

**INTEGRATING INFORMATION AND COMMUNICATIONS TECHNOLOGIES (ICTs)
INTO THE TEACHING OF TECHNICAL SUBJECTS IN LESOTHO**

by

PITSO ENOCH MPHUNYANE

(2010094759)

Presented in accomplishment of the requirements in relation to the qualification

Master's Degree in Education

(M.Ed. degree)

in

CURRICULUM STUDIES

FACULTY OF EDUCATION

at the

UNIVERSITY OF THE FREE STATE

BLOEMFONTEIN

Supervisor: Dr N.J.P Teis

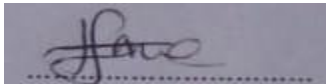
July 2021

DECLARATION

I, Pitso Mphunyane, herewith affirm that the dissertation that I present for the Master's Degree qualification in Education at the University of Free State is my own work and that I have not presented it previously for any qualification at a different institution of higher learning.

I therefore proclaim that I am aware that the University of the Free State bears the copyright and also declare that I used complete references to show and acknowledge all the sources I have quoted.

Signature

A rectangular box containing a handwritten signature in black ink. The signature is stylized and appears to read 'Pitso Mphunyane'.

Date

08 / 10 / 2021

ABSTRACT

The usage of information communication technology (ICT) in teaching and learning has become popular throughout world. This research explores the integration of ICTs into the teaching and learning of technical subjects in Lesotho. The research seeks to understand how the integration of ICTs into technical subjects may enhance teaching and learning. The study utilised a qualitative method research approach and quantitative approach as the supplementary data to generate data on how technical teachers in Lesotho use ICTs when teaching. Thirty-nine technical teachers responded to a questionnaire, followed by individual interviews of the eight teachers for a deeper understanding of their teaching and analysis of the documents (lesson plans, scheme and the syllabus. The study employed the Technological Pedagogical Content Knowledge (TPACK) framework as a conceptual frame to investigate key teacher competency areas with their effective ICT integration in technical teaching practices. The TPACK model grants a holistic framework for data collection and analysis of teachers' views and beliefs about their knowledge and proficiency in relation to content, pedagogy and technology use for teaching technical subjects.

The study found that almost none of the technical teachers that participated were trained in the integration of ICTs into teaching and learning of critical technical content knowledge and skills, and they had difficulty using ICTs in their daily instructional activities. The research noted that technical teachers do make a significant effort to integrate ICTs in their lessons as they gain experience from practice. The teachers view ICTs as the basis of effective teaching, but do not consider ICTs as the discipline-specific teaching tools needed to improve learning. Again, it was found that teachers are used to computers and overhead projectors in their teaching activities, as opposed to other advanced discipline-specific ICTs such as 3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers, to name a few.

Therefore, these results call for further research on advanced technologies and the discipline-specific ICT tools teachers can utilise in the technical teaching and learning

context. Teachers need to know about technological advancements and how they could be utilised to enhance teaching and learning towards useful participation in the rapidly changing technical world. Again, the need for ICT policy and curriculum reform that will reflect the multi-media devices and other digital tools or discipline-specific technologies tools as significant in the teaching and learning approach.

Keywords: discipline-specific teaching technologies; effective engagement; pedagogic leadership

DEDICATION

In completing this dissertation, I give credit to my wife, Mathaabe Mphunyane, who always encouraged me to undertake the current study. I also convey my appreciation to my uncle, Maboi Mphunyane, and auntie, Makhoba Mphunyane, for always giving words of encouragement and supporting me, as well as my younger sister, Limphe, for pushing me to complete this dissertation. Moreover, I offer the completion of my Master's Degree to my two daughters, the real lifesavers: Lebohang and Rethabile Mphunyane.

ACKNOWLEDGEMENTS

It is an honour to pass my special appreciation, thanks, and gratitude to the persons who assisted me in the attainment of this project. I am very thankful to the University of the Free State Ethics Committee for granting me permission to undertake this research. I am also grateful to the school teachers and the principal who took part in this research for their unconditional assistance and readiness to share their knowledge with me. This research became possible because of their cooperation and understanding.

Moreover, I also sincerely pass my great appreciation to my supervisor, Dr Nixon Teis, for his professional assistance, guidance, mentoring, and motivation and for always sparing his time whenever I needed him. I thank you so much, Dr Teis, for your unconditional support.

This publication has been developed through the Teaching and Learning Development Capacity Improvement Programme which is being implemented through a partnership between the Department of Higher Education and Training and the European Union.

Contents

DECLARATION	1
ABSTRACT	2
ACKNOWLEDGEMENTS	5
LIST OF FIGURES	13
LIST OF TABLES	13
LIST OF ABBREVIATIONS	13
CHAPTER 1: INTRODUCTION AND OVERVIEW	1
1.1 INTRODUCTION	1
1.2 BACKGROUND INFORMATION	1
1.3 CONCEPTUAL FRAMEWORK.....	4
1.4 STATEMENT OF THE RESEARCH PROBLEM.....	5
1.5 RESEARCH QUESTIONS	6
1.6 RESEARCH AIM AND OBJECTIVES	6
1.7 THE SIGNIFICANCE OF THE STUDY	7
1.8 RESEARCH METHODOLOGY	7
1.8.1 Research paradigm.....	7
1.8.2 Research approaches.....	8
1.8.3 Population and sampling.....	8
1.8.4 Data-collection strategies.....	9
1.8.5 Data analysis and interpretation	11
1.9 THE STUDY DELIMITATIONS AND LIMITATIONS	11
1.10 ETHICAL CONSIDERATIONS.....	12

CHAPTER 2 LITERATURE REVIEW ON INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) IN THE TEACHING OF TECHNICAL SUBJECTS IN LESOTHO	14
2.1 INTRODUCTION	14
2.2 CONCEPTUAL FRAMEWORK.....	14
2.2.1 The historical origin of the Technological Pedagogical Content Knowledge (TPACK) framework.....	15
2.2.2 The TPACK model.....	16
Figure 2.1: TheTPACK model	17
2.2.2.1 <i>Content knowledge (CK)</i>	17
2.2.2.2 <i>Pedagogical knowledge (PK)</i>	18
2.2.2.2.1 Diverse learning.....	19
2.2.2.2.2 Learner centred.....	19
Figure 2.2: Twenty-first century learning characteristics. Source: adapted from Heick (2012).....	20
2.2.2.3 <i>Pedagogical content knowledge (PCK)</i>	20
2.2.2.4 <i>Technological pedagogical knowledge (TPK)</i>	21
2.2.2.5 <i>Technological content knowledge (TCK)</i>	21
2.2.2.6 <i>Technology pedagogy (TP)</i>	22
2.2.3 The importance of the TPACK model	22
2.2.4 TPACK applications and limitations	23
2.2.5 Rationale for utilising TPACK as the conceptual framework for this study	24
2.3. GENERAL DICUSSION OF ICTs	25
2.3.1 The history of information and communications technology (ICT) in Lesotho.....	26
2.3.2 Definition of ICTs.....	28

2.3.3	Bloom’s taxonomy of learning domains in the teaching and learning of ICTs	28
2.3.3.1	<i>Cognitive skills</i>	29
2.3.3.2	<i>Motor skills</i>	29
2.3.3.3	<i>Affective skills</i>	29
2.3.4	ICT tools used in teaching and learning.....	30
2.3.4.1	<i>Interactive whiteboards (IWBs)</i>	30
a)	Integrated technology	31
b)	Enhanced education	31
c)	Improved learner contribution	31
d)	Enhanced learner teamwork	32
e)	Improved feedback	32
f)	The Internet connection	32
2.3.4.2	Computers.....	33
	Figure 2.3: Fourth Industrial Revolution (4IR) structure.....	33
2.3.4.3	Mobile phones.....	35
2.3.4.4	Robotics	36
2.3.4.5	Conclusion on ICT tools.....	36
2.3.5	ICTs in schools	38
2.3.6	ICT as a changing factor in the learning process.....	39
2.3.7	Teaching technical subjects using ICTs.....	44
2.3.8	Factors that influence the quality of education via the use of ICTs	46
2.3.8.1	Defining learning objectives	46

2.3.8.2	<i>Leadership skills</i>	47
2.3.8.3	<i>Managerial functions</i>	48
2.3.8.4	<i>Decision making</i>	48
2.3.8.5	<i>School context</i>	49
2.3.8.6	<i>School resources</i>	49
2.3.9	Factors that enable or disable the integration of ICTs.....	49
2.3.9.1	<i>Lack of confidence</i>	50
2.3.9.2	<i>Lack of teacher competence</i>	50
2.3.9.3	<i>Resisting change and negative attitudes</i>	50
2.3.9.4	<i>Lack of access</i>	51
2.3.9.5	<i>Lack of time</i>	51
2.3.9.6	<i>Lack of effective training</i>	51
2.4	THE POSITION OF THE TEACHER IN TEACHING AND LEARNING.....	52
2.5	TEACHERS' PROFESSIONAL DEVELOPMENT.....	54
2.6	CONCLUSION.....	53
 CHAPTER 3 RESEARCH DESIGN AND METHODOLOGY		
3.1	INTRODUCTION	56
3.2	THE PURPOSE OF THE STUDY	56
3.3	RESEARCH QUESTIONS	57
3.4	RESEARCH PARADIGM	57
3.4.1	Objectives of interpretivism.....	58
3.4.2	The ontology of interpretivism.....	60
3.4.3	The epistemology of interpretivism	60
3.5	RESEARCH APPROACH	61

3.6	THE CHOICE OF RESEARCH PROBLEM.....	62
3.7	THE POSITION OF THE RESEARCHER.....	62
3.8	POPULATION AND SAMPLING.....	63
3.9	DATA COLLECTION.....	64
3.9.1	Interviews.....	66
3.9.2	Document analysis.....	66
3.9.3	Survey questionnaire.....	67
3.10	DATA ANALYSIS.....	68
3.11	ETHICAL ISSUES IN QUALITATIVE AND QUANTITATIVE RESEARCH.....	70
3.12	CONFIDENTIALITY.....	71
3.13	CONCLUSION.....	71
CHAPTER 4: DATA ANALYSIS, INTERPRETATION, AND PRESENTATION OF FINDINGS.....		73
4.1	INTRODUCTION.....	73
4.2	ANALYSIS OF THE EMPIRICAL DATA.....	74
4.3	PROFILES OF TEACHER PARTICIPANTS.....	74
4.3.1	Teacher A.....	74
4.3.2	Teacher B.....	75
4.3.3	Teacher C.....	75
4.3.4	Teacher D.....	76
4.3.5	Teacher E.....	76
4.3.6	Teacher F.....	77
4.3.7	Teacher G.....	77

4.3.8	Teacher H.....	78
4.5	PRESENTATION OF THE FINDINGS.....	79
4.5.1	Themes that surfaced from the teacher data analysis.....	80
	Theme1: Teachers' competence in using ICTs.....	80
	Figure 4.1: Lack of training.....	81
4.5.1.2	<i>Level 1.2: Confidence</i>	84
	Figure 4.2: Teachers' confidence	84
4.5.1.3	<i>Level 1.3: Lack of interest in ICT use</i>	86
	Figure 4.3: Teachers' interest.....	86
4.5.2	Theme 2: Insufficient ICT infrastructure.....	87
4.5.2.1	<i>Level 2.1: Insufficient computers</i>	88
	Figure 4.4: Presence of ICT laboratories.....	88
4.5.2.2	<i>Level 2.2: Limited time and space</i>	89
4.5.2.3	<i>Level 2.3: Internet connectivity</i>	90
	Figure 4.5: Internet access at school.....	90
4.5.3	Theme 3: Importance of discipline-specific ICTs in teaching and learning	91
4.5.3.1	<i>Level 3.1: Learning methods</i>	92
	Figure 4.6: Discipline-specific ICTs in teaching and learning	92
4.5.3.2	<i>Level 3.2: Teaching methods</i>	94
4.5.3.3	<i>Level 3.3: Delivery of subject matter</i>	96
	Figure 4.8: Tasks that prompt Internet usage.....	96
4.5.4	Theme 4: Using ICTs to teach	97
4.6	DOCUMENT ANALYSIS.....	99

4.7	DOCUMENT ANALYSIS PROCEDURE	100
4.7.1	Theme 1: ICT training and skills	100
4.7.1.1	<i>Level 1.2: Skills</i>	101
4.7.1.2	<i>Level 1.3: Competencies</i>	101
4.7.1.3	<i>Level 1.4: Interest in the use of discipline-specific ICTs in teaching and learning</i>	101
4.7.2	Theme 2: ICT infrastructure	101
4.7.3	Theme 3: Benefits of discipline-specific ICTs in teaching	102
4.7.3.1	<i>Level 3.1: Teaching and learning methods</i>	102
4.8	CONCLUSION.....	101
 CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS		104
5.1	INTRODUCTION	104
5.2	SUMMARY OF RESEARCH FINDINGS.....	104
5.2.1	The summary of the results of the literature review	105
5.2.2	Summary of the findings of the empirical research	106
5.2.3	Summary of the document analysis.....	111
5.3	RECOMMENDATIONS.....	112
5.4	CONCLUSIONS.....	117
 REFERENCES.....		120
 APPENDICES		149
 APPENDIX A1: LETTER OF CONSENT: TEACHERS		149
 APPENDIX A2: LETTER OF CONSENT: PRINCIPAL		150
 APPENDIX B: ETHICAL CLEARANCE		151

LIST OF FIGURES

Figure 2.1: The TPACK model	14
Figure 2.2: Twenty-first century learning characteristics	17
Figure 2.3: Fourth Industrial Revolution (4IR) structure	30
Figure 4.1: Lack of training	77
Figure 4.2: Teachers' confidence	80
Figure 4.3: Teachers' interest	82
Figure 4.4: Presence of ICT laboratories	84
Figure 4.5: Internet access at school	86
Figure 4.6: Discipline-specific ICTs in teaching and learning	88
Figure 4.8: Tasks that prompt Internet usage	93

LIST OF TABLES

Table 3.1: Information on interviews with teacher participants	64
Table 4.1: Summary of teachers' life history	74
Table 4.2: Documents and data analysed	97

LIST OF ABBREVIATIONS

4IR	Fourth Industrial Revolution
AutoCAD	Automated computer aided design
CAD	Computer-aided design

CK	Content knowledge
ICT	Information and communications technology
ICTs	Information and communications technologies
IT	Information technology
IWB	Interactive whiteboard
PCK	Pedagogical content knowledge
PK	Pedagogical knowledge
TCK	Technological content knowledge
TK	Technological knowledge
TP	Technology pedagogy
TPACK	Technological Pedagogical Content Knowledge[model]
TPK	Technological pedagogical knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization

CHAPTER 1: INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION

In an extremely short period of time, information and communications technology (ICT) has received more attention than ever before in modern society. That is why many countries, such as the United Kingdom (Livingstone, 2012), Malaysia (Kannan, Sharma & Abdullah, 2012), Turkey (Cavas, Cavas, Karaoglan & Kislak, 2009), and the Republic of Korea (Hwang, Yang & Kim, 2010) have taken the initiative to bring in and aggrandise the integration of ICTs in their education systems to change education and to bring a greater understanding of new technology to people. Many countries now view understanding information and communications technologies (ICTs) and grasping the fundamental proficiency and ideas of ICTs as the elementary core of education. This study analysed literature on the use of ICTs in teaching and learning of technical subjects, with specific reference to three schools in the Butha-Buthe district in Lesotho. ICTs are acclaimed as a solution to some of the challenges in the education structure in both developing and developed countries. The current research seeks to understand how technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects. Some schools in Lesotho are resourced with ICT tools such as computers and projectors to enhance teaching and learning (Kalanda, 2012).

This chapter outlines the background of the study, the theoretical framework, the problem statement, the research questions, the aims of the study, the significance of the study, the research methodology, ethical considerations, and an overview of the study.

1.2 BACKGROUND INFORMATION

In the 21st century, ICTs have become vital to society (Kuskaya & Kocak, 2010). Entire countries, developed and developing, are embarking on the significant and intricate duty of reforming their education structures to meet growth needs in the context of the changing environment (United Nations Educational, Scientific and Cultural Organization

[UNESCO], 2010). Roblyer and Edwards (2000) noted that ICTs that are developed to enhance learning can perform a vital task in the growth of learning traditions in the (technical) classroom. The literature suggests that ICTs that are developed as enhanced learning tools could be described as the collection of hardware and software utilised in the teaching and learning system. This may include computer-based training systems, multimedia systems, electronic performance support systems, telecommunications systems, as well as the Internet and the World Wide Web (Rutten, Van Joolingen & Van der Veen, 2012).

It is therefore not surprising to consider education as the most important channel for people's growth that needs to take note of the endless changes in the work place students will enter in the future. Pursuant to the fast growth and the ICT employment in the world of work, therefore, it is vital that the modern generation of technical education students should be equipped with the relevant ICT knowledge and skills needed for effective engagement in the current and future workplace (Sangraa & Mercedes, 2010).

The Ministry of Education and Training of Lesotho regards ICTs as essential human capital development tools that must be integrated in the Lesotho school curriculum (Ministry of Communications, Science and Technology, 2005). This demonstrates the education sector's pivotal task in enhancing teaching and learning methods that cultivate an ICT-literate society. The Lesotho National ICT Policy (Ministry of Communications, Science and Technology, 2005) outlined the objectives towards the development and application of ICT literacy. The policy promotes the development of relevant ICT information and proficiency in the teaching and learning of all subjects, including technical subjects such as woodwork, metalwork, drawing and design, and technology (Hennessy *et al.*, 2010).

In addition, Lesotho's Vision 2020 outlines the purpose of embracing ICTs that seek to connect Lesotho to the globalised world. This research argues that Lesotho needs to develop knowledgeable and skilled workers. This perspective is in accordance with the goal to project the nation as prominent in the global context. The Ministry of Education and Training of Lesotho, in Lesotho's Vision 2020, recommended the curriculum implementation capacity proficiency that teachers should demonstrate with the aim to

guide the Lesotho educational mandate to be competitive in the world economy. One of the aims that underpin Vision 2020 is that teachers will have the appropriate technology at their disposal to meet the high demand in teaching and learning of technical subjects. The Ministry of Education and Training of Lesotho, in Education Sector Plan 2016 - 2026 plans to strengthen delivery of quality equitable education and provide of ICT solutions in schools.

Technical subjects are described as educational courses associated with practical learning, including technology, engineering, design, or other workforce-associated subjects (Beauchamp, 2011). Teis (2014) further viewed technical subjects as a curriculum that prepares learners for tasks that are considered manual or practical activities. Yusuf 2006 (as cited in Innocent 2013) further explains technical subjects or education as type of education that intends at grooming learners for service in a sound field of work. It equips learners with skills attitudes and knowledge needed participate and contribute effectively in the world of work. Hence, Afeti (2010) show that technical education has emerged as one of the most effective human resource development strategies, Africa needs to embrace with the aim to modernise their workforce. Similarly, Lesotho needs this type of technical education to fully equip their students with the needed skills and attitudes to use discipline specific tools to learn and be able to contribute effectively

Therefore, in this study, the researcher investigated the following technical subjects: Basic Handcrafts, Technical Drawing, and Design and Technology (these were chosen because they are technical subjects that are offered in the schools of Lesotho and are the subjects of my specialisation) that impart training and develop the essential skills of production of craftsmen and technical persons.

The studies by Almadhour (2010), Chere-Masopha (2011), Adesote & Fatoki (2013), Jo Fan Fu (2013), and Aslan & Zhu (2016) have affirmed the significance of ICT employment into the teaching and learning of technical subjects. For instance, Crittenden (2009) emphasised that the integration of ICTs among technical subject

teachers is aimed at transmitting, storing, creating, sharing, or exchanging information by different platforms such as radio, television, video, DVD, telephone, satellite systems, computers, and the Internet. Other studies (Jamsek & Kocijanic, 2007; Abdulrasool & Mishra, 2009) showed that ICT platforms utilised in the classrooms of technical and vocational schools and in teaching engineering subjects include computer-aided design (CAD), 2D/3D modelling, and simulation products. Coetzee (2019) postulated that utilising ICTs to teach will inspire students who study engineering-related subjects to obtain the relevant information, proficiency, and habits needed to effectively meet the demands of the 4IR workplace.

Despite previous studies that have highlighted the need for positive outcomes in the usage of ICTs to teach and learn context knowledge within technical subjects, many studies have reported that the inclusion of ICTs seems minimal, and the use of ICTs in the technical classroom is an active practice that is related to various issues such as the teacher's proficiency, knowledge of ICTs, maturity, gender, type of training, level of qualification, computer and peripherals accessible at schools, and administrative back-up (Scardamalia & Bereiter, 2000). These studies considered the essential ICT understanding and proficiency of teachers with the assumption that teachers in their respective specialisations will be required to obtain it. Suitably, this research examined integrating ICTs into the teaching of technical subjects such as woodwork, graphic design, and engineering in different schools in Lesotho.

1.3 CONCEPTUAL FRAMEWORK

The conceptual framework utilised for this study is the Technological Pedagogical Content Knowledge (TPACK) framework. The TPACK framework is an expansion of pedagogical content knowledge (PCK), a word invented by Shulman (1986). According to Mishra and Koehler (2006:107), the TPACK model is a framework devised to acquire certain important virtues of teacher skills vital for technology integration in teaching. For example, teachers are well proficient or experienced in the content or theme they teach (content knowledge) (CK). Teachers relate pedagogical knowledge (PK) when they think how their students study, ways to involve their learners in the learning procedure,

and suitable methods to measure learning. Finally, educators draw from their technological knowledge (TK) when utilising different technological tools and resources in their classrooms (Jita, 2016). The TPACK model is therefore utilised in this study because it links classroom practice to theory through *what* to teach (CK) and *how* to teach (PK), and demonstrates an understanding of how teachers can integrate ICTs into technical subjects.

