, R., & NA'ALLAH, D. M. (2015). Beyond Policies and Programs: Contextualizing ICT Integration in South African Schools. In *SOUTH AFRICA INTERNATIONAL CONFERENCE ON EDUCATIONAL TECHNOLOGIES* (p. 162).
- DOE (2007). *Guidelines for Teacher Training and Professional Development in ICT*
- DOE (2004). *White Paper on e-Education*. Notice 1869 of 2004, published 23rd on page 3 of government Gazette No.236734 of 26 August 2004.
- DUPAGNE, M., & KRENDL, K. A. (1992). Teachers' Attitudes toward Computers: A Review of the Literature. *Journal of Research on Computing in Education*, 24(3), 420-29.
- ERTMER, P. A., PAUL, A., MOLLY, L., EVA, R., & DENISE, W. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom. *Journal of research on Computing in Education*, 32(1), 54-72.
- ERTMER, P. A., & OTTENBREIT-LEFTWICH, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42(3), 255-284
- FOLEY, P., ALFONSO, X. & GHANI, S. (2002). *The digital divide in a world city*, London: Greater London Authority
- FOWLER, C. J. H., & MAYES, J. T. (1999). Learning relationships: From theory to design. *Association for Learning Technology Journal*, 7(3), 6-16.
- FULLAN, M. (2013). *The new pedagogy: Students and teachers as learning partners*. Accessed Feb. 4, 2014 from <http://www.learninglandscapes.ca/images/documents/ll-no12/fullan.pdf>
- GATWIRI, B. D. (2013). *ICT Adoption Framework in Rural Secondary Schools: Case of Meru, Kenya* (Doctoral dissertation, Strathmore University).

GODDARD, W., & MELVILLE, S. (2004). Research methodology: An introduction. Juta and Company Ltd.

GOLDKUHL, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems*, 21(2), 135-146.

GOMEZ, L. M., SHERIN, M. G., GRIESDORN, J., & FINN, L. (2008). Creating social relationships: The role of technology in pre-service teacher preparation. *Journal of Teacher Education*, 59(2), 117-131.

GOKTAS, Y., YILDIRIM, S., & YILDIRIM, Z. (2009). Main barriers and possible enablers of ICTs integration into pre-service teacher education Programs. *Educational Technology & Society*, 12(1), 193-204.

GROUNDAR, S. (2011). What is the potential impact of using mobile devices in education. In *Proceedings of SIG GlobDev Fourth Annual Workshop*.

GRANGER, C.A., MORBEY, M.L., LOTHERINGTON, H., OWSTON, R.D. & WIDERMANN, H.H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*, 18(1): 480-488, 14 May 2002.

GUHA, S. (2000). Are we all technically prepared? Teachers' perspectives on the causes of comfort or discomfort in using computers at elementary grade teaching, Annual Meeting of the National Association for the Education of Young Children Atlanta, GA, November 8-11, 2000. Available From http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/19/2b/0c.pdf

GUPTA, B., DASGUPTA, S., & GUPTA, A. (2008). Adoption of ICT in a government organization in a developing country: An empirical study. *The Journal of Strategic Information Systems*, 17(2), 140-154.

GORDER, L. M. (2008). A study of teacher perceptions of instructional technology integration in the classroom. *Delta Pi Epsilon Journal*, vol. 50, no. 2, pp. 63-76.

HAKKARAINEN, K., MUUKONEN, H., LIPPONENI, L., ILOMAKI, L., RAHIKAINEN, M., & LEHTINEN, E. (2001). Teachers' information and communication technology

(ICT) skills and practices of using ICT. *Journal of Technology and Teacher Education*, 9(2), 181-197.

HARDY, M. (2010). Enhancing pre-service mathematics teachers' TPCK. *Journal of Computers in Mathematics and Science Teaching*, 29(1), 73-86.

HARRIS, J., & HOFER, M. (2009). Instructional planning activity types as vehicles for curriculum-based TPACK development. In C. D. Maddux. (Ed.), *Research highlights in technology and teacher education* (pp. 99-108). Chesapeake, VA: Society for Information Technology.

HAY, I. (2017). Qualitative Data. *The International Encyclopaedia of Geography*.

HECHTER, R. P. (2012). Pre-service teachers' maturing perceptions of a TPACK-framed signature pedagogy in science education. *Computers in the Schools*, 29(1-2), 53-69.

HENNESSY, S., HARRISON, D., WAMAKOTE, L. (2010). Teacher Factors Influencing Classroom use of ICT in sub-Saharan Africa. *Itupale Online Journal of African Studies* (2) pp. 39-54.

HODGKINSON-WILLIAMS, C. (2005). Understanding ICT integration in South African classrooms: research: information and communication technologies. *Perspectives in Education: Research on ICTs and Education in South Africa: Special Issue 4*, 23.

HODGKINSON-WILLIAMS, C., SIEBORGER, I., & TERZOLI, A. (2007). Enabling and constraining ICT practice in secondary schools: case studies in South Africa. *International Journal of knowledge and Learning*, 3(2-3), 171-190.