1.4 STATEMENT OF THE RESEARCH PROBLEM

Even though ICTs are notably one of the most important factors in education for the 21st century, there is paucity of literature and studies relating to their operation and integration in the teaching of technical subjects. Lloyd (2009) emphasised that, although there are arguments on the integration of information and communication technologies in education and a variety of studies, there has been inadequate research done on the usage of technology in the teaching of technical subjects. Still, the record of the UNESCO-UNEVOC International Centre for Technical and Vocational Education contains partial facts concerning the active usage of ICTs in the teaching of technical subjects at school (Ward & Parr, 2010). In addition to the researcher's knowledge, little research, if any, has been conducted concerning ICT usage in the teaching of technical subjects in Lesotho schools.

The Lesotho government has undertaken huge initiatives to build up an ICT policy to guide the educational agenda, which states that "all education institutions are liable to enhance teaching and learning devices which develops an ICT literate society" (Ministry of Communications, Science and Technology, 2005). The government also outlined that the core curriculum should entail ICT literacy (Lesotho Ministry of Communications, Science and Technology, 2004). In addition, the Ministry of Education and Training of Lesotho (2012) stipulates that the relevant technological skills and knowledge to respond to learners' needs should be provided by schools. Yet, despite this policy statement and initiatives, this has been nothing more than lip service (Aduwa-Ogiegbean & Iyamu, 2005; Alazam, Bakar & Hamzah, 2012). The researcher noted a disjuncture between what policies suggest and what in fact takes place inside the

classroom. This research therefore seeks to understand how technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects.

Moreover, from the experience as an educator in Lesotho, the researcher noted that, even though ICTs are provided in schools, some teachers are hesitant to incorporate them into teaching practices. This provoked the researcher's curiosity and, as a result, he decided to undertake this study.

1.5 RESEARCH QUESTIONS

The key research question this study aimed to address is: How technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects.

The study aims to answer the following sub-research questions:

- a) What is the educational relevance and value of the integration of ICTs into technical education subjects?
- b) What factors influence technical teachers' effective integration of relevant ICTs into technical education classes?
- c) What recommendations can be made to enhance discipline-specific ICTs when integrating them into teaching and learning?

1.6 RESEARCH AIM AND OBJECTIVES

The current research seeks to understand how technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects.

The following are the objectives of this research:

- 1) To explain the relevance and educational value of ICTs in the teaching and learning of technical subjects in Lesotho.

- 2) To explore factors that influences the use of relevant ICTs into the teaching and learning of technical subjects and their integration into the classroom.
- 3) To make recommendations to improve the use of discipline-specific ICTs into teaching and learning.

1.7 THE SIGNIFICANCE OF THE STUDY

The research will benefit teachers who experience difficulty using ICTs in the teaching and learning of technical subjects. Teachers will also become aware of how ICTs could be integrated to improve their teaching and learning. The research findings will benefit the Ministry of Education and Training of Lesotho because it will provide insight into the challenges that educators face in the execution of ICTs in schools and what measures can be taken to bring change to Lesotho's education system.

1.8 RESEARCH METHODOLOGY

1.8.1 Research paradigm

The research paradigm of this study is interpretivist. Interpretivism is an approach that Creswell (2007) claimed individuals use to know their world and build up biased meanings of their knowledge. The interpretivist paradigm, as De Vos, Strydom, Fouché and Delpont (2011) maintain, evokes participants' dispositions of meaning, experiences, or ideas. It was selected to underpin the assumptions of this study because the intentions of educational research in this are to make sense following the teachers' knowledge, which are shared in the collective and cultural context in which they happen (Kim, 2003).

Interpretivism was chosen to guide this study because this approach is concerned with understanding the meanings derived from empirical semi-structured interviews and semi-structured focus group interviews. Symbolically, the researcher's position is to know, give details, and show collective truth in multiple interpretations that vary, whereby results are created and not found (Mack, 2010). Studies in this field are distinctive and cannot be generalised, which is typical of a case study style of research

(Christiansen, Bertram & Land, 2010). This suggests that the case study research methodology and interpretive paradigm are the most suitable because they deal with personal experiences (similar to the aim of this study).

1.8.2 Research approaches

Rovai, Baker and Ponton (2014) wrote that quantitative research is deemed to be a reflective technique for research. They argued that carving up this truth into handy and smaller quantities for the use of research leads to an understanding of this reality. It is therefore inside these minor parts that notes could be prepared and that assumptions can be checked or examined and duplicated in connection with the contact amid variables (Almalki, 2016).

Denzin and Lincoln (2000; 2005) contended that qualitative study is a set pursuit that places observers in the visible world. Nieman (2000) and Berg (2007) asserted that qualitative research is flexible, open, and not strictly regimented (open-minded). Nieman (2000) further claimed that it is an approach that studies the object of research as it is observed (letting the object to speak for itself), experienced, and defined by participants. Qualitative research emphasises discovering and accepting the sense people or a cluster assigned to a social or human setback (Creswell, 2014). Qualitative research is usually explained as permitting the comprehensive examination of a area of concern in which information is composed by a researcher in case studies, ethnographic work, interviews, etc. (Harwell, n.d.). Therefore in this study qualitative approach is used because it is deep in nature, exact and detailed (Mortari, 2015). Quantitative approach is also used as the supplementary data because the researcher sought to acquire the deep insights of the fundamental basis, views, and knowledge of teachers regarding the use of ICTs in the teaching of technical subjects.

1.8.3 Population and sampling

Gentles, Charles, Ploeg and McKibbin (2015:1775) contended that the descriptive choice of individuals, places, or objects from which facts are collected is described as a sample. The background in which this research is focused is specifically schools in

Lesotho. The researcher selected the purposive sampling method, which is frequently used in qualitative studies. In this research, I employed the purposive sampling method to select participating technical teachers who were trained to deploy a range of teaching strategies in enhancing learning. Babbie (2010) defines purposive sampling as a non-probable form of sampling, for which the details are chosen based on the researcher's judgement. Therefore the schools that participated in this research were chosen on the basis that they have existing computer laboratories that were well furnished and equipped with computers and internet connectivity. The purposive sampling of (n=8) technical teachers from three technical schools contributed to the generation of the research data of the study. The researcher chose this specific group of participants with the assumption that the results of the research could not be applied to the wider population within the context of this research, but contributes to the generation of solutions to enhance technical teaching through the use of ICTs for this educational district.

Quantitative research data were generated through surveys that were distributed to 60 technical subject teachers from the Northern region, representing all the technical schools in the Northern region. Out of 60 technical subject teachers who were issued with the questionnaires, only thirty nine (39) technical educators from all technical schools in the Northern region returned the questionnaires.

1.8.4 Data-collection strategies

Creswell (2007) contended that the collection of data consists of analogous pursuits designed together with admissible acquired facts to respond to the research questions. Qualitative researchers use observation and interviews to obtain information from direct sources, and quantitative researchers use surveys.

The study at hand employed qualitative approach and quantitative strategy as the supplementary data, where data was collected from the semi-structured interviewing of eight (8) technical subject teachers, the documents, lesson plans, schemes and records of work, the syllabus and survey questions (questionnaires) of 60 technical subject teachers from the Northern region representing all the technical schools in the Northern

region. The approach was utilised with the aim of assembling the best data from each method (qualitative and quantitative) to answer to the questions in the study.

Interviews create an environment for participants to feel free to convey their ideas unreservedly, which could offer consistent, similar qualitative data (for in-depth description). In the qualitative phase, written consent forms were issued during the meeting held by the principal and the researcher. A follow-up invitation was made via a cell phone call for one on one interviews. Participants for interviews (n=8) were interviewed to seek an understanding of how the integration of ICTs into technical subjects may enhance teaching and learning in the technical subjects that they teach. The data was transcribed into texts and then coded and grouped into different themes.

In the quantitative phase, the survey questionnaire included the questions on teacher knowledge of ICTs and their level of competence on the use of ICTs in technical teaching context. The sample of (n=39) teachers that engaged in the survey data collection process were teaching at the junior secondary and the high school.

For the survey instrument, "YES" or "NO" questions were utilised for data collection and analysis and to provide a description of how the integration of ICTs into technical subjects may enhance teaching and learning. A Microsoft Excel spreadsheet was used to analyse the data. The survey questionnaire was administered to technical teachers in an annual meeting at one school in Leribe. The arrangement was convenient for the researcher to collect the data instantly from the participants because all the technical schools in the Northern region were represented. I collected all the surveys from the participants after the gathering.

This suggests that these two types of data-collection tools (interviews and questionnaires) contributed to the generation of data regarding technical teachers' experiences in the use of ICTs and the integration ICTs in technical subject teaching to enhance learner experience.

1.8.5 Data analysis and interpretation

The interviews were noted and recorded and thereafter processed. The data were coded and read in an uncritical manner and then in a critical manner so as to develop themes that emerged from the diverse perspectives of the respondents on the use and integration of ICTs. Thematic analysis was used because it reduces data and categorises it in meaningful ways without losing the significance of the data (Braun & Clark, 2006).

1.9 THE STUDY DELIMITATIONS AND LIMITATIONS

Simon (2011) contended that delimitations are features that reduce the range or classify the limits of a study. The qualitative data were generated from three teachers per two schools and two teachers from another high school in Butha-Buthe, which are two church schools and one community school. The quantitative data were collected from 39 participating technical teachers from other schools in the district that the researcher found accessible.

Even though the sample to this research was minimal and the schools chosen were from the Butha-Buthe district for qualitative data collection and technical teachers in the Northern region (Mokhotlong, Butha-Buthe, Leribe and Berea) for quantitative data, this qualitative and quantitative analysis aim was not to generalise, but to offer a rich, contextualised understanding of matters involving the integration of ICTs in the local technical teaching and learning environments. Such a perspective was necessary as it contributes to policy makers', school managers' and teachers' perspectives of local knowledge frameworks and competencies in the use and integration of ICTs in the technical educational context. This collective contextual perspective could then contribute to how both similar and different school communities could engage and strategise to integrate ICTs more effectively in the teaching context.

1.10 ETHICAL CONSIDERATIONS

The identities of the participants were protected, and they remained confidential. Pseudonyms were used to report the results of the qualitative and quantitative data generated in this research (Maree, 2007). It was the duty of the researcher to first seek full authorisation from the University Free State to embark on this study. Ethical clearance (UFS-HSD2018/0157) was granted after a rigorous application process that seeks to ensure that the dignity and integrity of those who contribute to the knowledge development process of this study were not harmed. The study took place within the jurisdiction of the Lesotho's Ministry of Education and Training, with the approval of the community and school authorities. The researcher therefore first sought full permission from the different local school administrations. The researcher compiled the research objectives and thereafter informed all the respondents of the objectives of the research and their intended role. The participants were informed how they would benefit from the research so that they would genuinely want to take part in the research. I also discussed the importance of such a knowledge generation process for the professional development of all involved. The participants were notified that they may decline to participate in the study at any stage of the process if they did not feel comfortable.

1.11. CONCLUSION

The current research seeks to understand how technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance the teaching and learning of technical subjects. The research draws from, and builds teacher knowledge generation processes through the use of TPACK as a conceptual framework for this study. The study also outlines the problem to be researched, the research aims and objectives. Again, the significance of the study was outlined, the research paradigm, the research approach, population and sampling, data collection strategies, and lastly ethical concerns were discussed.

The next chapter focuses on the conceptual framework (TPACK) for this research, a literature review on ICTs, and their impact on and benefits for technical education teaching and learning.

CHAPTER 2

LITERATURE REVIEW ON INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) IN THE TEACHING OF TECHNICAL SUBJECTS IN LESOTHO

2.1 INTRODUCTION

The research explores the educational value of the integration of ICTs in technical subjects in Lesotho's teaching and learning environments. This chapter reviews literature on relevant discipline-specific ICTs for technical teaching and learning. The chapter first examines the appropriate conceptual framework that guided the study, namely the Technological Pedagogical Content Knowledge (TPACK) Model, and justifies its appropriateness for pursuing the objectives of this study (Koehler and Mishra, 2006). This chapter then defines the operational concepts that anchor the research. The section further summarises the historical perspective of the integration of ICTs into Lesotho's educational context, the integration of technical subjects using ICTs, the significance of ICTs in the classroom, and the responsibility of the technical teacher using ICTs to enhance technical literacy.

2.2 CONCEPTUAL FRAMEWORK

The TPACK lens was deemed the most suitable conceptual framework to assist in understanding how ICTs can be incorporated into the teaching and learning of technical subjects. Trauth and Jessup (2000) argued that the TPACK model concentrates on the multifaceted aspect of sense-making as a condition unfolds, which could make it suitable as a relevant framework to understand teacher knowledge from their diverse competency expectations. Such a perspective is further supported by the recent SA teacher training policy directive that argue for a multifaceted (knowledge-mix) teacher competency as a requirement for effective teacher engagement in the teaching context (DHET, 2013). The relevance of the TPACK model was therefore investigated and is illustrated under subheadings that relate to identifying a theoretical framework suitable for the study. The historical background of the TPACK framework and its six

components, the importance of the TPACK model, TPACK applications and limitations, and the rationale for using the TPACK model are discussed.

2.2.1 The historical origin of the Technological Pedagogical Content Knowledge (TPACK) framework

The TPACK model is a framework that was first suggested by Mishra and Koehler in 2006, and has since been explored further by some researchers in the area of the integration of ICTs into schools (Schmidt, Cogan & Houang, 2011). Mishra and Koehler (2008) articulated that traditionally, if teachers were to utilise technology, they were taught technology skills via workshops or training seminars. Between 1999 and 2000, Matt and Punya (1986) had a few conversations about this idea and eventually reached the conclusion that this approach was not working, and they had a rough idea why. Matt and Punya (1986) then began with a few design experiments where educational technology master's students were orientated about a method that was called learning technology by plan. People would study educational technology by devising educational technology. Matt and Punya (1986) developed a theory about educators and a curricular style. Educational technology design projects included designing a website or PowerPoint presentation to teach. Data were collected through interviews to determine what people were learning. Although they were sure that it was working, they were not sure why it was working. Certainly, it was because of the learning technology in context, but what did it imply? What is the educational technology background anyway? Matt and Punya (1986) then ran into an incredibly fine explanation of teacher knowledge by Shulman (1986). Shulman (1986) claims that, up to this point, there are approximately two issues that scholars recognised that teachers are required to know: CK (knowledge on the matter they were teaching) and PK (expertise concerning teaching methods, evaluation, etc.). However, what was not there was PCK, which was expertise in approaching and handling the subject matter.

2.2.2 The TPACK model

Koehler, Mishra and Cain (2013) described the TPACK model as an effective teacher knowledge framework for technology integration. The TPACK model identifies various types of skills or competencies that educators require to effectively use technology in their teaching activities. Shulman's (1986) vital addition is that the TPACK model starts to explain specific and additional components of skills that subject teachers need to successfully use ICTs in their teaching activities (Jita, 2016). Jita (2016) claims that experience from the amalgamation of six types of skills components is described well by the TPACK model. The TPACK model forms the knowledge components and their relationship, which are mostly shown in the form of a Venn diagram. In the Venn diagram, there are three overlapping circles with TPACK in the centre, signifying the overlapping of all the skill elements. Figure 2.1 clarifies the six syntheses. The three main components of TPACK are TK, PK, and CK. The remaining knowledge components form the intersections emanating from the main components. In short, TPACK is the connection of the three main components. These components appear to be at the centre of high quality teaching using technological tools, and they are known to be content, pedagogy and technology. Graham (2011) noted that it is extremely difficult to grasp this type of knowledge (content, pedagogy and technology) in isolation; nevertheless, he claims that it should be treated in an evolving type that knows how these types of knowledge relate to one another. It may therefore be via the absolute or arrant aptitude of these overlapping factors that educators are capable to successfully become aware of the pedagogical use of technology.

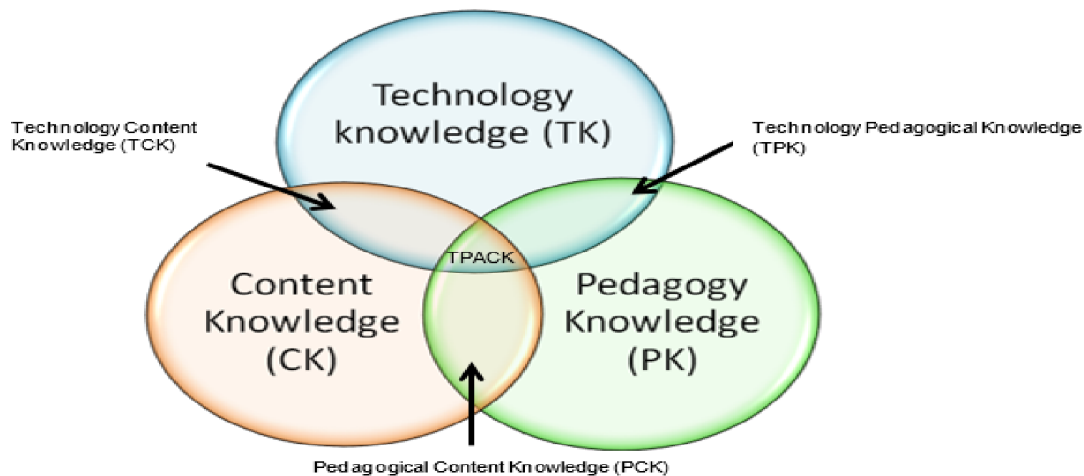


Figure 2.1: TheTPACK model

Source: Mishra *et al.* (2013)

This study used the conceptual framework of TPACK because it links classroom practice to theory, through what to teach (CK) and how to teach (PK), and demonstrates an understanding of how teachers can integrate ICTs into technical subjects. It is vital to be aware that the TPACK is a holistic framework that includes different parts of knowledge, and all the parts need to integrate with one another as one domain of knowledge (Harris, Mishra & Koehler, 2009, cited in Jita, 2016).

In general, the TPACK framework offers a pattern that illustrates the stability amid three interdependent components of teachers' knowledge, namely CK, PK, and TK (Jita, 2016; Harris *et al.*, 2009). In the next sections the researcher explores each of these types (the six sub-domains of the TPACK model) of skills, focussing on the connection between content, technology, and pedagogy.

2.2.2.1 Content knowledge (CK)

CK is the knowledge that teachers have on the topic to be treated (Koehler *et al.*, 2013). It is important for a teacher to have a comprehensive base of CK to be considered competent in their subject area. CK is one of the six sub-domains of the TPACK model that is linked to PCK and technological content knowledge (TCK). Technical subject teachers must be competent in CK (subject content and new and emerging technologies such as 3D printers, computerised lathes, 5G, wireless computing through IoT technologies, robotics, etc.). They have to understand and link different domains

when preparing to teach the subject matter (Shulman, 1986). Technical subject teachers ought to acquire these skills in order to be competent to assist their students to function globally. For teachers, it is essentially important to be aware that being a competent an educator is not about helping students pass their examinations and gaining their certificates – they must dig deep and acquire these new technological skills so that they can give students an edge and provide them with all the skills that are required for the future and being able to compete worldwide. According to Shulman (1986), knowledge incorporates ideas, theories, facts, and evidence or confirmation. Teachers should know the knowledge basics of the subject they educate because knowledge and the features of inquiry vary critically among the subject.

2.2.2.2 Pedagogical knowledge (PK)

PK falls under one of the three core components of knowledge in the TPACK. It is profound knowledge on the procedures and habits of teaching and learning, which encompass learning goals, ethics, approach, and others (Mishra & Koehler, 2006). PKT is a basic type of knowledge that relates to type of learners a teacher has in the classroom and their learning needs, remedial classes, assessment strategies and teaching approaches to be utilised. The world is operating in the 4IR now and teachers are compelled to possess the teaching methods and competence used in the 21st century (cf. 2.2).

Figure 2.2 below shows the nature of the 21st century structure and its importance. The 21st Century structure shows that education is multicultural and global. Information is quickly accessed, digital tools are fast changing and collaboration globally is easy. Therefore, due to emerging technologies, knowledge is readily available and teachers together with their learners should use ICTs to enhance teaching and learning. To effectively integrate ICTs in teaching and learning, 21st century skills should be investigated and incorporated in all teaching activities. These skills are learner centred, diverse, data rich and are discussed below.

2.2.2.2.1 Diverse learning

Diverse learning occurs when students consider their roles and interact in their groups or spaces (Care, Scoular & Griffin, 2016). In collaboration, students solve tasks at a high level compared to students who work individually. When integrating ICTs in their teaching and learning, students will be able to interact, share and learn globally with their peers.

2.2.2.2.2 Learner centred

It is associated with analytical thinking where learner grapple with the content, analyse, evaluate and give solutions to the given problems and challenges (Sheik & Siti, 2016). In a learner centred approach, learners take full control of their learning with the aim of determining the timing of their work (assignments, classwork) (Wohlfarth, Sheras, Bennette, Simon, Pimentel & Gamel, 2008).