HUYER, S. (2005). Women, ICT and the information society: Global perspectives and initiatives. In *Proceedings of the international symposium on Women and ICT: creating global transformation* (p. 1). ACM.

HUYSAMEN, G. K. (1993). *Methodology for the social and behavioural sciences*. Southern Book Publishers.

INAN, F. A., LOWTHER, D. L., ROSS, S., STRAHL, J. D. (2010). Pattern of classroom activities during students use of computers: Relations between instructional strategies

and computer applications. *Teaching and Teacher Education*, 26(3), 540-546.

ISTE [International Society for Technology in Education] (2008). National educational technology standards. Retrieved April 2, 2014 from <http://www.iste.org/standards/standards-for-teachers/nets-for-teachers-2008>

JAFFER, S., NG'AMBI, D., & CZERNIEWICZ, L. (2007). The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. *International journal of Education and Development using ICT*, 3(4).

JAMIESON-PROCTOR, R. M., BURNETT, P. C., FINGER, G., & WATSON, G. (2006). ICT integration and teachers' confidence in using ICT for teaching and learning in Queensland state schools. *Australasian Journal of Educational Technology*, vol, 22, no. 4, pp. 511-530

JANG, S. J. (2009). Exploration of secondary students' creativity by integrating Web-based technology into an innovative science curriculum. *Computers & Education*, 52(1), 247-255.

JANG, S. J. (2010). Integrating the interactive whiteboard and peer coaching to develop the TPACK of secondary science teachers. *Computers & Education*, 55(4), 1744-1751.

JANG, S. J. (2012). Developing a technology-team teaching model to enhance the TPACK of pre-service science teachers. In: S. Abramovich (Ed.), *Computers in education* (pp. 71-90). New York, N.Y.: Nova Science Publishers, Inc.

JANG, S. J., & TSAI, M. F. (2012). Exploring the TPACK of Taiwanese elementary mathematics and science teachers with respect to use of interactive whiteboards. *Computers & Education*, 59(2), 327-338.

JANTJIES, M., & JOY, M. (2015). Mobile Enhanced Learning in a South African Context. *Educational Technology & Society*, 18(1), 308-320.

JONES, A. (2004). A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers. *British Educational Communications and Technology Agency*. Retrieved May 20, 2010 from <http://www.becta.org.uk>.

JONES, C., ZENIOS, M., & GRIFFITHS, J. (2004). Academic use of digital resources: Disciplinary differences and the issue of progression. In *Networked Learning 2004 Conference* (p. 8).

KAY, R. H. (2006). Evaluating strategies used to incorporate technology into pre-service education: A review of the literature. *Journal of Research on Technology in Education*, 38(4), 383-408.

KAMAU, G. K. (2012). Constraints in the use of ICT in teaching-learning processes in secondary schools in Nyandarua South District, Nyandarua County, Kenya. Master's thesis, Kenyatta University, Nairobi. Retrieved from <http://ir.library.ku.ac.ke/bitstream/handle/123456789/5285/Kamau%20George%20Kamau.pdf?sequence=3>

KANDASAMY, M., & SHAH, P. B. M. (2013). Knowledge, attitude and use of ICT among ESL teachers. *Proceedings of the Global Summit on Education*. Available at http://worldconferences.net/proceedings/gse2013/papers_gse2013/247%20Moganashwari%20Kandasamy-Parilah%20Bt%20Hj.%20Mohd%20Shah.pdf914-930. Retrieved on February, 10, 2014.

KHAN, S. (2011). New pedagogies on teaching science with computer simulations. *Journal of Science Education and Technology*, 20(3), 215-232.

KOEHLER, M. J., & MISHRA, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, 32(2), 131-152.

KORTE, W.B., & HUSING, T. (2007). Benchmarking access and use of ICT in European schools 2006: Results from Head teacher and a classroom surveys in 27 European countries, *eLearning papers*, vol. 29, no. 10, pp. 1-6.

KOZMA, R. B. (2003). ICT and educational change. In R. B. Kozma (Ed.), *Technology, innovation, and educational change: A global perspective* (pp. 1-18). Eugene, OR: ISTE.

LAU, B. T., & SIM, C. H. (2008). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT*

research, 2(2), 19-36.

LAUDON, K. C. AND LAUDON, J. P. (2006). *Essentials of Business Information Systems*. (Ed) New Jersey: Prentice Hall

LEE, H., & HOLLEBRANDS, K. (2008). Preparing to teach mathematics with technology: An integrated approach to developing technological pedagogical content knowledge. *Contemporary Issues in Technology and Teacher Education*, 8(4),

326-341

LEE, M. H., & TSAI, C. C. (2010). Exploring teachers' perceived self-efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web. *Instructional Science*, 38, 1-21.

Leung, L., & Zhang, R. (2017). Mapping ICT use at home and telecommuting practices: A perspective from work/family border theory. *Telematics and Informatics*, 34(1), 385-396.

LIM, C.P. (2006). Effective Integration of ICT in Singapore Schools: pedagogical and policy indicators. *Springer*, 55: 83-116, 8 December 2006.

LIM, C.P. & KHINE, M.S. (2006). Managing Teachers' Barriers to ICT integration in Singapore Schools. *Journal of Technology and Teacher Education*, 14(1): 91-125

LIM, C. P. (2007). Effective integration of ICT in Singapore schools: Pedagogical and policy implications. *Educational Technology Research and Development*, 55(1), 83-116.

LEWIS-BECK, M., BRYMAN, A. E., & LIAO, T. F. (2003). *The Sage encyclopaedia of social science research methods*. Sage Publications.

LOHR, M. (2014) EBooks as pdf files, in Epub format or as interactive ibooks? Digital books in physics lessons of secondary education. *MOBILE LEARNING*, 11

LOOK, D. (2005). Discussion Paper: Impact of Technology on Education, PUSD Excellence Committee, December 2005. Available from <http://pleasanton.k12.ca.us/Superintendent/Downloads/Technology.pdf>

LOVELESS, A., & DORE, B. (2002). ICT in the primary curriculum. CT in the primary school, 3-22.

MACHADO, R (1999). The Foundations of Business. Juta & Co. Ltd. Kenwyn.

MACHARIA, J. K., & PELSER, T. G. (2012). Key factors that influence the diffusion and infusion of information and communication technologies in Kenyan higher education. *Studies in Higher Education*, 39(4), 695–709.

MALEK, JALALUDDIN, A. et al. (2012) From agricultural society to digital inclusion Society: a case study of Felda Community, WSEAS Transactions on Information Science and Applications, Issue 4, Vol. 9, April 2012

MALTZ, L., & DEBLOIS, P. B. (2005). Current IT issues. *EDUCAUSE Review*, 40(3), 14–29

MARRS, K. A., & NOVAK, G. (2004). Just-in-time teaching in biology: creating an active learner classroom using the internet. *Cell Biology Education*, 3(1), 49-61.

MARKAUSKAITE, L. (2006). Gender issues in preservice teachers' training: ICT literacy and online learning. *Australasian Journal of Educational Technology*, vol. 22, no. 1, pp. 1-20.

MASSOUD, S. L. (1991). Computer attitudes and computer knowledge of adult students. *Journal of Educational Computing Research*, 7(3), 269-291.

MAXWELL, J. A., & MITTAPALLI, K. (2008). Explanatory research. The SAGE encyclopaedia of qualitative research methods, 324-326.

MCMILLAN, J. H., & SCHUMACHER, S. (2014). *Research in education: Evidence-based inquiry*. Pearson Higher Ed.

MCGRATH, J., KARABAS, G., & WILLIS, J. (2011). From TPACK concept to TPACK practice: An analysis of the suitability and usefulness of the concept as a guide in the real world of teacher development. *International Journal of Technology in Teaching and Learning*, 7(1), 1-23.

MENESES, J., FÀBREGUES, S., RODRÍGUEZ-GÓMES, D., & ION, G. (2012).

Internet in teachers' professional practice outside the classroom: examining supportive and management uses in primary and secondary schools. *Computers & Education*, 59, 915–924.

MISHRA, P., & KOEHLER, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record*, 108(6), 1017-1054.

MITCHELL, E. (2005). Towards a framework for benchmarking ICT practice, competence and performance in small firms. *Performance Measurement and Metrics*, 6(1), 39-52.

MOSER, Z. F. (2007). Faculty adoption of educational technology. *Educause Quarterly*, 30(1), 66-69. Retrieved April 1, 2014 from <http://www.alexandria.unisg.ch/publications/34660>

MOSTERT, J., & NTHETHA, M. (2008). Information and Communication Technologies (ICTs) in secondary educational institutions in the uMhlathuze municipality, South Africa: an insight into their utilisation, impact, and the challenges faced. *South African Journal of Libraries and Information Science*, 74(68).

NATIONAL RESEARCH COUNCIL. (1996). Nutrient requirements of beef cattle (7th ed.). Washington, DC: National Academy Press.

NCHUNGE, D. M., SAKWA, M., & MWANGI, W. (2012). Users perception on ICT adoption for education support in schools: A survey of secondary school teachers in Thika district kenya. *International Journal of Humanities and Social Science*, 2(10), 17-29.

NDLOVU, N. S., & LAWRENCE, D. (2012). The quality of ICT use in South African classrooms. *Towards Carnegie III (Cape Town, 2012)*.

NEWHOUSE, C. P., & CLARKSON, B. D. (2008). Using learning environment attributes to evaluate the impact of ICT on learning in schools. *Research and Practice in Technology Enhanced Learning*, 3(2), 139-158.

NGOLOLO, E. N., HOWIE, S. J., & PLOMP, T. (2012). An evaluation of the implementation of the national ICT policy for education in Namibian rural science

classrooms. *African Journal of Research in Mathematics, Science and Technology Education*, 16(1), 4–17.