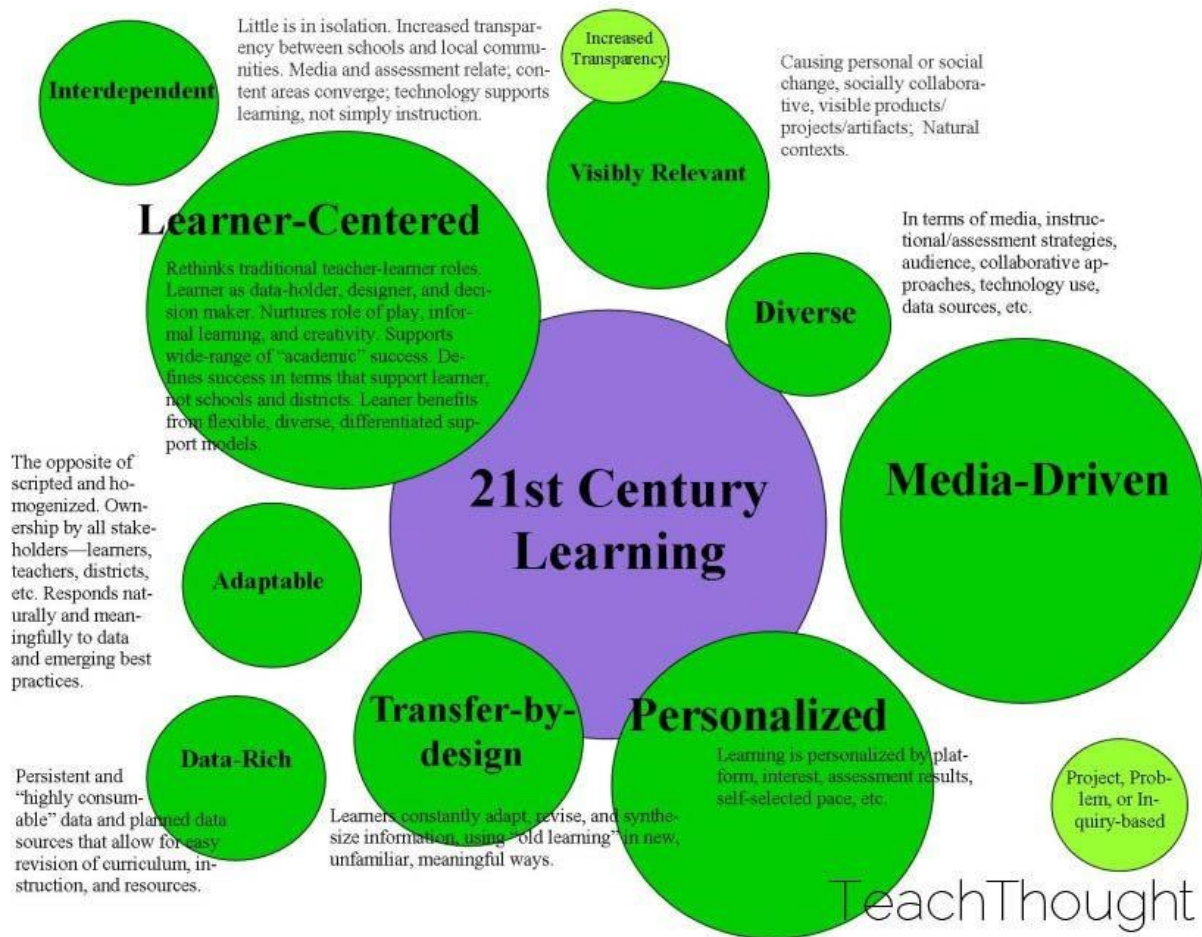


Figure 2.2: Twenty-first century learning characteristics. Source: adapted from Heick (2012)

An educator with profound PK knows how students build knowledge and gain skills in a separate fashion (Graham, 2011). As such, PK requires an understanding of cognitive, social, and developmental theories of learning and how they apply to students in the classroom.

2.2.2.3 Pedagogical content knowledge (PCK)

PCK is an intersection and relations of pedagogy and CK (Harris et al., 2009). Shulman (1986) labelled it a second kind of CK. This therefore means that PCK refers to the meaning given by technical subject teachers as they apply teaching principles in the context of the subject matter to enhance learning (Shulman, 1986). Integrating ICTs into

the teaching and learning of technical subjects provides a platform to expose technical subject teachers to a variety of learners, different teaching environments, and content that requires them to modify the curriculum to meet the requirements of all the learners, which is why PCK automatically features as teachers do their planning and implement teaching using ICTs. Teaching and blending content so that knowledge is accessible to all the students are very important; integrating ICTs is therefore one kind of skill that technical subject teachers must grow with the aim of being capable to be considered competent to teach content.

2.2.2.4 Technological pedagogical knowledge (TPK)

Mishra and Koehler (2006), Harris *et al.* (2009), and Koehler *et al.* (2013) were of the opinion that TPK is knowledge to recognise when teaching and learning transform during the introduction of technologies such as computers, the Internet, etc. TPK is therefore a skill that technical subject teachers can learn in teacher education programme courses, including designated ICT courses or methodology courses. It has the potential to develop only when technical subject teachers are provided with opportunities to practise teaching under varied conditions using various ICTs. Technical subject teachers should be competent to fully know the challenges and strengths of using ICTs when designing and developing lessons for different audiences. A competent technical subject teacher would require being competent to measure the significance of using ICTs to teach a particular section of the content or choosing one tool over another.

2.2.2.5 Technological content knowledge (TCK)

TCK is described by Harris *et al.* (2009) as the knowledge of how technology, in the form of ICTs, can influence and create new challenges in teaching new content and how teachers can use a particular technology to alter the manner learners practise and know concepts within a content area. Graham (2011) argued that TCK is knowing of the way in which technology and content knowledge change and limit each other. The assumption is that technologists develop technologies and technology integration

strategies; therefore technical subject teachers need to be fully competent in their subject matter and must also possess a sound knowledge of the different styles in which the subject matter can be imparted, particularly the practical use of ICTs in teaching and learning. The ability to operate ICT tools can therefore help enhance the significance of learning, as well as knowing one's subject matter, which is very important in the delivery of a lesson. Teachers should therefore be knowledgeable and appropriately use technology (Graham, 2011). The merging of ICT tools and the appropriate teaching of content are a key to the development of competent technical subject teachers.

2.2.2.6 Technology pedagogy (TP)

One other important generic element that is not singled out in the TPACK framework is TP. According to Teis (2014), a vital aspect of inferring the viewpoints of technology is that it requires educators to express the present type of technology in a discipline-specific way that allows related facts to spread. Wiener (1981, cited in Layton, 1993) contended that schools transmit their learning schedule as they are inclined to include CK that is disjoined from realism. Therefore, via the use of the TP method to teaching and learning and its global nature, technology intends to use experience and proficiency with knowledge in pursuit of administering (technological) knowledge in everyday events (Pudi, 2007). This concludes that technology education is about problem solving with a teaching emphasis/priority that focuses on both the product and the process (Teis, 2014). On the other hand, teachers should provide hands-on activities for learners. The TPACK model is the conceptual framework that gives technology teachers an aptitude for superior educational skill to teach concepts (De Miranda, 2008). The TPACK model is presently contemplated as a crucial framework for advocating the instructional competency of 21st-century teachers (Srisawasdi, 2012).

2.2.3 The importance of the TPACK model

The TPACK model is a knowledge framework that is acquired individually, and it denotes a motivational aim with an understanding of skills in training (Cook & Brown,

1999). Mishra and Koehler (2008) viewed it as “good teaching with technology” and considered it as “effective teaching with technology” (Mishra & Koehler, 2008).

The Committee on Innovation and Technology (2008) from the American Association of Colleges for Teacher Education revealed that the genuine product of the TPACK model, via researchers, is the power to build up significant learning knowledge for students that use technology efficiently. The TPACK model therefore envisions teachers’ knowledge about various technologies, which include knowledge about traditional technologies, including pen, pencil, and chalkboards, and also new innovative technologies such as the 3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers, to name a few. The conclusion is that the TPACK model has been widely accepted in the educational community as the theoretical model that grounds the desired implementation of effective technological practices (Hechter & Vermette, 2013). This therefore concludes that the TPACK framework is a consequential method to determine how educators could use learning technology to teach because it demystifies the kind of skill required for successful integration in the classroom.

However, as much as the TPACK model is important to teaching and learning, Mishra and Koehler (2006) stressed that educators require a profound, basic knowledge and mastery of information technology (IT) for handling facts, interactions, and tackling problems. These views coincide with this research perspective on ICT implementation in technical subjects and the required discipline-specific teacher knowledge needed to enhance technical literacy through the integration of ICTs into technical education.

2.2.4 TPACK applications and limitations

At an ideational level, this study details TPACK as a model for examining the various elements of the research that relate to the teaching of technical subject content utilising ICTs in schools. Plentiful research has been carried out on the integration of ICTs for teaching and learning that have used the TPACK framework (Teis, 2014; Jita, 2016; Lisene, 2017). Hence, to carry out this research, the researcher reviewed articles published in the past 10 years, where the TPACK model was utilised to evaluate pre-

service and in-service teaching of specific content. The review showed that the model has been used to examine how teacher preparation programmes in England prepare future teachers to teach their subjects using ICTs. The study drew from this research to explore the strategies used in the development of pre-service teachers (Haydn, 2014). These researchers concluded that, to prepare future teachers, there is a need for subject specificity in the use of ICTs. The current research focused on the integration of ICTs into the teaching of technical subjects in schools in Lesotho.

2.2.5 Rationale for utilising TPACK as the conceptual framework for this study

There are various prevalent frameworks that relate to the use of ICTs in teaching and learning (Jita, 2016). The researcher used search engines to find studies and articles from journals and books for this research; hence it is significant to justify the selection of the conceptual framework that was used in this research. Justification of the conceptual framework would assist in terms of its alignment with the aim of the research and the research problem. The TPACK framework was chosen because it is believed to have the possibility to produce facts to answer the main research question, namely: How are ICTs integrated into the teaching and learning of technical subjects?

For the TPACK model to be deemed the chosen framework, it was first compared to other frameworks that connect with the use of ICTs in teaching and learning. After the comparison, all other theories were rejected because they lacked relevance to the study, and the TPACK model was deemed the best framework for engaging in integrating ICTs into teaching technical subjects. According to Jita (2016), the TPACK model does not simply combine the three multifaceted and interdependent theories of technology, pedagogy, and content, but it also symbolises the relevance of certain skills of planning and technology, plus the practical use of ICT knowledge. The researcher chose the TPACK framework to study many of the concerns that occur when knowledge merges technology, content, and pedagogy in teaching Design and Technology. The TPACK framework originated from Shulman's (1986) theoretical framework that emphasised general aspects of teaching subjects. The TPACK framework adds the important technological aspects that can be used to enhance teaching of content such

as Design and Technology. The TPACK framework is therefore a useful model to study the use of ICTs as one example of the technological aspects with pedagogy and content during teaching practice.

2.3. GENERAL DISCUSSION OF ICTs

It is now a century after the missionaries first shouldered the responsibility for education in Lesotho. This included organising the schools, paying for and providing professional support to teachers, making available facilities, and providing the curriculum. Church halls and churches are used as classrooms and teaching and learning are often conducted in the open air, and even under trees.

The education system in Lesotho includes integrated early childhood care and development and lasts for three years. Primary education lasts seven years. Junior secondary education lasts three years, and senior secondary education lasts two years. There is also a parallel technical vocational diploma course (senior secondary and/or three years Technical and Vocational Education and Training) (Kalanda, 2012). There is curriculum reform that involves an exit from the subject and examination-based curriculum to a new dispensation wherein the curriculum is organised into learning areas reflecting practical life challenges (Raselimo and Mahao, 2015).

The government has, however, taken a huge step by building more schools to attempt to address the (situation) of having to hold classes in church halls and churches. According to Isaacs (2007), although the government of Lesotho has been concerned with education since the 1920s, allocating this duty to its churches means that much of the official education system is still administered by missions and is mainly managed by the three largest churches, namely the Roman Catholic Church, the Lesotho Evangelical Church, and the Anglican Church of Lesotho, under the direction of the Ministry of Education and Training of Lesotho.

Lesotho is confronted with serious challenges in education. Just about 25% of children do not go to school, specifically in rural areas (Isaacs, 2007). Isaacs showed that the expenses of school attendance, books, uniforms, and educational materials are

unaffordable for many families, particularly those who undergo family stress and poverty. There is a massive shortage of adequate classrooms, because of the lack of resources and implementation capacity. There is also the difficult terrain and climate; as a result, less than half of the classrooms meet the required standards. Lesotho's schools are also faced with a lack of financial resources required to convene the rising challenges for well-educated local teachers, the call for literacy, and for vocational and technical training outside the formal academic setting (Isaacs, 2007). Isaacs concluded by showing that efforts are being made to establish more practical subjects to make education more relevant.

Lesotho has a severely underdeveloped infrastructure (Farrell, Isaacs & Trucano, 2007; Chere-Masopha, 2011). Due to the above context, the researcher concluded that ICT use in Lesotho is still very minimal among the population at large.

2.3.1 The history of information and communications technology (ICT) in Lesotho

ICT has had a long history in its evolution process. Towards the end of the 1980s, according to Pelgrum and Law (2003), the term “computers” was replaced by IT, which signified a shift in focus from computing technology to the capacity to store and retrieve information. In the early 1990s, the term “information and communications technology” was introduced when e-mail started to become available to the general public (Pelgrum & Law, 2003).

The researcher regards the integration of ICTs in technical subjects in Lesotho as “a sleeping giant” because technical subject classrooms have not implemented ICTs as much as other fields have managed so far due to the heavy teacher workloads, poor ICT training and the fact that some schools are poorly equipped with ICT equipment (Alkahtani, 2017). The government of Lesotho ICT Policy (2005) reiterates that most of the teaching force in Lesotho lacked computing skills and there was little suitable training for e-learning, which made the integration of ICT into schools a difficult and challenging task. The integration of ICTs into teaching and learning is not a recent idea; it could be as old as other ICTs such as chalk, paper, television, and radio. However, the rapid emergence of discipline-specific ICT tools such as 3D printers, computerised

lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, programmable logic controllers, and web technology has propelled teachers to be interested in the use of ICTs (Odhiambo, 2013). ICTs should therefore be utilised not because they are available but because they can facilitate the teaching process and improve learning.

Earle (2002) wrote that integration has a sense of completeness by which all crucial fundamentals of a structure are perfectly jointed together to make a whole. Technical subject teachers should always or more often properly prepare ICT-integrated lessons; that is, ICTs and other crucial learning tools such as content and pedagogy should be jointed into one unit to achieve the objectives of the session.

ICTs are integrated when they are utilised in a flawless way to keep up and broaden the set of course goals and to commit students in a meaningful way during the learning process. The integration of ICTs is therefore a process rather than a product. Earle (2002) stressed that computers ought to be fixed into the curriculum and not vice-versa. The valuable integration of ICTs must centre on didactic planning by explaining ways in which the technology is utilised and for what reasons because efficient use of ICTs into the learning process has the ability to engage learners. Besides, most teachers are optimistic about the integration of ICTs as they are convinced that they can improve instruction (Aslan & Zhu, 2016; Selwyn, 2011).

Earle (2002) defined the integration of ICTs as the use of discipline specific tools or platforms to convey subject matter in the teaching practice. Ghavifekr and Rosdy (2015) referred to the integration of ICTs into education as the use of computer-based interactions that are incorporated into daily classroom instructional procedures. Lever-Duffy, McDonald and Mizell (2005) also shared a similar view by claiming that the integration of ICTs includes several kinds of technology utilised in the classroom by teachers. The integration of ICTs into teaching and learning of technical subjects is therefore generally seen as a technology-based teaching and learning process that directly relates to the utilisation of learning technologies in a technical subject classroom to make teaching and learning easier equally for the teachers and learners. It is because the integration of ICTs reinvigorates teachers and students that the

development and the value of learning by giving curricular backing in complex subject parts will be improved. Teachers should therefore be engaged in combined tasks and the improvement of the approach, which would involve teaching with ICTs that are motivating and inspired by real-world cases (Alkahtani, 2017). However, even though most teachers are aware of the significance and the need for the use of ICTs into teaching and learning, various studies have revealed that the use of ICTs into the school curriculum is still at a low level (Rosnaini & Mohd, 2008).

2.3.2 Definition of ICTs

Information and communications technology consists of three elements, where the term “information” is described as any representation of knowledge such as facts, data, or opinions in any medium (Boell and Kecmanovic, 2015). “Communication(s)” is regarded as an integral part of human existence (Alkilandeswari, kumar, Freeda and Kumar, 2014). It is referred to as the process of transferring information from a sender to a receiver with the use of a medium in which the communication information (the message) is understood by both. “Technology” is the practical form of scientific knowledge or the science of knowledge application (Wahab Rose and Osman, 2012).

ICTs are generally described in education as various groups of technological tools and resources utilised to impart, produce, distribute, keep, and handle information (Meenakshi, 2013; UNESCO, 2008; Basargekar & Singhavi, 2017). Hussain and Safdar (2008) defined ICTs as an array of devices that can assist to give accurate information at the exact moment when it is needed. Hennessy *et al.* (2010) and Almadhour (2010) revealed that ICT has quite a lot of explanations based on the type of its work, and for this, they believed that ICT is used as an umbrella term that comprise any interaction tool that includes radio, television, mobile-phones, and computers, to name few. From the educational context, ICTs help students gain access to learning readily and easily without the inconvenience of time and location (Jita, 2016). In this study, ICT is taken to be any platform that helps enhance smooth communication and improve teaching and learning among people at any time in any place. ICTs should therefore be used as mechanisms that effectively improve teaching and learning.

It is the skill of a person operating autonomously and maturely with others, to suitably and efficiently utilise technological tools to retrieve, handle, incorporate, assess, produce, and impart knowledge (Davies, 2011; Hansen, 2003; Smith, 2015). Ollis and Pearson (2006) defined technology literacy as the ability of a person to efficiently and maturely utilise technology to gain access to, handle, infuse, assess, produce, and impart knowledge.

2.3.3 Bloom's taxonomy of learning domains in the teaching and learning of ICTs

To effectively integrate ICTs into teaching and learning, teachers should employ Bloom's Taxonomy of learning domains. The three domains of learning are: cognitive, affective and psychomotor. These are discussed below:

2.3.3.1 Cognitive skills

According Zeng *et al.* (2017) and the World Development Report (World Bank, 2018), these are the main expertise the brain utilises to sense, study, gather, recall, analyse, and concentrate. Collectively, these skills take incoming information and transfer it into the pool of knowledge one utilises every day at school, at work, and in life in general.

2.3.3.2 Motor skills

Zeng *et al.* (2017) wrote that motor skills need the employment of slighter muscle groups to execute slighter actions with the wrists, hands, fingers, and the feet and toes.

2.3.3.3 Affective skills

Affective skills are associated with behaviours and the mindset students require to study in order to be efficient in their own and professional lives (Zeng *et al.*, 2017).

2.3.4 ICT tools used in teaching and learning

There are various ICT tools to enhance teaching and learning in schools. The following section discusses some of these. They are: Interactive whiteboards (IWBs), computers, mobile phones, and robotics.

2.3.4.1 Interactive whiteboards (IWBs)

IWBs, also referred to as electronic whiteboards, are one type of classroom technology (Karsenti, 2016; Benoit, 2018). An IWB is a big touch screen that allows the user to interrelate with digital subject matter in a fashion that is not possible with a normal computer-projector (Maher, Phelps, Urane & Lee, 2012; Gregorcic, Etkina & Planinsic, 2017). An IWB, or smart-board, is therefore a cooperative display in the set-up of a whiteboard. An IWB reacts to direct user input or via other devices; for instance, a conventional IWB installation includes an electronic whiteboard connected to a networked computer and a data projector (Al-Qirim, 2011). Standard whiteboards have been regularly utilised for quite some time now as a way for people to present information, share messages, and employ in joint correspondence and thought growth. It is with these joint purposes that IWBs have the capacity to connect to the Internet and promptly digitise tasks and operations.