NIEDERHAUSER, D.S. & STODDART, T. (2001). Teachers' instructional perspectives and use of educational software. *Teaching and teacher education*, vol. 17, pp.15-integtion

NJOROGE, R., & KIBARU, F. (2012). Implementing quality e-learning: Which way for education institutions in Kenya? *World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 1, 1707–1712.

NORRIS, C., T., SULLIVAN, J., POIROT., & SOLOWAY, E. (2003). No access, no use, no impact: Snapshot surveys of educational technology in K-12, *Journal of Research on Technology in Education*, vol. 36, no. 1, pp. 15-27

NOVAK, G. M., PATTERSON, E. T., GAVRIN, A. D., CHRISTIAN, W., & FORINASH, K. (1999). Just-in-time teaching. *American Journal of Physics*, 67(10), 937-938.

OECD [Organisation for Economic Co-operation and Development]. (2010). Inspired by technology, driven by pedagogy: A systemic approach to technology-based school innovations. Retrieved April 2, 2014, from <http://www.oecdbookshop.org/oecd/display.asp?sf1=identifiers&st1=9789264094789>

OPIE, C. (2004). *Doing educational research*. Sage.

OPIE, C. (2009). *Doing educational research*. Sage.

ORLANDO, J. (2009). Understanding changes in teachers' ICT practices: A longitudinal perspective. *Technology, Pedagogy and Education*, 18(1), 33-44.

PELGRUM, W. J., & PLOMP, T. (Eds.). (2008). *Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study* (Vol. 23). Springer Science & Business Media.

PERALTA, H., COSTA, F.A. (2007). Teachers' competence and confidence regarding the use of ICT. *Educational Sciences Journal*, vol. 3, pp. 75-84

POSTHOLM, M. B. (2006). The teacher's role when pupils work on task using ICT in project work. *Educational Research*, 48(2), 155-175.

REDWOOD, J., THELNING, S., ELMUALIM, A., & PULLEN, S. (2017). The proliferation of ICT and digital technology systems and their influence on the dynamic capabilities of construction firms.

REYNOLDS, L., INGRAM, J. & HAMMOND, M., (2011). How and why do student teachers use ICT? *Journal of Computer assisted learning*, 27(3), 191-203.

RODRIGUES, S., MARKS, A., & STEEL, P. (2003). Developing science and ICT pedagogical content knowledge: A model of continuing professional development. *Innovations in Education and Teaching International*, 40, 386-394.

ROSEN, L. D., & WEIL, M. M. (1995). Computer availability, computer experience and technophobia among public school teachers. *Computers in human behaviour*, 11(1), 9-31.

RICHARDSON, J. (2000). ICT Implementation in Education: An analysis of implementation strategies in Australia, Canada, Finland and Israel. Luxembourg: Ministry of Education, Luxembourg.

RUSSELL, M., O'DWYER, L. M., BEBELL, D., & TAO, W. (2007). How teachers' uses of technology vary by tenure and longevity. *Journal of Educational Computing Research*, vol. 37, no. 4, pp. 393-417.

SABANCI, A., OZYILDIRIM, G., & IMSIR, R. (2014). The Effect of ICT Usage on the Classroom Management: A Case Study in Language Teaching. *International Review of Social Sciences and Humanities*, 7, 232-245.

SAAR, C., & NETWORK, G. E. (2005). ICT in High Schools.

SAHIN, I. (2011). Development of survey of technological pedagogical and content knowledge (TPACK). *The Turkish Online Journal of Educational Technology*, 10(1), 97-105.

SAMAK, A., & TAWFIK, Z. (2016). Exploration of Jordanian English Language Teachers' Attitudes, Skills, and Access as Indicator of Information and Communication Technology Integration in Jordan.

SCHMIDT, D. A., BARAN, E., THOMPSON, A. D., MISHRA, P., KOEHLER, M. J., &



SHIN, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for pre-service teachers. *Journal of Research on Technology in Education*, 42(2), 123-149.

SHUSTERMAN, R. (2016). *Practicing philosophy: Pragmatism and the philosophical life*. Routledge.

SIMPSON, M., PAYNE, E.R. & CONDIE, G. (2002). *Introducing ICT in Secondary Schools*. Edinburgh: University of Edinburgh.

SINGH, S. (2012) Developing e-skills for competitiveness, growth and employment: The European perspective, *International Journal of Development Issues*, Vol.11 Issue: 1:37-59

SLAOUTI, D., BARTON, A. (2007). Opportunities for practice and development: newly qualified teachers and the use of information and communication technologies in teaching foreign languages in English secondary school contexts. *Journal of In-service Education*, 33(4), 19.

SO, T., SWATMAN P. M.C. (2006). *E-Learning readiness of Hong Kong Teachers*. University of South Australia.

SOUTH AFRICA. Department of Education. (2003). *Draft White Paper on e-Education. Transforming Learning and Teaching through ICT*. Pretoria: Government Printer.

SOUTH AFRICA. (2004). *White Paper on e-Education*. Retrieved 4 November, 2011, from <http://www.education.gpg.gov.za/Legislation/White%20paper%207%20on%20e-Education.pdf>

STRAUSS, A. L., & CORBIN, J. M. (1990). *Basics of qualitative research* (Vol. 15). Newbury Park, CA: Sage.

SUKAMOLSON, S. (2010). *Fundamentals of quantitative research*. *Language Institute, Chulalongkorn University*.

SUTHERLAND, R., ARMSTRONG, V., BARNES, S., BRAWN, R., BREEZE, N., GALL, M. ... JOHN, P. (2004). *Transforming teaching and learning: Embedding ICT*

into everyday classroom practices. *Journal of Computer Assisted Learning*, 20, 413-425.

SURRY, D., ENSMINGER, D., & JONES, M. (2003). A model for integrating instructional technology into higher education. Retrieved April 1, 2014 from: <http://iphase.org/papers/RIPPLES.rtf>

SURTY, E. (2010). DBE's ICT Plans revealed. Retrieved 2 November, 2010, from <http://www.mg.co.za/printformat/single/2010-11-01-dbes-ict-plans-revealed>

SWENNEN, A., & VAN DER KLINK, M. (2009). *Becoming a teacher: Theory and practice for teacher teachers*. Heidelberg: Springer.

TELEM, M. (1996). MIS implementation in schools: A systems socio-technical framework. *Computers & Education*, 27(2).

TELEM, M., & PINTO, S. (2006). Information technology's impact on school–parents and parents–student interrelations: a case study. *Computers & Education*, 47(3), 260-279.

TELLA, A., TELLA, A., TOYOBO, O.M., ADIKA, L.O., AND ADEYINKA, A.A. (2007). An Assessment of Secondary School Teachers Uses of ICTs: Implications for Further Development of ICT's Use in Nigerian Secondary Schools. *The Turkish Online Journal of Educational Technology*, 6(3), 12.

TELLA, A. (2007). The impact of motivation on student's academic achievement and learning outcomes in mathematics among secondary school students in Nigeria. *Eurasia Journal of Mathematics, Science & Technology Education*, 3(2).

THE NEW SOCIAL WORK DICTIONARY (1995) Revised Edition. Pretoria.

THILL, J. V., & BOVÉE, C. L. (2007). *Excellence in business communication*. R. B. Chatterjee, & K. Subramanian (Eds.). Pearson.

Thomas, R. M. (2003). *Blending qualitative and quantitative research methods in theses and dissertations*. Corwin Press.

TONDEUR, J., VAN BRAAK, J., & VALCKE, M. (2007). Towards a typology of computer use in primary education. *Journal of Computer Assisted Learning*, 23, 197–

TONG, K.P., AND TRINIADA, S.G. (2005). Conditions and constraints of sustainable innovative pedagogical practices using technology. *Journal of International Electronic for leadership in learning*, vol. 9, no.3, pp. 1-27.

TRAUTMANN, N. M., & MAKINSTER, J. G. (2010). Flexibly adaptive professional development in support of teaching science with geospatial technology. *Journal of Science Teacher Education*, 21(3), 351-370.

U.S. DEPARTMENT OF EDUCATION. NATIONAL CENTER FOR EDUCATION STATISTICS. (2000). *Teachers' tools for the 21st Century: A Report on teachers' use of technology*.

VALDEZ, G., FULTON, K., GLENN, A., WIMMER, N., & BLOMEYER, R. (2004). Effective technology integration in teacher education: A comparative study of six programs. *Innovate*, 1(1). Retrieved April 1, 2014 from <http://www.innovateonline.info/index.php?view=article&id=4>.

VERMA, R.K. & VERMA, G. (2004) *Research Methodology*. Common Wealth Publishers. Delhi.

VOLMAN M. AND VAN ECK, E. (2001). Gender equity and information technology in education: The second decade. *Review of Educational Research*, vol. 71, no. 4, pp. 613-634.

WALLIMAN, N., & BUCKLER, S. (2008). *Your dissertation in education*. Sage.

WELLS, R., & WELLS, S. (2007). Challenges and opportunities in ICT educational development: A Ugandan case study. *International Journal of Education and Development using ICT*, 3(2).

WILSON-STRYDOM, M., THOMSON, J., & HODGKINSON-WILLIAMS, C. (2005). Understanding ICT integration in South African classrooms: research: information and communication technologies. *Perspectives in Education: Research on ICTs and Education in South Africa: Special Issue 4*, 23, p-71.

WILSON-STRYDOM, M. AND THOMSON J. (2005). Understanding ICT Integration in

South African Classrooms. SchoolNet SA research and evaluation.

WIMS, P., & LAWLER, M. (2007). Investing in ICTs in educational institutions in developing countries: An evaluation of their impact in Kenya. *International Journal of Education and Development using ICT*, 3(1).

WINNANS, C., & BROWN, D. (1992). Some factors affecting elementary school Teachers' use of the computers. *Education*, 8, 301-309.

WOODROW, J. E. (1992). The influence of programming training on the computer literacy and attitudes of pre-service teachers. *Journal of Research on Computing in Education*, 25(2), 200-218.