IWBs vary among large-format screens with a separate system on a chip and combinations of video projectors or smart projectors, and these ones use a tablet or other devices with drivers for user interaction (Rouse & Haughn, n.d.). Forms of operation are often either by infrared, resistive touch, magnetic or ultrasonic pen. IWB software often comprises easy-to-use charts, polls, and graphs, including virtual versions of tools one might locate in a classroom, such as rulers, compasses, or protractors (Maher *et al.*, 2012; EZ Talks.com, 2017). They can show several kinds of media and help teachers design cooperative lessons for their students. IWBs are of utmost importance in the smart classroom. For example, in a Basic Handcrafts class, the teacher might be giving a lesson on isometric projection in freehand sketch to show learners how it is done. An IWB permits teachers and learners to collaborate on the same script and for the entire class to participate. The same IWBs can save the joint

activity for later use by students as a point of reference in the absence of a teacher. The use of IWBs in the lesson of technical subjects (Basic Handcrafts) can improve teaching and how students learn. The availability of IWBs has made teaching simple and inspiring to teachers because it offers interesting and exciting lessons to learners and grasps ideas in an improved manner (Dube, Nhamo & Magonde, 2018). Benoit (2018) reiterated that IWBs enable inventive teaching practices and learning experiences. The following are examples.

a) Integrated technology

In the traditional classroom, the teacher is the source of information and transmits knowledge to learners (Bada, 2015), but when integrating IWBs into teaching and learning, it allows many other ICTs to enhance students' learning. These devices can be video cameras, computers, microscopes, cameras, mobile phones, and/or tablets that can be attached to the boards to enhance instruction, and consequently, the possibilities are endless. That is, learners can connect their mobile phones to the smart-board and transfer the topic being dealt with, manipulate the content, and even share it with their companions in other schools (Harlow, Cowie & Heazlewood, 2010).

b) Enhanced education

While some students are auditory learners who enjoy obtaining information verbally from their teachers who are transmitters of knowledge, others are visual learners who learn better by seeing something. IWBs provide almost all learners, if not all, with the chance to absorb information in various formats (Dostal, 2011). This assists learners to learn efficiently.

c) Improved learner contribution

Pictures and figures obtained while utilising IWBs can be saved and printed, therefore learners are encouraged to fully take part in learning or combined discussions at a more purposeful and occupied way rather than being forced to take notes during discussions (Khambari, Hassett, Thomas & Wong, 2014).

d) Enhanced learner teamwork

Integrating an IWB into lessons enhances teaching and learning because it encourages learners to work together efficiently (Saw *et al.*, 2008, cited in Maher *et al.*, 2012). It permits students to turn into fulltime partners of the process, instead of merely being the receiver of organised information by the teacher as the source of knowledge. When learners are part of the content, they learn by seeing and remember better. The interaction with the IWB through touch makes them understand and remember better than when only hearing the teacher.

e) Improved feedback

Using traditional ways of teaching results in a delayed transmission of feedback. Students can be provided with an instant response through an interactive medium where they can pose a question and seek answers at the same time about the topic they are treating. Furthermore, it can provide immediate feedback and immediate assessment to the learners. The IWB is therefore depicted as a helper of whole-class teaching with the ability to confidently influence pedagogy, inspiration, communication, opinions, and accomplishment (Benoit, 2017).

f) The Internet connection

The use of IWBs is more dynamic and flexible because they can be connected to the Internet (Maher *et al.*, 2012; De Vita, Verschaffel & Elen, 2018). When connected to the Internet, they are a resource of online information and tools in which picture, content, and supplements from other software programs (e.g. Basic Handcrafts software) can be joined and manoeuvred on the screen by teachers (De Vita *et al.*, 2018). It is therefore possible for teachers to access a variety of resources to improve and back their lessons via YouTube, videos, pictures, educational tools, and many more. On the other hand, learners also have an abundance of rich resources for research and learning.

To conclude, IWBs permit learners to interact with the learning material and become full partners in the lesson. IWBs allow them to draw or write on the board to express their comprehension of the subject matter, and as a result, they are fully engaged with the learning content.

2.3.4.2 Computers

The computer is a technological innovation under the control of stored programme that can perform some of the intellectual roles of man even beyond human capability (Tayo, Ajibade & Ojedokun, 2009). Albarkati, 2016) shared the same idea that it is an electrically powered device equipped with electronic circuits, storage compartments, USB slots, and many others. The researcher therefore defines a computer to be various devices combined to solve problems after accepting data, processing the data, and then giving the desired results.

The world is fast advancing and is operating in Industry 4.0, yet some operations are still in Industry 2.0. In Lesotho, in particular in the education sector, the curricula are still not explicit on using ICTs to improve teaching and learning. It is the choice of the teacher whether to integrate ICTs into their lesson or not.

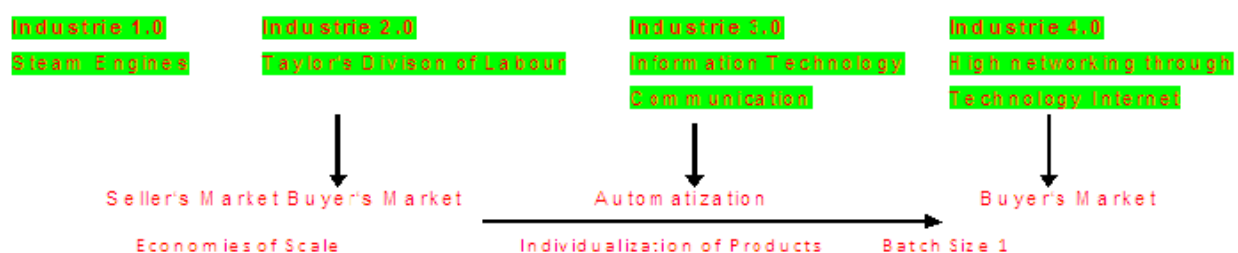


Figure 2.3: Fourth Industrial Revolution (4IR) structure

Source: Conversio (2016)

The Fourth Industrial Revolution (4IR) creates a world in which virtual and physical systems of manufacturing cooperate in a flexible way at the global level. In teaching and learning, the structure denotes the use of ICTs by teachers and learners interacting globally to enhance teaching and learning. Favourable learning environments are promoted via the effective use of ICTs, and it is through these favourable learning environments that teachers and students are competent to achieve good participation in the achievement of academic goals. Teaching and learning in the Fourth Industrial Revolution provides such environments.

The use of computers to enhance instruction in the classroom has caused many reforms to teaching. The world is currently in the period of knowledge growth, and every concerned stakeholder needs to be acquainted with the use of computers to enhance teaching. To meet the requirements of Industry 4.0 and do away with old-fashioned habits, technical subject teachers need to integrate ICTs, e.g. computers, to be acquainted with the desires of the learners in teaching and learning. With computers, teachers can install software known as automated computer-aided design (AutoCAD). AutoCAD is a 2-dimensional and 3-dimensional computer-aided drafting software application utilised in structural design, construction, and manufacturing to help in the grounding of drawings and other engineering plans (Yarwood, 1994). It is used for a number of applications such as producing any technical drawing regardless of whether it is complicated or not.

Rather than using T-squares, drawing boards, set squares, and many others in a drawing room and consuming a great deal of time to draw and redraw objects, CAD software installed on a computer can be used to quickly and accurately produce such drawings because the duplication of sketches or pictures is simple, quick, and consistent in dimensional exactness and accuracy. Drawings or parts of drawings can easily be placed on other drawings, which avoid having to draw the same detail twice. The Zoom Command Facility function enables the user to spot small facets on a bigger vision.

In a technical subject classroom, learners could be exposed to this technology, given tasks to perform, record them on the computer, and submit online to a teacher for corrections.

Computers have an important part to perform in the educational structure, and although they are comparatively new in the education system, they have proved to be an efficient and vital technology in current education (Akom, Asante & Frimpong, 2016). Computers are used actively in education to improve quality and learning outcomes (Matthew & Nwamaka, 2019). The use of a computer stimulates a modern mood where teachers and students can cooperate and work together to discover new skills and insights about any subject matter and solve difficult tasks (Tedla, 2012). To prepare lesson plans,

teachers can use audio, video, and graphic aids through a computer. Technical subject teachers can use Microsoft PowerPoint to deliver electronic presentations to learners, as it is a very good aspect of interactive pedagogy. Multimedia projectors can be used to portray these presentations in the classroom where everyone will be interested in the latest teaching methodology because they are easy to deliver by the teachers and suitable for interactive participatory pedagogy. They also capture learners' interest and are easy to learn. Multimedia presentations save a remarkable amount of attempts and time and ensure increased productivity in overall classroom management (Matthew & Nwamaka, 2019).

2.3.4.3 Mobile phones

The manner in which teaching and learning activities have been performed lately has been revolutionised by the introduction of ICTs such as mobile phones. Mobile phones aid instant access to information resources required for teaching and learning. Odiakaosa and Jere (2017) insist that most teachers, if not all, can utilise mobile phones for the communal exchange of ideas, which also links them to the combined learning. This means that mobile phones are capable of enhancing the accessibility of information and exchange of information from learners to learners and teachers to learners. Mobile phones improve communication and promote cooperation and collaboration in teaching and learning. Msungu and Mtega (2012) posited that ICTs such as mobile phones are regarded as cost effective because they facilitate collaboration among learners and teachers as well as enhancing pedagogical enhancement via simulations, virtual experiences, and graphic representations. Mobile phones provide a conducive and rich platform for teachers and learners in a teaching process.

Mobile phones expand teaching and learning from inside to the world beyond classrooms walls. For example, in a Basic Handcrafts classroom, a teacher can teach using a cell phone; that is, he or she can record a video of him- or herself presenting a lesson and share it with his or her learners via e-mail, YouTube, WhatsApp, or Facebook because the expansion of web technology invokes more opportunities for teaching. The

internet connectivity of mobile phones rises above problems brought about by distance among learners and teachers (Msungu & Mtega, 2012).

Mobile phones are used by many people, particularly learners. Mobile phones have many applications that teachers and learners can utilise in their educational activities. Teaching and learning that occurs via mobile tools and platforms are known as mobile learning (Msungu & Mtega, 2012). Guy (2009) stated that “mobile learning is an electronic learning (e-learning) via mobile computational devices”. Therefore, it could be concluded that mobile learning is a process where students can access learning materials freely and easily on their own time, space and place. It therefore means learners can grapple with the content and submit their work to the teacher, and the teacher marks and provides feedback immediately. Mobile learning supports audio, video, and images; it is therefore extremely useful for innovative and modern teaching methodologies. Teaching and learning in the digital era are fast-paced, and graphics are visually appealing and engaging; the learners in the classroom therefore engage more when exposed to these tools. They keep their attention on par in an effective fashion.

2.3.4.4 Robotics

Robotics have immense ability in being utilised as learning technology and are therefore developing into an essential part of society (Mubin, Stevens, Shahid, Al Mahmud & Dong, 2013). Robotics could be utilised for students’ growth and progress. Robotics can be an amusing platform to learn about various subjects and particularly technical subjects. Mubin *et al.* (2013) stated that “educational robotics are a subset of educational technology and they are used to facilitate learning and to improve the educational performance of students”. Educational robotics is a discipline that improves students’ experiences via hands-on and minds-on learning (Afari & Khine, 2017).

Robotics are a learning system that decide the educational influence of robotic function (Alimisis, 2012). Mubin *et al.* (2013) argued that robotic technologies are not sheer equipment, but fairly prospective mechanisms of alternate patterns of contemplating teaching and learning. Via robotics, learners are able to create palpable articles that they can either handle or find significant when they learn. Learners are encouraged to

function on investigative projects with particular utilisation of attainable resources (Bushnell and Crick, 2003). The focus should be on their own interests, learning strategies, and research in robotics. They should search for solutions to real-world problems. When learners engage in work regarding programmable robotic constructions in their different groups, they should first discuss the given tasks (Papert and Harel, 1991). Afterwards, in their plenary sessions, they should also devise an action plan to unravel the problem. When the plan is complete, they should then implement it, not forgetting the feedback they received from their teacher (Alamisis, 2012). Learners can undertake experiments with simple programmable mechanical devices for cutting wood in the workshop and associated software (Belpaeme, Kennedy, Ramachandran, Scassellati and Tanaka, 2018). After preliminary work, learners may spot a problem, and then they are advised to redefine the task plan with the experience they have gained. At this juncture, the teacher would ask the learners to synthesise their findings and reach conclusions (Alamisis, 2012). Learners would also be asked to provide solutions to the task at hand. After completion of the final work, learners in their groups should discuss, evaluate, and present their work. Finally, in their groups, learners are to reflect on their work, express their views, document their experiences, and then post these on any ICT platform to encourage more views and promote collaboration from one learner to another (Alamisis, 2012).

The following paragraph is a conclusion on ICT tools used in enhancing teaching and learning

2.3.4.5 Conclusion on ICT tools

The teaching and learning process nowadays is no longer bound to the physical classroom because ICTs offer flexibility in terms of time, space, and place (Rosnaini & Mohd, 2008). Learning does not only occur in physical spaces such as classrooms. Therefore, devices such as computers, mobile phones, robotics, interactive whiteboard and many other ICT tools not only enhance the learning in face-to-face classes but also outside the classroom. For example, ICTs such as televisions and computers deliver

information all over the world and people are able to learn from others across multiple physical spaces. Academically, teachers perform a significant professional role in ensuring that the integration of ICTs into teaching and learning is educationally sound for every learner. New technologies provide encouraging ways to assist with teaching on the level of the student (World Bank, 2018). High levels of interactivity among teachers and students, as well as among students and the technologies they use should be effective when using ICTs into teaching and learning processes. Teachers ought to evaluate the effectiveness and appropriateness of available technologies before deciding when and how to utilise them with their students. Recently, the demands and uses of ICTs in formal learning environments such as schools and higher education institutions have been on the rise. For instance, the Ministry of Education and Training of Lesotho created a policy that compels every higher education institution in Lesotho to improve their ICT services in order to improve and back teaching and learning, studies, and other tasks (Ministry of Communications, Science and Technology, 2005). Lesotho is among the developing countries that have witnessed growth in ICTs in various industries and at the same time witnessed an improvement in the active usage of ICTs in other sectors, including education. This study aimed to understand how ICTs are integrated into teaching and learning technical subjects in Lesotho.

2.3.5 ICTs in schools

It is common practice that, before teachers can join teaching professions, they are educated to suit the demands of the subject matter. With 21st-century ICTs, the same is expected of teachers; that is, teachers should be educated so that they become competent in the use of the ICTs to enhance teaching and learning (Aslan and Zhu 2016). The government therefore needs to be clear on the integration and good employment of ICTs in schools. The use of ICT in and for education is quickly escalating in various countries and is currently perceived globally as equally a need and a chance for enhancing and developing the education worldwide (Rampersad, 2011). Therefore, it goes without saying that in most developed countries, in Europe for example, the use of ICTs is considered a requisite skill for teaching and learning. Likewise, the Lesotho government also is trying to close the gap in terms of ICTs for the

entire country. For instance, the government has developed the ICT Policy as a tool to allow Lesotho to attain its growth aims as expressed in the Lesotho Vision 2020 Policy Document (Ministry of Communications, Science and Technology, 2005). The ICT Policy of 2005 was intended to succeed the Lesotho Telecommunications Policy of 1999, by taking the directive of organised ICT infrastructure further so that Lesotho's Vision for 2020 can be achieved. In response to these demands, the government also outlined the Higher Education Institutions Policy Objectives, which state that all public higher education institutions in Lesotho should be enabled to improve their ICT services in order to improve and back teaching and learning, study, and other tasks.

However, as much as the labour markets in Lesotho have started to demand school graduates who can utilise technology proficiently to improve efficiency and vision, and despite how hard they have struggled to set policies to warrant that ICTs in the country are entirely used, there are still many trials that hamper the success of technology projects in Lesotho (Higher Education Policy for the Kingdom of Lesotho, 2013). There are contradictions between what the policies are claiming and what exactly is taking place in the classroom.

2.3.6 ICT as a changing factor in the learning process

Lateh and Muniandy (2010) wrote that the presentation of ICTs in learning could create opportunities for improvement. It also provides an increase or contests, demands, and modifications to active means (Laurillard, 2006). This calls for a substantial change in education policies, pedagogy, and training for sectors and teachers.

ICTs are of the greatest value in education systems. In the ways of working of teachers as well as other members of educational institutions, ICT utilisation has brought about massive enhancement. Within the teaching and learning processes and instructional strategies, the approach to ICT has a positive effect on the system of education; educational institutions are therefore able to perform their duties in a manageable and well-organised way. Favourable learning environments are promoted via the good use of ICTs, and it is through these favourable learning environments that teachers and students are competent to achieve good participation in the achievement of academic

goals. ICTs provide an encouraging or supportive learning environment to students so that they can vigorously and passionately participate (Kaur, 2015). The Ministry of Education and Training of Lesotho provides the content and syllabus, and this is regarded as significant, but it is vitally significant for teachers to prepare thoroughly before they go to class to deliver their lessons. The use of ICTs promotes independent learning and makes classrooms interesting and livelier, and thus improves students' achievement (Kaur, 2015). Teaching and learning in the 21st century puts further weight on planning on the part of the teachers and leads the students via a succession of structural cycles to get the needed outcomes. With the help of discipline-specific ICTs, and by integrating them into lessons, teaching and learning become easier and more effective than merely memorising facts.

Nowadays, the teaching and learning process is no longer bound to take place in physical classrooms because ICTs offer flexibility in terms of when students learn, why they learn, and where they learn. Recent ideas, incorporating learning on demand and mobile learning, allow students to obtain instructional services anytime, wherever, and whenever they need (Mahmud & Mohd Arif, 2008). It is evident that ICTs influence the excellent and quantity of teaching, learning, and research in traditional, ICT-sourced classrooms, and distance education institutions (Yusuf, 2005) because they inspire and involve students in learning. Yunus, Nordin, Salehi, Sun and Embi (2013) disputed that the employment of computer technology could trigger drained thoughts among students as they might not consider their work earnestly and besides that, the students' understanding ability acquired from scrolling on a computer screen could lead to enthused but trivial or incorrect understanding of the subject matter. However, Yusuf (2005) reiterated that ICTs can give a true opportunity for personal lessons, as well as enhancing teaching and learning through their interactive, active, and engaging subject matter.

ICTs possess the ability to speed up, improve, and extend skills and to stimulate and engage students in teaching and learning. Mutuku and Ogutu (2018) claimed that good utilisation of ICTs can change the type of education in terms of where and how learning takes place, as well as the responsibilities of students and teachers in the learning

process. Shadreck (2015) asserted that the adoption of ICTs in the classroom will give learners adequate facts of particular topics and will thus enhance teaching and learning, as well as develop professional productivity.

The integration of ICTs in didactical arrangement acts as a force for transformation in the field, which is why Adesote and Fatoki (2013) stated that ICTs actually are tools that promote, inspire, and encourage autonomous learning. The ability to teach autonomously is strategic, reliable, and should be utilised as a benefit. Learners no longer have to wait for a teacher during specified and strictly stipulated timetables for lessons. ICTs have the ability to develop the value of teaching and learning variously; for instance, by enhancing teacher training and developing learner enthusiasm and involvement in the subject matter (Dela Rosa, 2016).

For teachers to realise the potential of ICTs as a learning tool, ICT-based programmes in schools must be intensified because, as Aladejana (2007) stated, ICTs can promote an encouraging, interactive teaching and learning environment, generate larger learning communities, and present educational tools for students. It is therefore of the utmost importance for teachers to allow, encourage, and engage learners in the integration of ICTs in the form of computers, Internet technologies, printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies and robotics to improve their intellectual abilities.

Even though ICTs are of the utmost importance to teaching and learning, they may also impact negatively on students. Mikre (2011) argued that students could be perplexed by the myriad of accessible information from which to select. The availability of Internet sites that are offensive portray a genuine danger because learners may be inclined to waste most of their learning time on web pages that have offensive content, such as erotica material (Devadason, 2010). Devadason (2010) further stressed that the easy accessibility of the Internet place students in an experimental position that frequently opposes efficient learning in the rigid timeframes of formal school structures because, as Mikre (2011) argued, with no teacher guidance and management, students may easily abuse the technology for leisure activities and consume less time learning efficiently. How easily students switch to websites and chat rooms such as Facebook,

Twitter, WhatsApp, and many other interactive platforms is one of the other apparent shortcomings of ICT integration in teaching and learning.

It can therefore be concluded that the integration of ICTs to gain access to websites containing unwanted and distractive content could force some students to acquire disruptive actions because some learners might be inclined to emulate anything they come across on these Internet sites (Mathevula & Uwizeyimana, 2014). Information security must be activated to deny learners access to unsolicited websites. Furthermore, teachers must play their role to try to ensure that students use websites related to the learning content.

For effective school reform, there should be existing practice for determining what motivates teachers as a starting point for change (Fullan, 2008, cited in Orlando, 2011). Pedagogy is the art of what teachers perform whilst they work together with students to promote learning (Odhiambo, 2013), and this also includes the attitudes and beliefs of teachers and their teaching approaches, learning skills, and learning environment. Technical subject teachers must be actively involved in the whole instruction for established elements of ownership of the innovation (Hong, 2016). Pedagogically, instruction is gradually defined by teachers' use of ICTs (Patel & Patel, 2017). For this reason, ICTs in education are a key aspect that requires the establishment of the latest technologies in improving pedagogy (Patel & Patel, 2017).

ICTs are pedagogical apparatus that may offer a means to reconsider and reform learning systems and processes; hence heading to worthy education for everyone (Patel & Patel, 2017). Patel and Patel (2017) further explained that pedagogy through the integration of ICT platforms stimulates educational technologies and understanding of the skills essential to advance in the 21st century. The emphasis is that in this era, there is a need to ensure that educators are information literate. To achieve this goal, Al-Bataineh & Brooks, (2003) insist that teachers have an obligation to obtain sufficient in-progress education. Technology employment should be coordinated to the curriculum's philosophy and model of learning, and a good number of computers must be placed in the classroom (Al-Bataineh & Brooks, 2003). ICT-based resources help teachers and learners to freely construct information, collaborate, and share information

with others anytime and anywhere. In this era of the knowledge society, ICTs therefore perform a key role (Makhasane & Fru, 2017) in teaching. Accordingly, there is a great need for governments to provide technology-driven tools to create innovative teaching areas.

With the provision of ICTs, teachers should recognize the advantages and disadvantages of connecting online (Jegede, 2008). These digital tools and resources signify a new realm of interactive communication, which is essential for success in the twenty-first century (Fullan, 2013). Therefore, ICT integration into teaching is one of the most vital ways of building successful interaction, ICT competencies, logical thinking, team working and confidence for successful transition in the classroom. This could as a result alter the manner in which people access and use information.

Jimoyiannis, (2008) stressed that effective and efficient interaction is necessary for changing teachers' habits of instruction. Butcher (2011) also underlined that ICT accessibility and employment in education can allow teachers to connect innovatively in this knowledge society era. The integration of ICTs could modify the teaching and learning approach in schools because it is a channel intended for the development of the teaching and learning process.