WONG, E.M.L. & LI, S.C. (2008). Framing ICT implementation in a context of educational change: a multilevel analysis. *School effectiveness and school improvement*, 19(1), 99-120.

WOZNEY, L., VENKATESH, V., & ABRAMI, P.C. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and teacher education*, vol. 14, no.1, pp. 173-207.

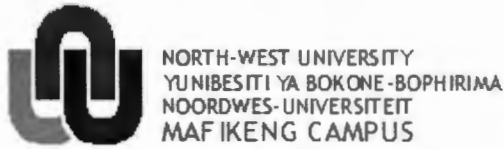
Wu, B., & Chen, X. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behaviour*, 67, 221-232. Chicago

YA'ACOB, A., NOR, N., AND AZMAN, H. (2005). Implementation of the Malaysian Smart School: An Investigation of Teaching-Learning Practices and Teacher-Student Readiness. *Internet Journal of e-Language Learning & Teaching*, 2(2), pp. 16-25.

YILMAZ, N.P. (2011). Evaluation of the Technology Integration Process in the Turkish Education System. *Contemporary Educational Technology*, vol.2, no.1, pp. 37-54.

ADDENDUM A

INTERVIEW SCHEDULE



What is the name of your school?

Are learners allowed to bring mobile phones to schools?

Does any learning happen on mobile phones?

Do you provide ICT lessons in your school? If yes, which grades and curriculum do you use?

How many learners do you have in your school?

What ICT facilities do you have in your school?

Do you use any of the ICT gadgets for teaching and learning purposes?

Do you use any software or website to prepare for lessons?

Has your school been supplied with Tablets PC's?

Are desktop computers installed for educational purposes for learners to use either alone or with a teacher in class?

What do you use computers/tablets (or other general technology) at work for?

Do you have access to a computer at home?

Do you have an email address?

How often do you use email?

Do you feel confident when using a computer?

Have you received any ICT-related training?

Does your school have an ICT coordinator?

If yes, is this ICT coordinator available full time or part time?

Does your school have an ICT teacher and which courses they teach, like CAT, computer science and so forth?

Have you attended any ICTor/CT in Education courses or workshops and how beneficial were they to you and how did they affect your perception of ICT use in schools?

Do you encourage teachers in your school to use technology? If yes how?

How do you think the uptake of ICT supported teaching can be encouraged amongst teachers and principals?

Are you aware of other initiatives in the province or country that support teachers who use technology?

Do you feel that you and your staff are adequately supported to use technology to support teaching and learning?

Are you aware of any software or websites that can support you to use ICT in the school?

Has your school ever sent any teachers for ICT related courses? Or has any training been provided on site?

How do you think that you can be better supported to use ICT in your work as a principal?

Thank you very much for your time.

ADDENDUM B
QUESTIONNAIRE



The purpose of this study is to establish how ICT can be used to minimize the workload of both learners and teachers by setting up measures to inspire teachers to make use of existing ICT resources, to improve academic performance of schools of the Ngaka Modiri Molema District.

Your participation in this study is most appreciative and rest assured your answers will be kept confidential and the completion of this questionnaire is voluntary. The results of this study will be provided on request.

QUESTIONNAIRE FOR TEACHERS AND PRINCIPALS

SECTION 1: DEMOGRAPHIC INFORMATION

Gender

Male	
Female	

Age

18 or less	
20-25	
26-35	
35-50	

Indicate the type of school you work at?

Primary	
Secondary	
High	

Where is your school located?

Town	
Village	
Township	
Farm	

5. The learner enrolment at your school

Less than 350	
350-600	

600-100	
1000 and more	

SECTION 2: TEACHER'S COMPETENCIES

This section will focus on proficiencies of teachers

7. Indicate your teaching category

(Select all that apply with an X)

Teacher	
Deputy Principal	
School principal	

8. Which year did you complete your higher education?

9. What level of education have you attained and which qualification did you obtain?

Pre-matric	
Matric	
Matric + Diploma	
Matric +degree	
Honors	
Masters	

PhD	
-----	--

Qualification

--

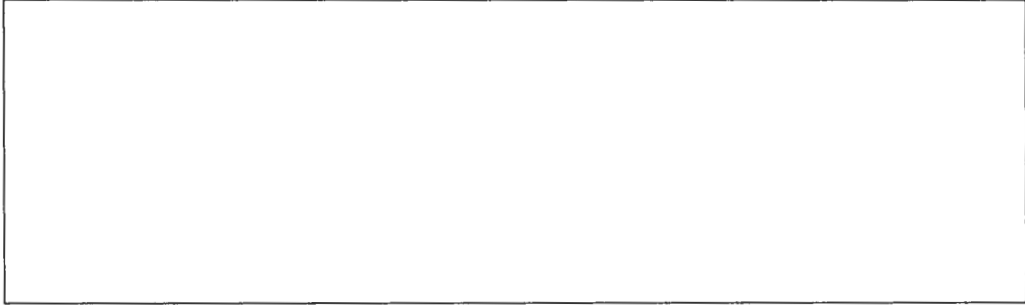
10. Number of computers at your school?

40 & more	
Less than 35	
Less than 20	
Less than 10	

11. Indicate grades that use computers

8-9	
10-11	
12 only	
Others/specify	

12. Which subject areas and grades do you teach?



SECTION 3: EXTENT AND FREQUENCY OF ICT USE IN SCHOOLS

This section will focus on the level and frequency of ICT use in schools

Indicate the level at which activities listed below are carried out

3. 1. Do you use any of the following technologies for teaching and learning purposes?

(Select all that apply with an X)

☐ Tablets

☐ Radio

☐ Television

☐ Digital cameras

☐ Data Projectors

☐ Laptops

☐ Interactive whiteboard

☐ Other

☐ None of the above

Equipment in use in your school

3.2. Approximately what proportion of this equipment (Digital cameras, Desktop computer, Tablets, Laptops) is fully operational this year?

(Indicate one option with an X)

☐ Less than 50%

☐ 50 to 75%

☐ 76 to 90%

☐ More than 90%

Deployment

3.3. Has your school been supplied with Tablets PC's, if yes by who?

(Indicate one option with an X)

☐ Yes

☐ No

Supplier

--

3.4 If yes what type (brand) of Tablets has been supplied to school?

(Select all that apply with an X)

☐ Apple

☐ Samsung

☐ Telefunken

☐ Acer

☐ Other

3.5. Are desktop computers installed for educational purposes for learners to use either alone or with a teacher in the following places?

(Select all that apply with an X)

☐ In classrooms

☐ In school laboratories

☐ In the school library

☐ Other location accessible to students

☐ None of the above

3.6. Are desktop computers installed for educational purposes for learners?

(Indicate one option with an X)

☐ Yes

☐ No

SECTION 4: TEACHER'S PERCEPTION OF ICTS

This section will focus on how teachers view ICTs

4.1. What do you use computers/tablets (or other general technology) at work for?

(Select all that apply with an X)

☐ Personal use

☐ Admin

☐ Teaching

☐ Other

4.2. How often do you use computers/tablets (or other general technology) at work?

(Indicate one option with an X)

☐ Within the past week

☐ Within the last 2 months

☐ Between 2 months and a year ago

☐ More than a year ago

☐ Never used one

4.3. Do you have access to a computer at home?

☐ Yes

☐ No

4.4. Do you have an email address?

☐ Yes

☐ No

4.5. How often do you use email?

(Indicate one option with an X)

☐ Within the past week

☐ Within the last 2 months

☐ Between 2 months and a year ago

☐ More than a year ago

☐ Never used one

4.6. Do you feel confident to use a computer?

(Indicate one option with an X)

☐ If someone is there to support you

☐ On your own

☐ To teach students

☐ To help colleagues

☐ Not at all

SECTION 5: TRAINING AND SUPPORT NEEDS

This section will focus on training and support needs of teachers

(Indicate one option with an X)

5.1 Have you received any ICT related training?

☐ Yes

☐ No

5.2. If your answer was yes above where appropriate please select one or more of the following:

☐ I can use technology for personal use i.e. send emails

☐ I can teach using the aid of basic technology i.e. PowerPoint slides

☐ I provide learners with learning material researched using technology

5.3. Have you received ICT-related training covering the following topics?

(Select all that apply with an X)

☐ Computer Literacy

☐ Teaching ICT as a subject

☐ Finding and using resources from the Internet

☐ Planning lessons or projects that integrate ICT

☐ Providing technical support in the school

☐ None of the above

5.4. How many hours of ICT related training have you received in the last 12 months?

☐ 0-4 hours

☐ 5-15 hours

☐ 16-40 hours

☐ More than 40 hours

☐ None of the above

5.5. Can you do the following?

(Select all that apply with an X)

☐ Install a printer

☐ Solve technical problems (e.g. computer does not start)

☐ Install new software on a computer

☐ None of the above

ICT coordinator

5.6. Does your school have an ICT coordinator?

☐ Yes

☐ No

If yes:

5.7. Is this ICT coordinator

(Indicate one option with an X)

☐Responsible for providing support in teaching ICT use

☐Available full time

5.8. Does your school have an ICT teacher and ask which courses they teach, CAT or computer science etc...?

(Indicate one option with an X)

☐ Yes

☐ No

5.9. Name any *ICT* or *ICT in Education* courses or workshops that you have attended in the last 12 months and rate its/their impact on your own development.