The 21st century is a time for the Lesotho education system to highlight and evolve Technical subject teachers' competencies. It is a period that deems ICTs as the main tools vital for general growth of competencies to bring back teachers' educational value (Comber & Lawson, 2003). These ICT competencies include: critical thinking, problem-solving, creativity and innovation. ICTs are tools that have the ability and the power to alter the directive (Comber & Lawson, 2003).

Employing technological-based resources for educational functions needs investment in sustaining teachers' training. Lesotho has a lack of ICT professionals and a shortage of educators with ICT skills (Butcher, 2011 & Chere-Masopha, 2011). Therefore, teachers with an inadequate understanding, ICT skills and knowledge find it difficult to integrate ICT materials to engage and enhance teaching. The existence of ICT resources will offer more variable and valuable ways for lifelong professional development (Khan,

Hasan & Clement, 2012). The lack of teachers' professional skills development hinders their integration of ICT tools for information (Kim, Kim & Lee, 2013). Therefore there should be recognition of well-prepared ICT teacher training and needs regarding ICT integration (Hong, 2016). As a result, teachers' professional development would be a platform for them to commence and plan to share materials and ideas aligned to their respective fields of study.

2.3.7 Teaching technical subjects using ICTs

Despite many changes in curricula and in the development of new technologies, some researchers state that classroom teaching and learning have not changed much over the past 50 years or so globally (Cuban, 2013; Twenge, 2009). Agbetuyi and Oluwatayo (2012) argued that the use of ICTs has improved entry to isolated learning resources because teachers and learners no longer have to depend only on physical media housed in libraries for their educational needs. Various ICT tools have been used for centuries and teachers used them to match the context of pedagogy to enhance the value of teaching (Manning & Johnson, 2011).

Nowadays, the search and exploration of available technology still apply to the utilisation of various ICTs, including the Internet, to teach a series of topics that are covered in the school curriculum (Jita, 2016). Nevertheless, in many of the schools in Lesotho, the integration of ICTs into teaching and learning is still merely lip service. Learners' learning abilities and efforts are therefore compromised. Technical subjects are technology based. It will be more appropriate and fruitful to a learner if ICTs are integrated into the teaching and learning of technical subjects. In the teaching of technical subjects, teachers should invent an interactive teaching and learning platform to maintain students' curiosity in the subject. By law, teachers are curriculum employers and they should therefore make ICTs a vital part of the teaching and learning process.

Pedagogically, teaching is increasingly being defined by teachers' integration of ICT devices (Patel & Patel, 2017). Equally, the successful integration of ICTs to enhance teaching and learning relies on the preparation of teachers (Mwalongo, 2011). Alkatani (2013) also showed that the ICT equipment should be available and in good condition.

ICTs in education entails the establishment of the most recent ICTs to guarantee sustainability of pedagogy (Patel & Patel, 2017). Most secondary schools in rural Lesotho do not have ICT-based materials, and therefore one cannot value ICT-support mechanisms utilised in ICT-based instructional deliveries. Integrating ICTs require resources such as computers, tablets, cell phones, and the Internet, to name few, which are not available in most schools. With a call for such availability, sustainability and change, ICT tools could offer a way to rethink and redesign the educational system and processes and thus lead to quality education for all (Patel & Patel, 2017).

Technical subjects are practical subjects, and they inspire people to observe and understand the world in various ways (Currie-Adler, 2016). With ICT, environmental proximity cannot hamper knowledge but present more possibilities for sharing, archiving and retrieving knowledge (Taleba & Sohrabib, 2012 in Makhasane & Fru, 2017). Makhasane and Fru (2017) argue that ICT-supported teaching is a crucial process of skills and knowledge construction in this digital era. Teaching is a profession that could promote and back ICTs as tools for knowledge creation and skills in the digital era. The use of ICTs in teaching and learning would be a motivation for both teachers and learners to engage in online educational practice.

2.3.8 The need for the use of ICTs in schools

With the intention of achieving various goals and to enhance the value of classes in all subject areas, as well as in technical subjects, the integration of ICTs into schools is needed (Gulbahar & Guven, 2008). Because ICTs dominate all developments based on information, it is vitally important that society as a whole becomes technologically competent, which particularly means technical subject teachers. As a result, this requires every school to be furnished with the needed ICT tools for easy access from one generation to the next to obtain the required skills. Gulbahar and Guven (2008) stated that, to ensure the thriving use of new technologies, any in-service training requires review support, peer coaching, and peer dialogue. It can be concluded that it is not enough to merely provide schools with all the equipment needed to facilitate

learning and in-service training, but the concerned teachers must be actively involved in the entire transformation process so that there is an element of “ownership” of the improvement(s) (Gulbahar & Guven, 2008). In starting their new responsibilities, teachers are required to improve their skills and gain new knowledge in their pedagogical practices and curriculum growth to be able to efficiently use ICTs in teaching and learning (Odhiambo, 2013). Schools should therefore revise their teaching programmes, reconsider their practices and resources, as well as look into their philosophy to ensure that ICTs are used in entire sections of learning structures for use in management, institutions of higher learning, and in the classrooms for teaching and learning activities. Merely equipping schools with the required ICTs does not produce more efficient learning spaces or upgrade the quality of instruction. Strong emphasis should be placed on providing teachers and students with appropriate ICT proficiency in the hope that this will allow them to accept the positive employment of ICTs in teaching and learning.

2.3.9 Factors that influence the quality of education via the use of ICTs

When promoting the quality of education through ICTs and attempting to implement it, there are certain aspects that need to be considered, and they are discussed in the following sections.

2.3.9.1 Defining learning objectives

Guilbrt (1984) insists that defining learning objectives are essential to teachers as well as their learners. Khan, Hande and Singh (2015) assert that defining learning objectives assists in scheming, lesson preparation and determining suitable teaching methods. Learning objectives help to clearly communicate with students the course expectations of the content and performance (Faulconer, 2017). The ICT curriculum fosters the growth of ICT insights and skills with the aim of accomplishing general digital literacy (Horta, Mendonca & Nascimento, 2012). Therefore, the teacher should create student autonomy, encouraging an environment for student exploration.

Chatterjee and Corral (2017) stated that learning objectives are clearly written and specific statements of observable learner behaviour that can be measured upon the completion of an educational activity. Every organisation sets rules and regulations, goals and objectives. Educational institutions at all levels have certain learning goals and objectives. For instance, educational institutions attempt to ensure that teaching and learning processes are organised in such a way that students grow and develop effectively and that their knowledge is extended in a manner that makes them fit to successfully achieve their personal and professional goals. The teaching and learning methods and educational programmes can be effectively assessed. This would occur within the framework of learning goals.

2.3.9.2 Leadership skills

McPheat (2010) postulated that leadership skills are the social graces and ability a person should possess with the aim of being capable and powerful in motivating and directing others. Students, teachers, principals, and parents should work in collaboration with one another when ICTs are to be integrated within the curriculum and instructional methods. There must be meetings with discussions of various matters, and they must give one another ideas and suggestions; for instance, the roles each stakeholder will perform to make the integration of ICTs a success. Schools with better management have better test scores (World Bank, 2018). It is therefore the job of the principal and education inspectors to guarantee that teachers, together with administrative staff members, are supplied with the needed tools to make good use of ICTs in a well-organised way.

Effective leadership means having school principals who are diligently involved in assisting teachers unravel issues and who offer instructional advice (World Bank, 2018). Robinson, Lloyd and Rowe (2008) and Waters, Marzano and McNulty (2003) affirmed that it also means having principals who set goals with teachers to draw up and attain high levels of learning. The World Development Report (World Bank, 2018) concluded that these factors are correlated with the highest levels of student learning, and that efficacious school leadership improves the quality of teacher-learner interactions.

The Ministry of Education and Training is also accountable for organising workshops and training programmes for teachers and staff. Staff and teachers will then be capable of extending their skills and understanding with the knowledge gained via workshops and training in teaching and learning. It is thus their duty to make sure that they integrate ICTs in an operative manner to enhance student learning and to assist them to reach their aims and purpose. The role of teachers in the integration of ICTs is important because they serve as gatekeepers for students' contact to their ICT surroundings. This relies on the teacher's attitude regarding ICTs (Hong, 2016). Hong (2016) pointed out that teachers' reluctance in terms of the implementation of ICTs may deny their students the chance to employ ICTs. Therefore, for this purpose, principals and teachers need to demonstrate good leadership skills and thus make good use of ICTs towards achieving the goals and objectives of their learners.

2.3.9.3 *Managerial functions*

For the good functionality of every educational institution, knowledge, skills, and abilities are among the qualities each individual should possess regarding managerial functions (Rahman, Mahmood & Farooqi, 2019). Planning, organising, directing, and controlling are a few examples of these. Individuals need to prepare and plan for a good number of approaches and methods when they need to integrate ICTs to make improvements in the quality of education. There is therefore an obligation to make sure that resources are utilised properly in a well-organised way.

2.3.9.4 *Decision making*

Decision making is a major responsibility of all administrators, but until decisions are converted into action, they are only good intentions (Simon, n.d.). Therefore, in every organisation and educational institution, decision-making processes are seen as an integral part, and when working for the improved integration of ICTs into teaching and learning, productive decisions must be made (Abubakar, Elrehail, Altailat and Elci, 2019). These decisions will prove to be beneficial in improving the quality of education for all members. Various types of ICTs are used in educational institutions; every

stakeholder who participates in decision-making processes therefore needs to consider various factors, such as environmental conditions, the age groups of students, subjects, learning abilities, and financial resources (Dietrich, 2010).

2.3.9.5 School context

There are different features that have to be considered in the school context. These factors include school location, size, number of classrooms, number of students, teachers and staff members, average pupil socioeconomic status, and the overall environmental conditions that influence the quality of education through ICTs. The Ministry of Education and Training of Lesotho, parents, principals, teachers, and learners should therefore ensure that, when ICTs are being put into operation, these factors are not affected negatively. ICT teacher training is crucial and useful when teachers are taught using ready-to-use classroom materials that fits into the teachers' curriculum (Hong, 2016). This means that teachers should acquire the necessary skills to be capable to use ICTs for the improvement of teaching and learning.

2.3.9.6 School resources

In every educational institutions, the availability of resources and infrastructure is of the utmost importance. Cuban (1993) recommended that the positioning of computers within the reach of teachers and within accommodative school cultures is significant so that teachers and students can enhance their ICT capabilities. It is therefore evident that, for every educational institution to function well, they should make use of ICTs. Financial and human resources are considered vital because they enable individuals to determine new practices and approaches that will be introduced to enhance the overall education system.

2.3.10 Factors that enable or disable the integration of ICTs

The Lesotho government recognises the implicit potential of ICTs in education. The resourceful and useful integration of ICTs is a main concern for various educational institutions (Dube *et al.*, 2018). There are, however, issues that hamper the effective

employment of ICTs into teaching and learning. Researchers have recognised various obstacles that hamper the use of ICTs in the classroom (Mathipa & Mukhari, 2014). These are discussed in the following sections.

2.3.10.1 *Lack of confidence*

According to Mathipa and Mukhari (2014), many researchers imply that a lack of teacher self-belief is an obstacle that impedes teachers from integrating ICTs into teaching and learning. All teachers come into teaching with their personal philosophy about teaching because they possess their own individual understanding of the instructional circumstances and an array of ways in which students learn (Nkula & Krauss, 2014). Mathipa and Mukhari (2014) cited nervousness and fear of failure to utilise ICTs in a session of learners who understand more about the processes of these ICT platforms.

2.3.10.2 *Lack of teacher competence*

ICT proficiency is explained as being capable of utilising a broad choice of dissimilar technologies for many purposes (Mafang'ha, 2016). Tedla (2012) showed that one more obstacle connected to lack of self-belief is the lack of proficiency in teachers. Teachers fail to use ICTs in their teaching as they lack the knowledge and skills to utilise them. Teachers' competence can assist to improve methods, principles, and harmonisation of ICT duties; the utilisation and repairing of ICT; the employment of ICT training, judgement, and valuation; the growth of ICT; the distribution of PK; etc. (Tedla, 2012).

2.3.10.3 *Resisting change and negative attitudes*

Change usually does not take place easily (Mathipa & Mukhari, 2014) because it is often daunting. Mathipa and Mukhari (2014) further claimed that older teachers who are satisfied with conventional methods of teaching do not favour current and inventive approaches of teaching. Makgato (2012) argued that they clearly like one on one teaching and traditional methods that offer them a sense of supremacy over their learners. A number of teachers who oppose ICTs in teaching and learning think that

ICTs have no importance for themselves or their learners. Strongly launching and integrating ICTs into teaching depends actively on teacher support and attitude (Mafang'ha, 2016). Tedla (2012) asserted that the teacher's stance is one of the most decisive issues that enhances or impedes the integration of ICTs into classroom activities. He further stated that teachers' positive attitudes ensure ICT implementation and guarantees further ICT innovation.

2.3.10.4 *Lack of access*

One more complicated obstacle is the lack of access to ICT resources and lack of Internet connectivity (Mathipa & Mukhari, 2014). Mathipa and Mukhari (2014) further stated that, in African states, the majority of computers are outdated, since they are gifts from companies. This is often the case in many of the schools in Lesotho. In other schools, they are just meant for computer literacy, whereas some schools have none. In fact, in most schools in Lesotho, the paucity of educational hardware is a crisis that hinders both teachers and learners from utilising ICTs in teaching and learning. When teachers can freely use ICTs, they may have enough time to put in order teaching materials, use the Internet to surf information, and go over the needed software (Cubukcuoglu, 2013).

2.3.10.5 *Lack of time*

A number of studies have revealed that incompetent teachers regarding ICT usage in teaching and learning use ICTs minimally and blame it on a lack of time (Mathipa & Mukhari, 2014).

2.3.10.6 *Lack of effective training*

A lack of specialised training on how to utilise ICTs in education is a main obstacle (Mathipa & Mukhari, 2014). Offering pedagogical guidance on utilising ICTs in the whole curriculum is a vital matter that will allow teachers to do well in teaching the next generation, who in turn are to hold the required 21st century skills and become members of the information society (Mathipa & Mukhari, 2014). Cubukcuoglu (2013) reiterated

that teachers ought to be imparted with training to enhance their pedagogical use of technology, as well as training in necessary technology skills. Cubukcuoglu (2013) further pointed out that this type of training will not only allow teachers to feel confident in teaching and learning, but they will also be fit in utilising ICTs at the right time and for good reason. In addition, when preparations give practical or true-life situations, it will assist trainees to know the best method and time to utilise ICTs in teaching and learning.

There are more elements that hamper the smooth integration of ICTs into teaching and learning. For instance, Adrian Schofield (2019) of the Institute of Information Technology Professionals South Africa (IITPSA) was quoted as follows:

The country's education system is not geared to deliver high-end ICT skills at the scale needed. Over 1.2 million young people go into the basic education system and if we're lucky, around a quarter of them finish matric. How can they get a good start in the digital world if they can't even get through basic education? There is not enough investment in basic education to create the pool of ICT skills South Africa needs.

The Global Challenge Insight Report (World Economic Forum, 2016) pointed out that much has been said about the need for reform in basic education. It is therefore critical that schools prepare whole-school policies on using ICTs across the curriculum, since it enables schools to effectively use of ICTs in the classroom (Scrimshaw, 2004). Schools, via principals, play an active role in supporting their teachers by encouraging them to go for retraining.

2.4 THE POSITION OF THE TEACHER IN TEACHING AND LEARNING

The merits of 21st-century learners need teachers to assemble the requirements of the entire group of learners and to consider them in the light of their personal ability (Mukhari, 2016). Teachers are therefore meant to utilise teaching strategies that allow learners to explain intricate problems and relate and convey their skills to other learning contexts with the aim to achieve this outcome. Likewise, in the technical subject classroom, teachers are seen as important components in the use of ICTs in teaching

and learning because they are required to embrace and integrate discipline-specific ICTs correctly in their teaching and apply the modification assumed in pedagogy (Ang'ondi, 2013). Due to the problems encountered, as well as the expectations in educational situations, technical subject teachers are obliged to arrange for a technology-rich outlook and carry on with alterations by implementing a valuable approach that integrates classes with suitable discipline-specific ICT tools to improve learning results beyond the curriculum. This was substantiated by Aguti (2016), when he stated that teachers should possess ICT use and digital proficiency in this era with the aim of introducing ICT expertise to their learners from low levels onwards and to train them to the labour market.

As said by Mukhari (2016), the teacher's responsibility is to give immediate and precise criticism and focus on permitting learners to be involved in vigorous educational approaches for enhanced, considerate and maximum performance. They also have a task to encourage innovative and inclusive knowledge, promote the sharing of knowledge amongst learners, and to groom them to participate in a society of all-time learners (Aguti, 2016; Hunde & Tacconi, 2013; Tedla, 2012; Mwalongo, 2011). Teachers' preparation has been arranged in line with the prospects of the network society, which Levinsen (2011) argues compels teachers to adjust their conventional teaching strategies so that ICTs would steer the educational route, even to implement inventive teaching talents with the aim of assisting the digital-era learners.

UNESCO (2012) revealed that the teacher's modern task as a mediator is modified to assist learners to reach their learning objectives that are seen as important in the knowledge society. Teachers have an obligation to carry on the ideology and methods of different learning philosophies, as well as deciding on the suitable discipline-specific ICTs that will help learners' understanding and improve learning. However, even though teachers have these roles to perform, they seem to be reluctant to do so. Lisene (2017) indicated that all the teachers in her school received training on computer literacy under the School-Net Lesotho project, but none of them applied these skills to teaching.

2.5 TEACHERS' PROFESSIONAL DEVELOPMENT

Teacher training is pivotal to integrate ICTs effectively for teaching and learning. Preparation can be accomplished by fully integrating technology into instruction. As stipulated by the ICT Policy, the education system is faced with the challenge of balancing national needs and globalisation with regard to technology advancement (Ministry of Education and Training of Lesotho, 2009). There is a need to promote the acquisition of knowledge and skills through training that ICTs present in terms of socioeconomic development (Ministry of Education and Training of Lesotho, 2009). Even so, ICT-based teaching requires well-qualified educators (Butcher, 2011) who are furnished with the skills and competence to integrate and use ICTs. There has been a dearth of teachers' professional development to support ICT practices in schooling (Chere-Masopha, 2011).

Harnessing technologies for education purposes requires investment in supporting educator training (Butcher, 2011). Lesotho has a shortage of ICT professionals and a lack of instructors with ICT skills. Consequently, teachers with limited awareness and technology proficiency and knowledge struggle to integrate ICTs to engage their learners and strengthen teaching. The presence of ICT materials will give adaptable and useful habits for all-time proficient growth (Khan, Hasan & Clement, 2012). The scarcity of teachers' professional skills development obstructs their use of a particular tool or software program for information searches (Kim, Kim, Lee, Spector & De Meester, 2013). Well-prepared ICT teacher training and needs regarding the integration of ICTs should be identified (Hong, 2016), which represents that professional development would be a platform for teachers to initiate and design their own professional development to share materials and ideas aligned to their respective fields of study.

2.6 CONCLUSION

The current chapter focused on the conceptual framework (TPACK) that guided the study and its six formats. The discussion revealed that TPACK links classroom practices to theory via what to teach and how to teach and shows an understanding of

how teachers integrate ICTs into technical subjects. The chapter further reviewed the literature on the use of ICTs in enhancing teaching and learning on the following topics: general discussion of ICTs, the history of information and communication technology (ICT) in Lesotho, definition of ICTs, Blooms' taxonomy of learning domains in the teaching and learning of ICTs, the ICT tools used in teaching and learning, ICTs in schools, ICTs as a changing factor, teaching technical subjects using ICTs, the need for the use of ICTs into schools, factors that influence the quality of education via the use of ICTs, factors that enable or disable the integration of ICTs, position of the teacher in teaching and learning and teachers' professional development.

The next chapter will focus on the research methodology used to understand how the integration of ICTs into technical subjects may enhance teaching and learning.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The current research seeks to understand how technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects. In pursuance of this aim, the current chapter centres on the research design and methodology that guided the research. This research utilised the interpretivist paradigm as its method of research design and methodology for data generation and analysis. The fundamental themes and components that define interpretivism are discussed under the historical origin of interpretivism, its objectives, steps, ontology, epistemology, the role of the researcher, and relationships with the co-researcher. This section further examines, explains, and validates the research design and methodology utilised in this study. The focus is on the description of the research paradigm as well as the method, purpose, and data-collection techniques used to build an in-depth understanding of integration of ICTs into the teaching and learning of technical subjects in Lesotho. Issues pertaining to credibility, trustworthiness, and ethical concerns also are taken into consideration. The aim was that the results would be acknowledged as significantly helpful in determining the research problem and useful to other researchers.

3.2 THE PURPOSE OF THE STUDY

The aim of the current research seeks to understand how technical subject teachers in a specific schools district in Lesotho integrate ICTs to enhance the teaching and learning of technical subjects. Moreover, from his experience as an educator in Lesotho, the researcher noted that, even though ICTs are provided in schools, some teachers are hesitant to include them in their teaching practice. This provoked the researcher's curiosity and, as a result, he decided to undertake this research. It is expected that the results from this research will assist teachers who experience difficulty with using ICTs in the teaching and learning of technical subjects and bring awareness on how ICTs can

be integrated to enhance their teaching and learning. The findings of the research will also benefit the Ministry of Education and Training of Lesotho because it will provide insight into the problems that teachers encounter with the integration of ICTs in schools.

3.3 RESEARCH QUESTIONS

The current research seeks to understand how technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects by asking the following main research question. How do technical subject teachers in a specific school district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects?