Number	Name of ICT or ICT in Education courses	High Impact	Medium Impact	Little Impact
1				
2				
3				
4				

5.10 On a scale of 1 - 5 how confident are you about the following:

1 - Very confident

2 - Fairly confident

3 - Confident

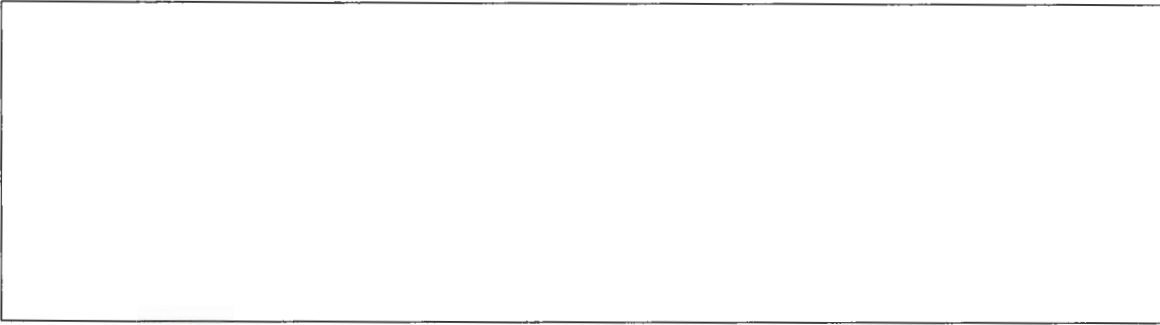
4 - Somewhat confident

5 - Not Confident

Skill	Rating
Ability to conduct lessons using some form of ICT	
Ability to develop and present assessments using ICT	
Ability to prepare for lessons using ICT	
Ability to prepare a lesson plan using ICT	
Ability to guide learners to useful technology platforms	

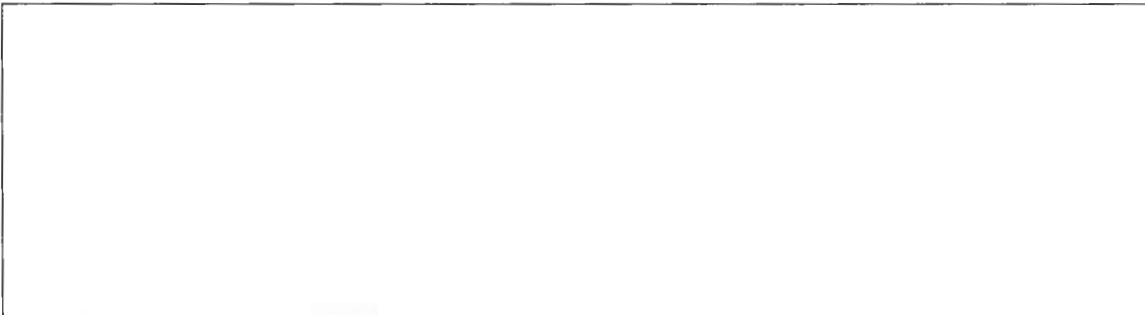
5.11. Which software/website do you normally use to aid you in preparing for lessons?

Please elaborate below



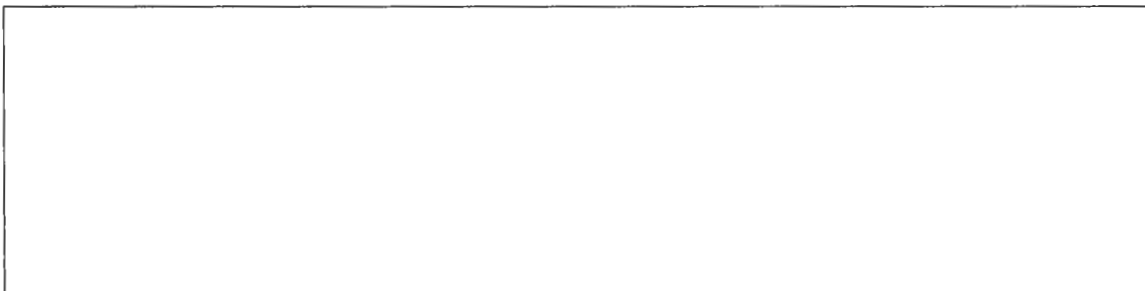
5.12. Which websites do you normally refer learners to to gain access to useful information?

Please elaborate below



5.13. Are you expected to use any software as part of your lessons or administration?

Please elaborate below



ADDENDUM C

PERMISSION TO CONDUCT RESEARCH



Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sport Ontwikkeling
Lefapha la Thuto le Tlhabololo ya Metsihamako
NORTH WEST PROVINCE

Quality Assurance Building
No : 861 Modir Molema Drive, Montshiwa
Private Bag X2044
Mmabatho 2735
Tel : (018) 397-3016
Fax : (018) 384 1598
e mail: mmmonoametsi@nwpg.gov.za

DIRECTORATE: WHOLE SCHOOL DEVELOPMENT SERVICES

Enquiries: Ms Motshidi Monoametsi
Tel No : 018 397 3026
E-mail: MMonoametsi@nwpg.gov.za

28 September 2015

Mr A. Keebine

Sir

RE: PERMISSION TO CONDUCT RESEARCH

This serves to inform you that permission to conduct research on Implementation and Adoption of ICT in schools of the Ngaka Modiri Molema District (Mafikeng Area Office) is granted subject to the following conditions:

- that it should not interfere with teaching and learning in schools and
- that the Department will receive a final copy of the research and summary of the research findings be made available.

Your cooperation in this regard will be appreciated.

We wish you all the best in your research study.

.....
Dr MC Teu
Director-WSD