This research also intended to answer the subsequent research questions:

- a) What is the educational relevance of the integration of ICTs into technical education subjects?
- b) What factors influence technical teachers' effective integration of relevant ICTs into technical education classes?
- c) What recommendations can be made to enhance discipline-specific ICTs when integrating them into teaching and learning?

3.4 RESEARCH PARADIGM

A paradigm is a structure of reference utilised to arrange notes and a certain way of thinking (Babbie, 2010). A paradigm, as defined by De Vos *et al.* (2011), is a model holding a group of justified ideas, as well as a plan for gathering and deducing data. Guba and Lincoln (1994) maintained that a paradigm is a group of key ideas that administer a key philosophy, and that these important ideas are acknowledged without enquiring. It can therefore be concluded that a paradigm is a model that individuals utilise to acquire and develop their knowledge and understanding via basic sets of beliefs. McMillan and Schumacher (2010) supported positivism, interpretivism, and critical theory as the common research paradigms that researchers bring to their research. This study used the interpretivist approach because it provides participants

the chance to voice their opinions, concerns, and practice with the aim to be heard, while, on the other hand, researchers have a chance to acquire handy and profound information (Thanh & Thanh, 2015).

Interpretivism was considered the appropriate methodology for this study as it is a world view that aims to understand and value people (Babbie & Mouton, 2008). McQueen (2002) stated that interpretivism observes the globe via a “series of individual eyes” and selects participants who “have their own interpretations of reality” to include their worldview. Interpretivism focuses on value and accepting the social connection among humans (Gephart, 1999).

3.4.1 Objectives of interpretivism

Interpretivism is the approach that the researcher postulated to be the best suited for understanding how ICTs are used in the teaching and learning of technical subjects because interpretivism is grasping and explaining daily activities, events, skills, and collective arrangement, and the principle persons who connect with these phenomena (Collis & Hussey, 2009; Rubin & Babbie, 2010). Interpretivism intends to acquire knowledge of the meaning of collective truths for those who encounter them (Noblit & Eaker, 1987). Bearing this in mind, interpretivism is connected with an understanding of complicated human behaviour and social settings (De Villiers, 2005).

Interpretivism normally develops in situations where people want to make changes thoughtfully, mostly after social interaction. It is for this reason that the researcher chose interpretivism as a suitable paradigm for this study, and because interpretivism advances the agenda of understanding the collective world as the practices and biased meanings that people attach to it. Interpretivist researchers support interaction and having discussions with chosen participants (Wahyuni, 2012).

Interpretivism is appropriate for a study that aims to uncover the private perspectives or authentic implications of collective occurrences from study participants as social knowledge. It allows the idea that facts and sense are the outcomes of understanding, and so there are no impartial facts that are free of human thought and reasoning

(Vosloo, 2014). In interpretivism, the connection among the researcher and the knower (participant) is vitally important. This study was therefore informed by the participants and the researcher, and by participating, their abilities, voices, meanings, and events are understood (Rahman, 2017). The study is therefore in accordance with the basic principles of interpretivism, which are as follows:

- People subjectively construct and give the social theory meaning. People are matter that has perceptions and their actions are shaped by knowledge of the social world. This knowledge is known to people;
- The researcher is a portion of what is experimented on; and
- Study is guided by interest (Wisker, 2008; Blumberg, Cooper & Schindler, 2011).

Interpretivists argue that an observation of the social world, done objectively, is impracticable because it has sense only for humans, and is made by deliberate activities and performances (Vosloo, 2014). Vosloo (2014) maintained that, since research in interpretivism is driven by interest, anything that remains real or factual for this time possibly will not automatically be genuine tomorrow, or in new group. In exploiting ideas from practical and real social constructions, knowledge is constructed and theory is created. Researchers therefore attempt to construct logic of what is occurring (Vosloo, 2014). This can even produce results further than the ordinary systematic or logical knowledge (Rubin & Babbie, 2010; Blumberg *et al.*, 2011). Interpretivists therefore attempt to subjectively find the truth as well as presenting justifications that are significant for the participants in the research.

Interpretivism can be observed as a research methodology and explanative perception is grounded in a cooperative, field-based inductive methodology, which, as a result, is tangled in preparation within a specific background (Henning, Van Rensburg & Smit, 2004). Livesey (2011) proposed that the best approaches in the interpretive research paradigm are those of observation and interpretation. As a reason, Livesey (2011) advanced that the researcher seeks to know how people practice and read their world.

3.4.2 The ontology of interpretivism

The word "ontology" is obtained from two Greek words (*onto*, which means "being" and *logia*, which means "science", "study", or "theory") (Kwadwo, Antwi & Hamza, 2015). Ontology is a part of philosophy that is involved with conveying the nature and organisation of the world (Wand & Weber, 1993). Ontology is thus utilised to designate the theory of being. It is therefore mandated to develop approaches that are able to clarify the parts of people's shared truth, concerning with what it looks like, things that exist, and how these correlate with one another. In interpretivism, researchers would think this truth is collectively formed and not independent or external (Vosloo, 2014). According to Mack (2010), the ontological assumptions of interpretivism are that social truth is observed by many people, and these people understand activities independently (resulting in various viewpoints of an event). Meaningful structure occurs via understanding researchers' knowledge and interactions. Their shared knowledge is based on subjective accounts from people who live within an environment. Ontologically, interpretivism is concerned with a kind of truth (Teddlie & Tashakkori, 2009). Leitch *et al.* (2010) believe that people construct knowledge both in isolation and jointly from their experiences. Teddlie and Tashakkori (2009) argued that interpretivists believe that people can never be optimistic about what is factual.

3.4.3 The epistemology of interpretivism

According to Kwadwo *et al.* (2015), epistemology raises the following questions: What is the connection between the knower and what is known? How do we know what we know? What counts as knowledge? Epistemology is described as the type of connection between the researcher (the knower) and what is known, and it implies the form of human knowledge and understanding that can perhaps be obtained via various kinds of investigation and other approaches of investigation (Hirschheim, Klein & Lytinen, 1995). Teddlie and Tashakkori (2009) claimed that epistemology concerns the connection between the researcher and the knower (participant). For interpretivists, this connection is regarded as subjective (Teddlie & Tashakkori, 2009), as researchers and their participants are expected to work together to construct the research.

3.5 RESEARCH APPROACH

According to Yin (2009), a research style is a coherent set of actions for getting from *here* to *there*; where *here* is taken to be the initial array of questions to be solved, and *there* is a group of responses to the questions asked. Tuli (2010) defined research methodology as an approach that interprets ontological and epistemological ideas into a procedure that shows how the study will be carried out.

The research methodology that the researcher should employ with the aim of gaining the knowledge needed to respond to the key research questions and the succeeding questions is shaped by the research problem (Mukhari, 2016). McMillan and Schumacher (2010) and Ivankova, Creswell and Clark (2007) therefore emphasised that the research aim could be accomplished by utilising any of the three research approaches, namely the quantitative approach, the qualitative approach, and the mixed-methods approach.

This study utilised a qualitative approach, as it is precise, spontaneous, and meaningful in nature, and interpretive (Yin, 2012; Mortari, 2015). The data in this method are collected from interviews and document analyses.

The study also utilised quantitative phase as the supplementary data, a survey questionnaire with 16 questions was given to 60 technical subject teachers from the Northern region who were available in one meeting at Leribe, and only 39 of the respondents returned the questionnaire. The sample included technical subject teachers who specialised in Design and Technology, Basic Handcrafts, and Drawing, and those who majored in both Design and technology and Basic Handcrafts. The 'YES' or 'NO' questions were used to collect data and analyse the data manually using Microsoft Excel.

In the qualitative phase, documents (the syllabus, lesson plan and scheme and record of work) were verbally requested during the day the interviews were conducted. Participants (n=8) were interviewed to explore how technical subject teachers integrate ICTs to enhance teaching and learning. A qualitative research was utilised because it has a better chance to achieve rich descriptions. A quantitative approach as the

supplementary data was also incorporated with a view of combining the strengths of each method to respond to the question of the study. A further cause for utilising the qualitative research and quantitative as the supplementary data is that the researcher was interested in exploring how ICTs are integrated into the teaching and learning of technical subjects in Lesotho because the assumption was that teachers are aware or conversant with ICT contexts in school. Some technical subject teachers do have CK, PK, and varying levels of TK, and therefore could be probed to express how ICTs affect teachers' practices and roles in the teaching and learning of technical subjects at their schools. Via these connections, the researcher had an opportunity to obtain detailed information of the teachers' proficiency and viewpoints, methods, as well as tasks that they perform in the usage of ICTs in their teaching of technical subjects.

3.6 THE CHOICE OF RESEARCH PROBLEM

The research problem choice for this study emanated from new tendencies that approve the integration of ICTs into the teaching and learning of technical subjects. The prevalence and globalisation of ICTs need teachers to adapt and improve their instructional approaches to promote their learners by integrating ICTs into the teaching and learning of technical subjects. Educational institutions also collaborate with the main stakeholders acknowledged to support a task in recognising the education policy by enhancing teaching and learning methods that elevate ICT literacy and make local ICT products and services (Isaacs, 2007).

3.7 THE POSITION OF THE RESEARCHER

The task of the researcher in interpretivism is that of a facilitator and an important research instrument who works with stakeholders in every aspect of the research process (McTaggart, 1997). Because of the leadership role, the researcher identifies and applies communicative skills to persuade participants to participate in the research. Furthermore, conducting interviews as a researcher ensures that the participants answer the questions as needed, as well as guarding against the researcher's individual beliefs and prejudice when eliciting applicable answers (Mukhari, 2016). Developing

trusting relationships with the participants is a crucial phase of the research procedure; therefore it requires both cooperation and mutuality. The researcher's goal in this study is to get full information on the core experiences of the research participants. The researcher therefore had to create a neutral environment for the participants, so that they could all be fully involved in the study with a vision that they would understand how ICTs are integrated into the teaching and learning of technical subjects.

The participants have the chance to voice their opinions, concerns, and practices in order to be heard in the interpretivist approach (McQueen, 2002). The understanding between the researcher and participants must be generated to permit participants to raise their voices and feelings freely. In doing so, this helps them to develop trust, and as a result, the environment is conducive to participants feeling free and giving genuine and honest answers.

3.8 POPULATION AND SAMPLING

The group of people researchers are interested in generalising about is referred to as the population (Babbie, 2010). The population in this research is therefore deemed to be the target population. Moreover, it is the array of factors on which the researcher sets his focus. De Vos *et al.* (2011) maintained that a sample is contained in a population and is therefore considered for inclusion in a study. McMillan and Schumacher (2010) explained qualitative sampling as a way of selecting information-rich interviews for detailed study to understand something about the interviewees without desiring to generalise to all such interviewees. Palys (2008) defined sampling as a sequence of planned options about whom, where, and how one conducts research. The researcher chooses the participants because they are thought to be informative and knowledgeable about the event under study. Both quantitative qualitative samplings were vital to this study because a few interviews and questionnaires studied in depth yielded a large amount of information about the topic at hand.

In this study, the researcher utilised purposive sampling to choose the research participants. The sample was comprised of three teachers from two high schools and two teachers from the last school, respectively, for qualitative interviews, and 39

technical subject teachers for quantitative survey questionnaires. The participants were chosen because their schools were believed to have an ICT infrastructure, the school and teachers were also accessible or near the researcher, and lastly, the technical subject teachers were believed to have been trained or received training on ICTs and are qualified technical subject teachers.

The study was conducted in the Butha-Buthe district for qualitative data and from other districts of Lesotho for quantitative data.

3.9 DATA COLLECTION

According to Mukhari (2016), descriptions and explanations of the participants are ways for providing sequence to researchers with the purpose of building a convincing response to the research aim that anchors the study. Interviews, survey questionnaires, and documents are the strategies used to gather data, and they allow researchers to gather data considered appropriate for the facts under scrutiny (Nieuwenhuis, 2007). In this research, semi-structured interviews, questionnaires, and document analysis were the data-collection approach utilised to collect appropriate data for responding to the research aims.

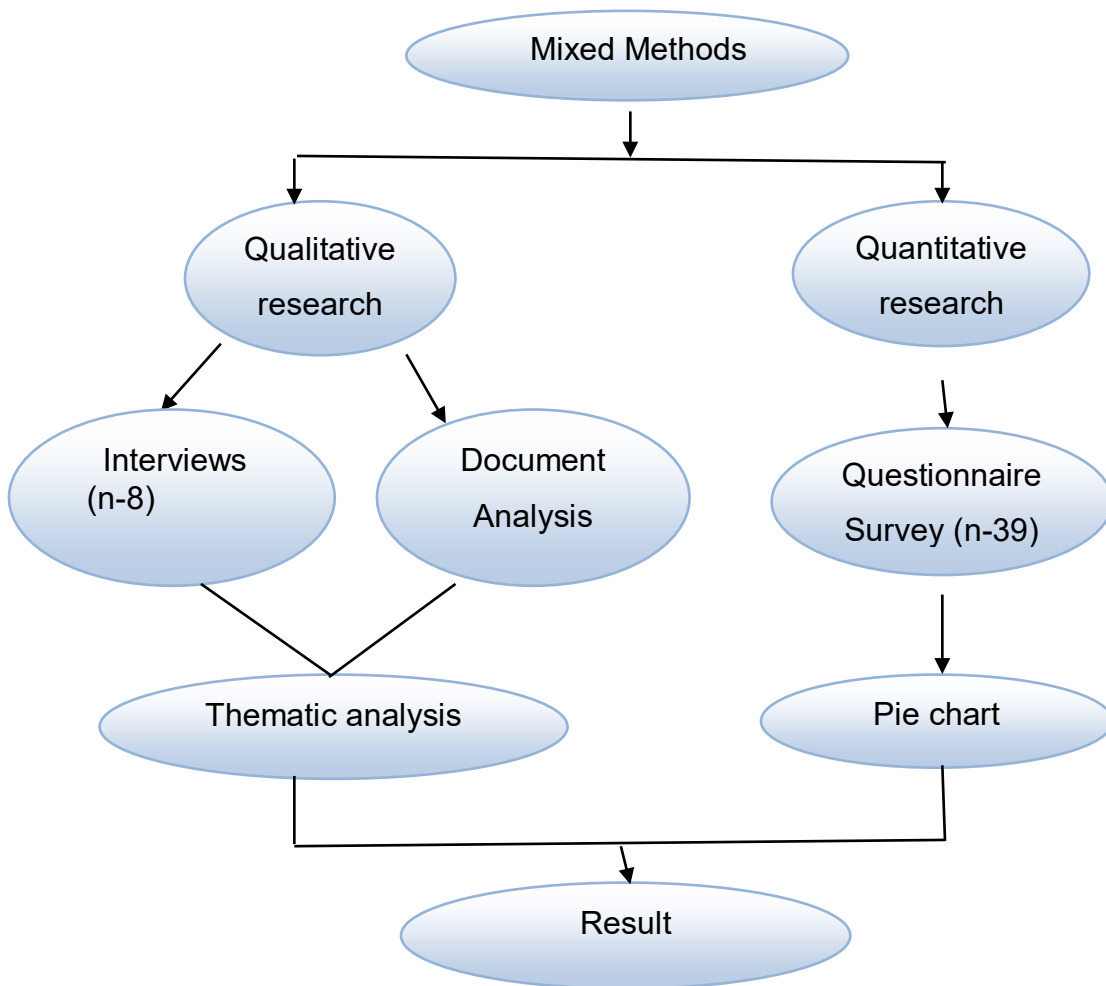


Figure 3.1 The summary structure of data collection

The data collection for the current study started in November/December of 2018. The researcher began with qualitative data collection, and then followed with quantitative as the supplementary data collection. One-on-one interviews were administered, including documents (lesson plans, syllabus and scheme, and record of work) that were submitted by two of the teachers, with the other six declining to submit theirs. The survey questionnaires were issued after the interviews were conducted.

In the qualitative phase, the semi-structured interview was the data-collection method utilised to question eight (n=8) technical subject teachers as individuals on a one-to-one basis.

The semi-structured interview was selected as, by its nature, it would provide teachers the liberty to respond to questions in any way they considered fit.

3.9.1 Interviews

Schostak (2006) defined an interview as a prolonged conversation between partners (interviewer and interviewee) that intends to gather in-depth knowledge concerning a particular topic, and via which facts can be examined in line with the meanings interviewees bring to it. Interviews were selected for this research because they provide researchers with the hope of "gaining information that is most likely not obtainable utilising methods such as questionnaires and observations" (Blaxter, Hughes & Tight, 2006). They further stated that interviewing is a normal manner of communication that may occur in different settings rather than only being a data-collection tool. According to Alshenqeeti (2014), more suitable responses and new authentic data will therefore be attained.

Interviews are a conversation whose aim is to collect descriptions of the life world of the interviewee (Kvale, 1996). Gathering such meanings can be done in different ways including one on one (Alshenqeeli, 2014). Prior to the study, the researcher set up interviews with the principals of the three selected schools in order to understand whether the teachers in their schools integrated ICTs into their teaching and whether each teacher was compelled to integrate ICTs on one on one situation. Unfortunately, only one principal could be interviewed. Afterwards, the whole study and possible benefits thereof were explained. Finally, the researcher asked to be granted permission to conduct interviews with the teachers, as they were the target group of this study.

One-on-one interviews were conducted for the actual study. All participants understood and used English and Sesotho as a medium of instruction, so no interpretation or translation services were required.

The researcher ensured that the interviews were not binding but optional because as noted by Cohen, Manion and Morison (2007) interviewing is a valuable method for exploring the construction and negotiation of meanings in a natural setting. In Jitas, (2016) study, participation was voluntary and invitations were done via face to face methodology classes, emails and even posted on the Blackboard. In the current study invitations to participate were made in person and consent forms were used to formalise the invitations. The researcher also used his mobile phone to send reminders to the participants regarding the selected time slots. The researcher opted to utilise a candid stance for the interviews. Each interview began by assuring the participants of their confidentiality (Jita, 2016). The existence of different cheap and prudent tape recorders, enable researchers to record conversations accurately (Harmanowics, 2002).In the current study, interviews were conducted in each school with audio recordings made of each teacher interview. The coding was later transcribed into text for analysis. To secure the identities of the participants, the numbers of participants and participants' labels were assigned to each interview.

Table 3.1: Information on interviews with teacher participants

Interviews	No. of participants	Participant identifier	Duration
One	3	A	30min.
		B	14min.
		C	23min.
Three	3	D	15min.
		E	27min.
		F	28min.
Two	2	G	16min.
		H	24min.

3.9.2 Document analysis

The document analysis is the second data collection technique in the qualitative phase. Document analysis allowed the researcher to gain more facts from documents such as the lesson plan, scheme and record of work, and the syllabus regarding the integration

of discipline-specific ICTs to improve teaching and learning. Document analysis was utilised in this study because, according to De Vos et al. (2011), it is a strategy utilised to examine and access the existing documents to follow the essential content on the facts explored. Niewenhuis (2007) argue that documents are considered to be a rich source of information that may help the researcher to recognise vital facts that would help to comprehend the phenomenon under study. In this study, the documents understudy was the lesson plan, the scheme, and record of work and syllabus.

3.9.3 Survey questionnaire

The survey questionnaire was conducted with technical subject teachers. The survey questionnaire was employed to seek to understand how ICTs are integrated in the teaching and learning of technical subjects. The researcher issued the survey questionnaires to technical teachers in a meeting held in Leribe. The researcher introduced the study and discussed why the study was conducted. After the issuance of the survey questionnaires, the researcher allowed the participants to ask questions for clarifications. The questions from the survey questionnaire asked the participants to judge their agreement via “Yes’ or “No”. The information was then manually filled and analysed using the Microsoft Excel. A survey method of data collection was used to seek to understand how integration of technical subjects may enhance the teaching and learning of technical subjects.

3.10 DATA ANALYSIS

Data analysis is the means of downsizing great quantities of collected data to construct concrete facts (Kawulich, 2004). Mukhari (2016) mentioned that data analysis is a logical process via which researchers manipulate the gathered data to understand the participants’ assertions with the intent to interpret and explain the observable facts being investigated. Data analysis starts with data collection and lasts until the data have been scrutinised. Patton (1987) mentioned three aspects: data are prepared, downsized via encapsulation and grouping, and the patterns and themes in the data are

acknowledged and related. Data collection and analysis are therefore linked because they influence each other. LeCompte and Schensul (1999, cited in Kawulich, 2004) stated that analysis may be conducted both in a top-down and bottom-up fashion. LeCompte and Schensul (1999) suggested that data analysis must be prepared as data gathered in the field, as soon as possible after data have been collected, both while the researcher is still in the field, and shortly after the researcher is no longer in the field. This is to say, data analysis begins in the researcher's mind, as data are being gathered from the participants and ends in concentrating on the practical part that pertains to classifying and handling the qualitative data.

The researcher in this study used a general inductive technique of data analysis. The general inductive technique of data analysis entails the one-sided and systemic interpretation of data via coding and the classification of themes. The first step of the analysis of the data entailed the transcription of interviews. The task was accomplished with the assistance of an associate. This was to ensure that the entire conversation by the participating teachers during the interviews was precisely and correctly captured. To ensure that the recorded conversation was exactly what the participant teachers really wanted to say and for the confirmation of the contents, the transcripts were returned to the participants to verify their accuracy. The verification process was also conducted to ensure credibility and trustworthiness, as well as to demystify concerns that emerged during the transcription and preliminary phase. Data analysis is guided by truth or reliability (Hashemnezhad, 2015). In this study, the researcher was pledged in several translations of the transcribed data and constant comparison of data. This was done with the aim of accumulating an in-depth understanding of the teachers' perspectives of how ICTs are integrated into teaching and learning, and to initiate inductive coding and thematic analysis.

The study at hand utilised the qualitative method of data collection and quantitative approach as the supplementary data which yielded large quantities of information both from the open-ended and closed-ended data that took approximately three and half months to complete the analysis. The researcher used the side-by-side approach. This

is where the two types (qualitative and quantitative) of data collected were separately analysed and compiled in a convergent manner.

In the qualitative interview, data were transcribed into texts and categorised into various themes after the researcher listened to the recorded interviews several times for in-depth understanding. The data was firstly organised and colour coded of to demonstrate the different levels. The related codes were also classified with the aim of identifying themes.

For quantitative data collection, the study consisted of 60 participants, with 39 returning questionnaires. The data were captured from the paper into an Excel spreadsheet. There were sixteen “Yes” or “No” questions to produce pie charts that would best present the data.

3.11 ETHICAL ISSUES IN QUALITATIVE

Babbie (2010) stipulated that principles in research are related to values and codes of conduct of what is right or wrong and what is good or bad in conducting research. The application of ethical principles in the research could help reduce harm. These ethical issues are delineated as a group of principles and are subsequently commonly taken as regulations that govern actions between participants and researchers (De Vos *et al.*, 2011). Ethical considerations in research, as Kadiri (2015) wrote, include summarising the matter of research and what is needed from participants, how informed consent was obtained, and how confidentiality was guaranteed.

Ethical clearance and permission from the University of the Free State to conduct research in the identified schools in the Butha-Buthe district in Lesotho were important ethical matters in this study. It was the duty of the researcher to inform his participants of all the information on the objectives of the study. Shahnazarian, Hagemann, Aburto and Rose (2013) stated that participants must be lawfully and mentally capable to give permission and they should also be informed that they are free to end the interview session the moment they feel uncomfortable. The researcher used written consent

forms (see appendix A), since it is a necessary condition of research study. The consent form contained very specific information to enable the participant to understand the contents of the form. Returning the signed form clearly indicated the stance of the participant.

3.12 CONFIDENTIALITY

Babbie (2010) described confidentiality as a state in which a researcher pledges to store information concerning the respondents confidentially. Mukhari (2016) stated that ethical guidelines indicate that it is the participant's right to make decisions when, where, and to what degree his or her attitudes, beliefs, and behaviour will be exposed, and therefore, every individual has the right to privacy.

In this study, information was provided willingly and without specification. The names of schools and teachers involved were kept confidential. In observance of this ethical condition, the participants are referred to as Teacher A, B, etc., although the identities of the teachers and the names of the schools were known to the researcher.

3.13 CONCLUSION

The above discussions summarised the research methodology followed in the search for an in-depth understanding of integrating ICTs into the teaching and learning of technical subjects in Lesotho. The qualitative research design and the supplementary data (quantitative technique) relevant for data collection were discussed. Furthermore, the discussion also indicated how the gathered data were analysed by utilising the systemic process of coding, categorisation, and interpretation. Ethical issues that are of prime importance to this study were also highlighted.

The next chapter focuses on the presentation of the findings on the data collected and analysed.

CHAPTER 4: DATA ANALYSIS, INTERPRETATION, AND PRESENTATION OF FINDINGS

4.1 INTRODUCTION

The significance of the qualitative approach and the need of utilising interviews for this research were shown in Chapter 3. This chapter consists of two sections, namely data analysis and a discussion of the findings. In the first section, the focus is on the analysis of the data and the discussion of the empirical findings. The focus in the second section is on the evaluation and discussion of the analysis of some documents on the integration of ICTs into teaching and learning. The first section of the empirical findings contains the highlights of all participant profiles. To answer the research questions outlined in Chapter 1, the results are unveiled and backed by participants' quotations. Bowen (2009) stated that the literature review (see Chapter 2) must present the basis that boosts the exposition of collected facts (see Chapter 4) and the recommendations (see Chapter 5) to guarantee that the research findings are supported and anchored in the literature.

This study used document analysis to acquire additional information. Using document analysis in combination with interviews allowed the researcher to appropriately acquire a rich view of the topic at hand. Yanow (2007) wrote that the other section of an observational study or an interview-based task is document analysis because it can give background information before planning the research task; for instance, before administering the interviews. In this study, documents that relate to the integration and use of ICTs in teaching and learning were examined as secondary sources of data. This was done with the aim of obtaining appropriate facts to answer the questions posed in this study. The interview technique used in this research included various types of questions, namely main questions, follow-up questions, and probing questions where necessary. The main question was intended to concentrate on the root of the research problem and to keep the focus on the goal of solving the research problem (Owen, 2014).

4.2 ANALYSIS OF THE EMPIRICAL DATA

The researcher in this study used the general inductive technique of data analysis. The general inductive technique of data analysis concerns the one-sided and systemic interpretation of data via coding and the classification of themes. The initial stage of data analysis entailed the transcription of interviews. The task was accomplished with the assistance of an associate. The assistance was to ensure that everything said by the participating teachers during the interviews was accurately captured. To ensure that the captured version was exactly what the participant teachers really wanted to say and for the verification of the contents, the transcripts were returned to the participants to verify the accuracy of the contents. The verification process was also conducted to ensure credibility and trustworthiness, as well as to demystify concerns that emerged during the transcription and preliminary phase. Data analysis is guided by truth or reliability (Hashemnezhad, 2015). In this study, the researcher used several translations of the transcribed data and made constant comparisons of the data. This was done with the aim of accumulating an in-depth understanding of the teachers' perspectives of how ICTs are integrated into teaching and learning, and to initiate inductive coding and thematic analysis.

The study utilised a general inductive and deductive way of analysing data. The researcher then started the coding process where texts that constituted essential parts to be utilised as units of analysis were established (refer to Appendix D). Data were transcribed into texts and texts were then coded and levelled into different themes. The next section is on teachers' transcripts.

4.3 PROFILES OF TEACHER PARTICIPANTS

4.3.1 Teacher A

Teacher A teaches at high school, and is a male who has been in the teaching sector for 21 years. He possesses a Bachelor of Technical Education certificate. He teaches Design and Technology in high school and arts and entrepreneurship to Grades 8 and

secondary school students. The teacher clarified that he used his personal laptop and his mobile phone to look for information and sometimes asked students' guardians to permit their children to bring their personal mobile phones to school to use when learning. Teacher A also encouraged his students to bring laptops to school for learning purposes. It emerged from the conversations that Teacher A did not attend training on the use of discipline-specific tools (3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers, to name a few), and that he learned the skills of using discipline-specific ICT tools in his teaching activities via the repeated use of his mobile phone, for instance, for research purposes. Regarding his experience with how ICTs are used in teaching and learning at his school, he stated that he relied on his personal ICTs because the management of the school made it clear that the computers belonged in the Science and Technology Department.

4.3.2 Teacher B

Teacher B is a teacher at a high school. He is a male and has 10years' experience in teaching technical subjects. He holds a Diploma in Secondary Education (DipEd.SEC-TEC). His school computer laboratory is equipped with computers. He teaches Basic Handcrafts and Design and Technology. Teacher B said he integrated ICTs when teaching, but not regularly. Although the ICTs have many advantages for teaching and learning, Teacher B indicated that they did not have enough facilities to use. He relied solely on his personal equipment. Teacher B regularly used the Internet to improve his subject knowledge and the educational advantage of his learners. He said he also encouraged his learners to bring their mobile phones to school to Google, although it is tough because learners need data to do so.

4.3.3 Teacher C

Teacher C teaches at a high school. He is a male having 23 years of teaching experience and holds a degree in Technical Education. The school he teaches at has computers, but the teachers do not have access to them. He teaches Basic Handcrafts

and Design and Technology and seldomly uses discipline-specific ICTs in his teaching in class, except when researching information for his learners, particularly in Design and Technology. It emerged that at his school, students are permitted to carry their own iPads, Smartphones, laptops, and tablets to class for teaching and learning when arrangements were made with management. Teacher C applauded the use of discipline-specific ICTs and revealed that, since they started using these tools in their teaching and learning, their results have improved.

Teacher C showed that he is not trained to use ICTs in teaching but hailed the importance of discipline-specific ICTs. He further indicated he could use ICTs and had improved due to the repeated use of his cell phone when surfing information.

4.3.4 Teacher D

Teacher D has been in the teaching department for 17 years and is a teacher at high school, teaching technical subjects. He holds a diploma in technical subjects and a degree in Technical Education (Btech-ED). The school has a computer laboratory, but it is small and meant for computer education only. Learners sometimes use it when given class work or assignments. They fail to use discipline-specific tools because there are factors that hinder this. For instance, teachers are hesitant to use these discipline-specific ICTs in class because students possess more skills and knowledge about these tools than their teachers do; that is, students have more confidence in using ICTs than their teachers.

4.3.5 Teacher E

Teacher E has 29 years of teaching experience. He teaches Basic Handcrafts and Design and Technology at secondary and high school respectively. He is a male who has a degree in Technical Education subjects (Btech-ED). He said the school has a small computer laboratory that has Internet connectivity and that the connection has been extended to every departmental office. Teacher E said ICTs are very important to teaching and learning, as learners acquire sufficient knowledge, as well as for communication purposes through Internet-enabled computers. Although Teacher E

praised the importance of ICTs, he had a strong fear that these ICTs would take away their jobs because learners in the future might not see a need to come to school and decide to stay at home and learn online. He hinted that the school lacked the resources to fully use discipline-specific ICTs for educational purposes.

4.3.6 Teacher F

Teacher F has three years of experience, and he teaches Basic Handcrafts and Design and Technology in secondary and high school classes respectively. He is a male who holds a diploma in Education Secondary Technology (DipED.SEC TECH). He stated that they have a computer that is connected to the Internet. Teacher F allows his students to search for information using the computer located in his office. He also stated that discipline-specific ICTs are important in learning, citing that learners learn better when fully engaged through the use of these technologies. Teacher F said that integrating discipline-specific ICTs into his teaching promoted competition among his learners.

4.3.7 Teacher G

Teacher G is a teacher majoring in Basic Handcrafts and Design and Technology at high school. He has been in a teaching field for 12 years and holds a diploma in Education Secondary Technology (DipED.SEC TECH). He has not received any training concerning the use of discipline-specific ICTs in teaching and learning, but has received training in computer literacy. Teacher G does not use discipline-specific ICTs in his teaching, as he believes that he does not have the resources to do so. Again, he explained that the management of the school prohibited students from take their mobile phones into the classroom. However, he insisted that discipline-specific ICTs have huge educational value when used appropriately because the world nowadays is about technology.

4.3.8 Teacher H

Teacher H teaches at a high school and has been a teacher for 12 years. He holds a diploma in Education Secondary Technology (DipED.SEC TECH). Teacher H teaches Basic Handcrafts and Design and Technology to respective high school classes. He mentioned that there are no ICTs at his school, and he did not receive any ICT training; therefore he is not comfortable to use discipline-specific ICTs in his lessons because he is not confident. Teacher H relies only on traditional methods of teaching because he believes that management would not give him support for discipline-specific ICTs, e.g. iPads or interactive pads. Teacher H values the importance of discipline-specific ICTs in teaching and demonstrated that they expedite the learning process as many things can be shown instantly.

Table 4.1: Summary of teachers' life history

Teacher participant	Gender and qualification	vocation description
Teacher A	Gender: Male Qualification: Bachelor's degree in Education Technical	Subjects: Arts and Entrepreneurship and Basic Handcrafts and Design Classes: Grade A and Form B Teaching experience: 21 years
Teacher B	Gender: Male Qualification: Diploma in Secondary Education	Subjects: Basic Handcrafts and Design and Technology Classes: Form C and Teaching experience: 10 years
Teacher C	Gender: Male Qualification: Degree in Technology Education	Subjects: Arts and Entrepreneurship and Basic Handcrafts and Design Classes: Form B and E Teaching experience: 23 years
Teacher D	Gender: Male Qualification: Diploma in Technical Subjects and degree in Technical Education	Subjects: Basic Handcrafts and Design Classes: Form B and E Teaching experience: 23 years
Teacher E	Gender: Male Qualification: Degree in Technical Education	Subjects: Basic Handcrafts and Design and Technology Classes: Form A to E Teaching experience: 29 years
Teacher F	Gender: Male Qualification: Diploma in Education Secondary Technology	Subjects: Basic Handcrafts and Design and Technology Classes: Form A to E Teaching experience: 3 years

Teacher G	Gender: Male Qualification: Diploma in Education Secondary Technology	Subjects: Arts and entrepreneurship and Design and Technology Classes: Grade: Grade A and Form D Teaching experience: 12 years
Teacher H	Gender: Male Qualification: Diploma in Education Secondary Technology	Subjects: Basic Handcrafts and Design and Technology Classes: Form C and Form E Teaching experience: 12 years

Table 4.1 shows that the teachers who participated in this study were all suitably trained pedagogically. Almost all of them had recognisable teaching experience at their schools. Only one teacher was relatively new to the teaching field. All eight participants were male. Aslan and Zhu (2016) stated that gender is not an important issue to determine teachers' use of technology in teaching and learning.

They insisted that teachers seem to utilise discipline-specific ICTs in teaching and learning practices regardless of their gender. In all high schools, all the teachers participating in this study demonstrated a great need to integrate ICTs into teaching, even though they currently rarely use it. Mukhari (2016) concluded that the pre-service teacher training schedules are soundly arranged or blueprinted to furnish student teachers with discipline-specific ICT skills to expedite teaching and learning processes effectively. It is therefore important for schooling ICT schedules to be grounded in the context of in-service Lesotho teachers with the aim of helping them attain the necessary ICTs skills appropriate for them to cope with the integration of discipline-specific ICTs in education. All the schools selected for this study have the necessary ICT infrastructure to be entirely utilised by teachers, even though they used their mobile Internet to search for information.

4.5 PRESENTATION OF THE FINDINGS

This study aimed to understand how ICTs are integrated into the teaching and learning of technical subjects in Lesotho. The data collected from the interviews and the analysis thereof were based on the articulations of the teacher participants. In the present study, the teachers' use of discipline-specific ICTs for teaching and learning is depicted by

factors that emerged as themes. These themes surfaced through coding and analysing the themes. The themes were fused afterwards. The amalgamation of the themes then generated four (4) essential themes, which were: Teachers' competence in using discipline-specific ICTs, insufficient ICT infrastructure, benefits of ICTs in teaching and learning, and using ICTs to teach. The levels are discussed under the relevant heading of the theme in the next discussion.

4.5.1 Themes that surfaced from the teacher data analysis

The themes that surfaced from teachers' answers and discussions were teachers' competence in using discipline-specific ICTs, insufficient ICT infrastructure, benefits of ICTs in teaching and learning, and using ICTs to teach.

Theme1: Teachers' competence in using ICTs

Under this theme, the teachers' acknowledgements demonstrated that inadequate guidance was a considerable obstacle leading to low ICT competencies. Many of them, however, had experience to use discipline-specific tools such as laptops and use the Internet to explore information. This theme was developed using the following levels: lack of ICT training and skills, confidence, and lack of interest in ICT use. These levels were found to be overlapping the disparate text divisions. These levels are discussed in the following sections.

4.5.1.1 Level 1.1: ICT training skills

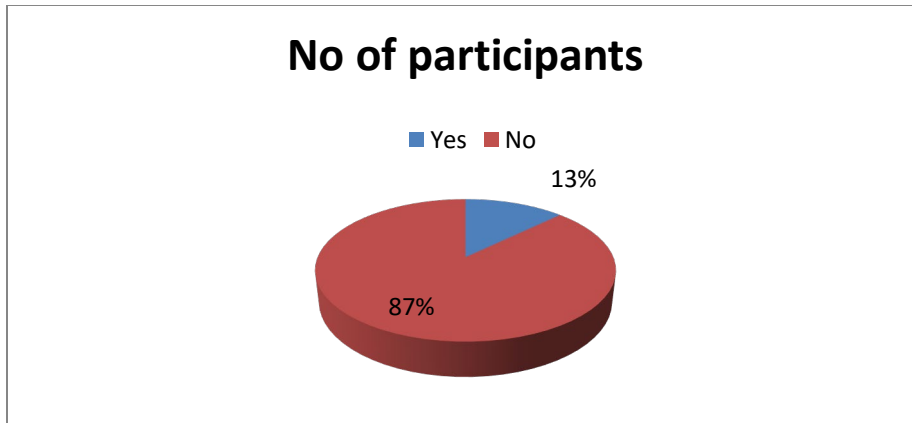


Figure 4.1: ICT training skills

Figure 4.1 illustrates the highest response as 87% (n=34) “No” and 13% (no=5) “Yes” on the question: “From your knowledge, have you attended ICT training on integration in technical subjects?” The results were also verified by the interview results when participants were asked: “From your knowledge, have you attended ICT training on integration in technical subjects?” The majority of the responses showed that the teachers did not attend any training in the use of ICTs in teaching and learning. To illustrate, one of the participants voiced his view as follows:

“I did not attend any training concerning the use of ICTs. I completed my degree way back in 1996” (Teacher C).

Another teacher participant reiterated that he was not at all comfortable to integrate ICTs into his teaching activities. He commented as follows:

“I rely on using traditional way of teaching because I am not fully knowledgeable about the use of ICTs. I am not comfortable to use it” (Teacher H).

Finally, because of inadequate training, the teachers found it difficult to enhance their teaching and learning processes due to lack of ICT proficiency. However, the participants, despite these drawbacks, still had the courage to carry on with the integration of ICTs provided that training would be availed. The desire to embrace the use of ICTs is demonstrated by a teacher who said:

“I need ICT training so that I can confidently integrate them into my teaching” (Teacher A).

The (n=34) (87%) of the technical subject (respondents) teachers revealed that they were not trained to utilise discipline-specific ICTs in teaching and learning of technical subjects. They still struggle to use discipline-specific ICTs to teach, since they did not possess sufficient skills to slot ICTs into their teaching and learning. This revealed their incompetence to integrate ICTs into their teaching and learning of technical education subjects. Furthermore, this is also a symbol of why different schools were not fully utilising the accessible discipline-specific ICTs in teaching. However, some of the teacher participants elucidated that they had informal training and were capable in the integration of discipline-specific ICTs in their lessons. One participant stated:

“I am confident and competent because I use ICTs regularly when researching information to give to my students” (Teacher B).

About (n=5) 13% of teachers admitted that they had received training but stated that their training was not sufficient because it was based on computer use itself rather than the pedagogical use. The pedagogical use of a computer is of great importance to empower teachers with ICT skills so that teaching and learning are enhanced. Wilson, Teslow, Cyr and Hamilton (1994) stated that the pedagogical use of computers served as a role-change means in the classroom, offering an inspiring consideration, reform or plan, and change. The utterance of a teacher participant made this evident:

“I only have a computer literacy, that is, how to type and save” (Teacher G).

This makes it clear that, in some of the schools, learners are only given technological skills; in some schools there is nothing at all and no teaching and learning using ICTs take place, which is important in the digital era for the promotion of well-informed citizens. This viewpoint is correlates with the views by Odora and Mokhothu at al. (2015). On various occasions, teachers did not receive any training or it was not sufficient to arm teachers with the techniques and aptitudes needed to effectively use discipline-specific ICTs in teaching and learning of technical subjects. Unfortunately,

teachers do not possess this training or proficiency that will allow them to completely employ these recent innovations to improve teaching and learning. However, the ICT Policy for Lesotho's (Ministry of Communications, Science and Technology, 2005) goals include promoting reasonable, general entry to ICT commodities and provisions and increasing ICT literacy levels in the country. It is therefore imperative for technical subject teachers to be fully qualified so that they can effectively assist learners in enhancing their ICT and technology literacy skills.

The assumption is that every teacher at a tertiary level has studied computer literacy, and it could be that these teachers have mastered TK. This is one of the TPACK aspects that enable teachers to use discipline-specific ICTs in teaching and learning of technical subjects. These teachers mentioned the following to demonstrate their engagement with integrating ICTs into their teaching:

"I just apply these ICTs during teaching using my cell-phone to google information to give to my learners" (Teacher A).

"I usually surf information from Internet and feed it into my laptop and play it to my students" (Teacher B).

Teacher D took a further step concerning the use of discipline-specific ICTs into his teaching. His dedication to and cooperation with his fellow teachers plus learners regarding the use of discipline-specific ICTs in his subject (Design and Technology) contributed massively to providing him with the necessary ICT experience and self-belief, as well as in enhancing his students' performance.

To demonstrate the commitment to integrating ICTs into his learning and teaching, he mentioned:

"We have opened a WhatsApp group where we impose questions to our students; they respond to the question on the same group and we too attend to their responses on the same group" (Teacher D).

The above teacher's information clearly demonstrates that some teachers make attempts to integrate ICTs into their pedagogical responsibilities to enhance teaching

and learning. They go to the extent of exhausting their own personal or family resources to ensure that they use discipline-specific ICTs to teach (also refer to Section 2.3.3.3). It was noticeable that Teacher D and his colleagues, together with their students, have a suitable degree of ICT ability and can use discipline-specific ICTs in their teaching and learning.

4.5.1.2 Level 1.2: Teachers' Confidence in using ICTs

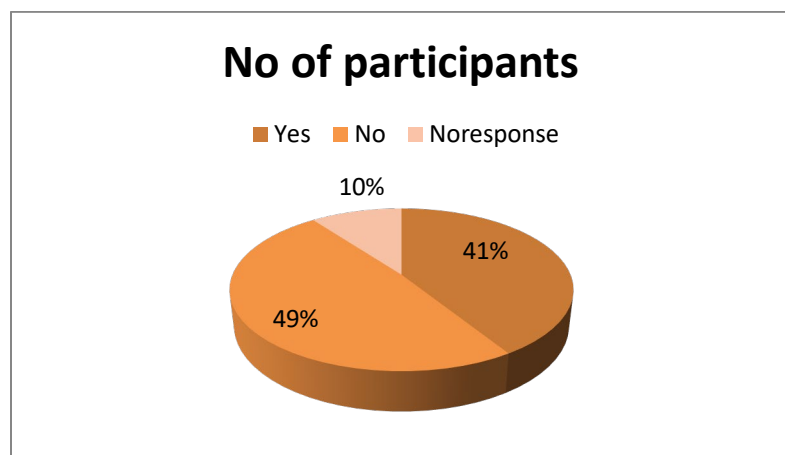


Figure 4.2: Teachers' confidence in using ICTs

Figure 4.2 demonstrates the confidence teachers have in the use of discipline-specific ICTs in teaching and learning of technical subjects. 41% (n=16) responded yes, 49% (n=19) responded no, and 10% (n=4) did not respond to the question: In teaching and learning of technical subjects, how confident are you in using discipline-specific ICTs to teach your learners? The results show an almost equal outcome for teachers who admitted that they had confidence and no confidence in using discipline-specific ICTs in teaching and learning, as opposed to only four teachers who did not respond at all.

Equally, the same perceptions were voiced in the interviews, and the teacher participants indicated this with the following statements:

"I use the Internet to research information for some of my teaching"
(Teacher B).

“I am quite confident because it has been a while now that we started using technology for teaching” (Teacher A).

“I own a Smartphone that I usually use for researches on certain topics” (Teacher D).

However, there are still some teachers who find it difficult to utilise discipline-specific ICTs in their teaching, as evidenced by the following response:

“Since I am not fully knowledgeable about the use of ICTs, I don’t feel comfortable to use it” (Teacher H).

Inadequate training to utilise discipline-specific ICTs in teaching and learning results in inadequacy of ICT skills, and a lack of self-belief results in low capabilities. Some teachers still find it difficult to use discipline-specific ICTs for teaching learners who are knowledgeable about ICT tools. It is therefore of the utmost importance to expose teachers to appropriate training because it will lead to all teachers adopting and using ICTs appropriately in curriculum delivery. One of the goals of the ICT Policy for Lesotho (Ministry of Communications, Science and Technology, 2005) is to promote the practice of discipline-specific ICTs to all sectors, including under-privileged groups. In teaching and learning, this means that all teachers are to be informed and well-read in computer use so that they will be able to use discipline-specific ICTs in their teaching. When they (teachers) are entirely knowledgeable and competent to utilise discipline-specific ICTs, they will be in a position to assist their students in enhancing their learning.

4.5.1.3 Level 1.3: Teachers, interest in using ICTs

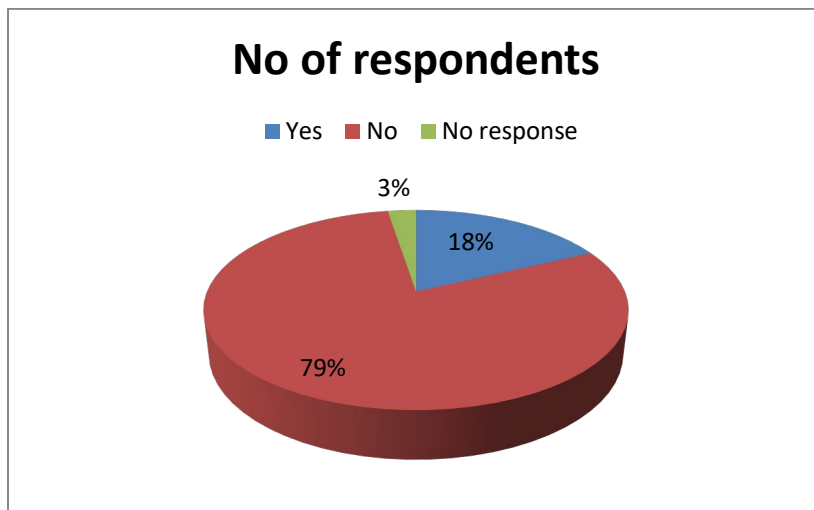


Figure 4.3: Teachers' interest in using ICTs

Figure 4.3 illustrates a pie diagram demonstrating interests technical subject teachers have in the use of ICTs. There were 39 technical subject teachers (respondents) and 18% (n=7) responded yes, 79% (n=31) no, and 3% (n=1) did not respond. The teachers were responding to the question: Do you use various discipline-specific ICT tools (WhatsApp, Facebook, email, Twitter) to give learners activities? 79% (n=31) of 39 technical teachers seemed to utilise the WhatsApp, Facebook, Twitter, and email to engage their students even beyond the classroom. Only 18% (n=7) declared that they did not use any ICTs to extend their teaching beyond the classroom, and 3% (n=1) of the 39 teachers did not respond to the question. However, the interviews seemed to concur with these perceptions. A teacher participant was quoted as follows:

"I don't use Internet for upgrading my professional development for I am not used to... I don't even give learners tasks prompting the use of Internet because they complain that it is too expensive to do so" (Teacher H).

Some teachers showed a lack of interest, even in the company of colleagues who are ICT-trained and keen to assist them to obtain ICT proficiency. An ICT-educated teacher

uttered his annoyance with some of his colleagues who are not willing to use discipline-specific ICTs in teaching:

“We’ve got very old teachers here. They are afraid of using these ICTs; they even call themselves BBTs [born before time] .They are afraid to use it because to them it’s very embarrassing to be corrected by students.”
(Teacher B).

“Concerning technology, these kids possess lots of knowledge than us as teachers and as time goes on, it will be very difficult to teach these kids because they are using cell-phones regularly to Google for information”
(Teacher G).

Various factors surfaced that impede school teachers from using discipline-specific ICTs in their lessons. These factors include resistance, lack of interest, and negative attitudes. Some teachers refuse or are hesitant to use discipline-specific ICTs in their lessons, and it is a concern to those teachers who are trying their best to use discipline-specific ICTs to enhance teaching and learning. Resistance to change is the main trait that teachers demonstrate in their refusal to use discipline-specific ICTs in their teaching. They mainly rely on old and traditional ways of teaching where the teacher imparts knowledge to learners. Some teachers dislike change and have a fear of technology, while others have a negative attitude and are reluctant to use discipline-specific ICTs in teaching and learning. Effective leadership means having school principals who are assiduously involved in assisting teachers to unravel issues, including providing instructional advice (World Bank, 2018). School leadership should therefore encourage teachers to be autonomous and to act according to the needs of their learners.

4.5.2 Theme 2: Insufficient ICT infrastructure

In this theme, the focus is on the accessibility of ICT infrastructure. It can be dealt with by also examining human resources and other vital attributes that are needed for the

promotion of teaching and learning with ICTs. This theme comprises insufficient computers, limited time and space, and Internet connectivity.

4.5.2.1 Level 2.1: Availability of ICTs resources

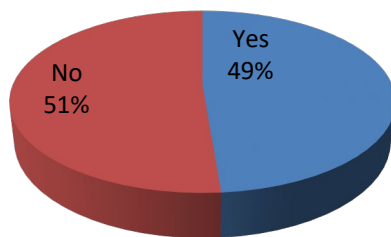


Figure 4.4: Availability of ICTs resources

Figure 4.4 demonstrates that 49% (n=19) out of 39 teachers indicated that they had a computer laboratory at their schools, compared to 51% (n=20) out 39 who said that they did not. The question was: Does your school have an Information Communication Technology laboratory? This is a balanced response. However, when the technical subject teachers were interviewed about the availability of a computer laboratory, they reported as follows:

“We have shortages of computers in our school, and some of them are also old” (Teacher E).

“We have computers in my school, but unfortunately they are all dead” (Teacher H).

A lack of ICT infrastructure and use of discipline-specific ICT infrastructure in schools seemed to pose problems. Some teachers appeared amazed to have ICT infrastructure that included overhead projectors and transparencies, Internet access, and personal mobile phones. On the other hand, some teachers were not pleased with the ICTs they had in their different schools. Inadequate discipline-specific ICTs in terms of overhead projectors and computers appeared to give teachers low morale. As a result of this

feeling, some teachers felt powerless and disappointed with regard to using discipline-specific ICTs to improve the way they teach and how their students learn. It is relatively impracticable to engage all learners effectively in one class, as the groups are too big to handle and they cannot study alone fruitfully.

The inadequacy of ICTs tools in Lesotho's schools is a major obstacle to integrating discipline-specific ICTs in their lessons, and the participants said:

"We need an independent ICT laboratory for our learners so that we do not rely on school computer lab, which is meant for computer education and also students should be allowed to bring their own laptops and cell-phones" (Teacher E).

These comments to the researcher symbolise the desire and passion of teachers to use discipline-specific ICTs in their lessons. To enable efficient teaching and learning, schools should have proper computer laboratories equipped with proper ICT tools. These ICT tools give learners the opportunity to fully commit to more effective and collaborative learning needed in the 21st century, as per the Lesotho ICT Policy's demands: "Offer and maintain the flow of ICT infrastructure for access to ICT services and products" (Ministry of Communications, Science and Technology, 2005:29).

4.5.2.2 Level 2.2: Limited time and space

Three (3) teachers indicated that there are computer laboratories at their schools that are furnished with computers. However, there are large groups of students that each teacher deals with and the time slots allocated to each class do not allow the regular use of ICTs. Therefore, one computer laboratory is not sufficient to accommodate these large groups of students ranging from 22 to 45 in one classroom. This concludes that schools need a several computer laboratories to cater to all the teachers' and students' needs. Even the size of the existing computer laboratories were said to be insufficient:

"We are a big school here and the computer lab is small and it cannot accommodate classes the way we want it" (Teacher D).

The same view was also shared by another teacher participant, who mentioned:

“The groups are too big and the time slot does not allow regular use of ICTs because whenever I want to use the computer lab, you will find that there is a class going on there” (Teacher E).

Limited space and time slots make it difficult for smooth teaching and learning. As a result, independent and collaborative learning fails to take place, which leaves students having to rely mostly on their teachers’ knowledge.

4.5.2.3 Level 2.3: Internet connectivity

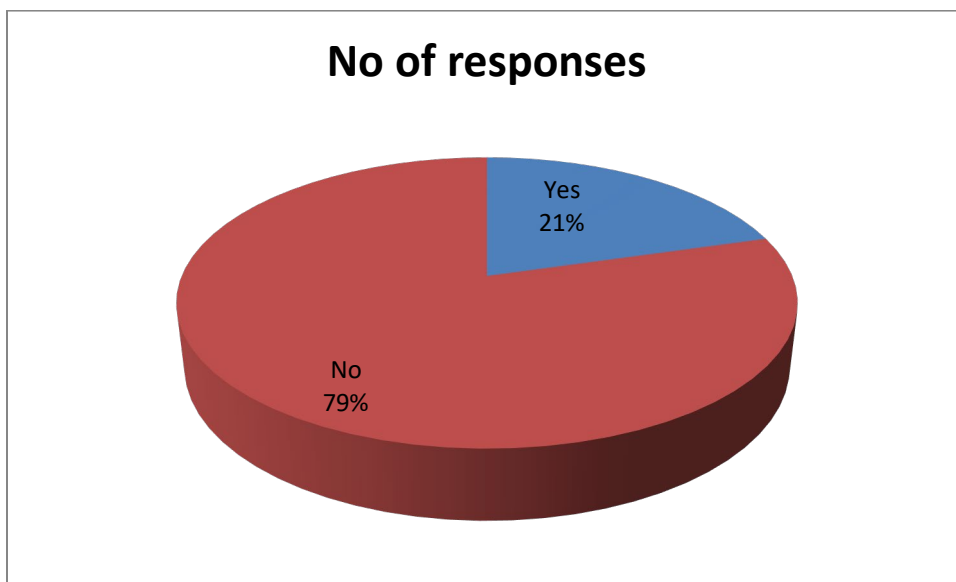


Figure 4.5: Internet access at school

Figure 4.5 illustrates that out of 39 teachers, 21% (n=8) responded yes and 79% (n=31) responded no. These technical teachers were asked a question: Do you use the Internet or wi-fi to teach and improve or update your subject knowledge? 79% (n=31) revealed that they do not use the Internet or wi-fi at their respective schools to teach and update their subject knowledge, since there is no Internet connectivity. Out of a total of 39 teachers, only 21% (n=8) revealed that they had Internet connectivity; hence they improve their subject knowledge regularly. The results were verified in the

interviews when the participants were asked: “Do you use the Internet or wi-fi to teach and improve or update your subject knowledge?” (n=5) of the interviewed teachers declared that they rely on their personal phones with their own data to connect to the Internet. To illustrate, some of the teachers explained:

“Due to financial constraints, it’s not easy to access wi-fi because it is sometimes switched off and opened at certain time” (Teacher C).

“At our school we don’t have Internet or wi-fi at all” (Teacher G).

The researcher’s view is that, due to these circumstances, discipline-specific ICTs are utilised minimally to improve teaching and learning. Unfortunately, most of the enthusiastic teachers may lose their curiosity, enthusiasm, and passion for integrating ICTs into the daily practice of their profession as a result. On a sad note, this can result in these active, passionate, and interested teachers to continue using traditional ways of teaching that do not address learners’ rights and needs.

4.5.3 Theme 3: Importance of discipline-specific ICTs in teaching and learning

ICTs were seen as a source for attending to educational limitations, hence conveying the anticipated change required in the 21st century. Teachers embraced the significance of utilising ICTs to improve students’ education. Technical subject teachers also confirmed and accredited the merits of using discipline-specific ICTs in teaching and learning of technical subjects. This theme entails the learning method, teaching methods, and the delivery of subject matter.

4.5.3.1 Level 3.1: Learning methods

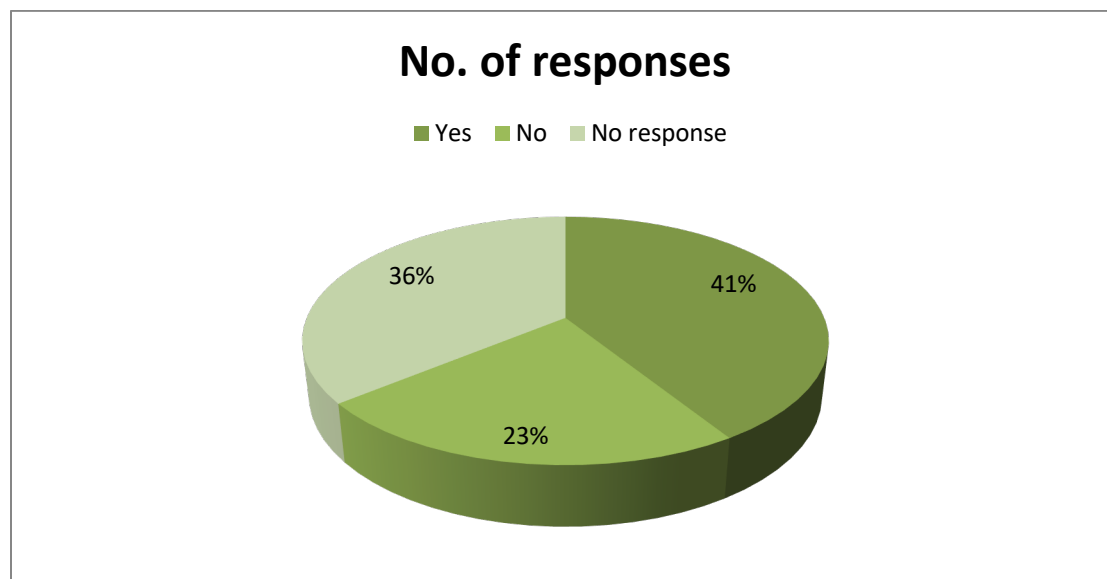


Figure 4.6: Discipline-specific ICTs in teaching and learning

Figure 4.6 illustrates teachers' integration of discipline-specific ICTs in teaching and learning. The question was: Do you use discipline-specific ICT tools when teaching technical subjects with the aim of providing new ways of enhancing learners' experience to acquire knowledge? Out of 39 teacher participants, 41% (n=16) responded yes, 36% (n=14) responded no, and 23% (n=9) did not respond. Therefore, this is inconclusive because many respondents did not answer the question. However, it can be concluded that some teachers use discipline-specific ICTs to improve teaching and learning.

New educational conferment with technology confirmed that teachers are seen as facilitators and no longer deemed as the only basis of knowledge; instead, learners on their own, through various specific disciplines such as online learning, electronic whiteboards, simulations, and the Internet, can access massive amounts of necessary information to class to collate and prorate facts. Just like anybody else, students differ from one another. They vary in the way they learn, i.e. their preferred modes of gathering, organising, and assessing information (Shah, Ahmed, Shenoy & Srikant, 2013). According to Muniandy and Shuib (2016), ICTs possess an inspirational influence on learners. Through it, learners are able to be supported visually, auditorily,

kinaesthetically, socially, solitarily, and linguistically (reading and writing). For instance, Shah *et al.* (2013) revealed the following:

Kinaesthetic learning employs a combination of sensory functions; such learners have to feel or live the experience to learn; they prefer simulations of real practices and experiences, lessons that emphasize on performing an activity, field trips, exhibits, samples, photographs, case studies, 'real life examples', role-plays, and applications to help them understand principles and advanced concepts.

These strategies attest how adaptable discipline-specific ICTs are in adjusting to learners with different learning styles with the aim of achieving learning outcomes:

"These kids learn a lot because finding information for themselves... makes them eager to learn more, rather than you as a teacher coming with a certain information"(Teacher B).

"I regard myself as a facilitator because now teaching is no longer teacher centred but learner centred as the kids are able to source out information for themselves" (Teacher C).

The fourth industrial revolution has changed the way teachers approach and teach, and today's students prefer to be taught on their own terms. One teacher admitted that 21st-century students learn in various ways and their demands are different from those of past generations. To this end, these teachers are encouraged to use new routines of teaching:

"Since it's technology, students like technology nowadays and like to concentrate more on technology because it makes learning very easy" (Teacher G).

4.5.3.2 Level 3.2: Teaching methods

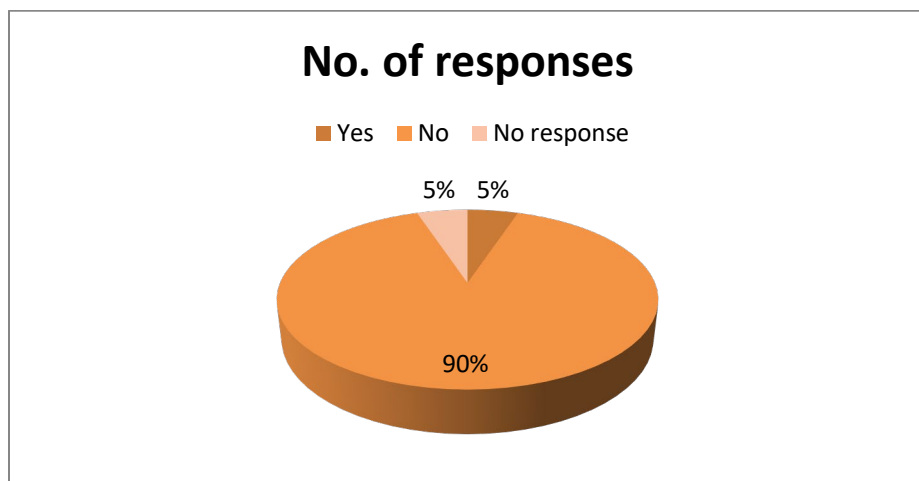


Figure 4.7: Use of discipline specific ICTs into teaching and learning

Figure 4.7 displays information about the use of discipline-specific ICTs to improve professional development from the question: Do you utilise various discipline-specific tools (internet, ipad etc) to update your subject knowledge? Of the (n=39) teachers who completed the questionnaire, only (n=2) 5% technical subject teachers integrated ICTs into their teaching, and (n=2) 5% did not answer the question. The (n=35) 90% technical subject teachers indicated that they did not use discipline-specific ICTs to their lessons. This figure sends a strong message to stakeholders concerned about education in Lesotho, particularly when the world is operating in the fourth industrial revolution.

The emergence of discipline-specific ICTs in teaching and learning offers teachers a current approach in their work as a mediator. Discipline-specific ICTs have ability to improve the value of education by uplifting learner interest and involvement and by facilitating the acquisition of basic skills (Meenakshi, 2013). Alkahtani (2017) explained that ICTs can be utilised to present lessons with engaging and thrilling real-world examples and inspiring visual and audio illustrations from an extremely wide range of sources. This is to say, ICTs indulge sundry options to permit teachers to attain educational goals regardless of learners' potential in the classroom. Despite the benefits

that ICTs provide, almost none of the teachers integrated ICTs into their teaching. The teacher participants supported this claim in the interviews:

“It’s really difficult to integrate ICTs into our teaching because students are not allowed to bring their cell-phones and other devices to school and even if they were allowed, wi-fi coverage is limited to a certain range and its weak” (Teacher F).

“We do not have Internet at our school to source to students and our students are compelled to buy data for themselves, which is not easy at all. Again, students are prohibited from bringing their cell phones to school, so when arrangements are made to allow them, they are also not allowed to charge them when the batteries are flat” (Teacher B).

“The financial constraints impede us from integrating ICTs into our teaching, and our leadership does not see the necessity of availing all the resources” (Teacher C).

However, although particular teachers failed to use discipline-specific ICTs in their teaching, they acknowledged the importance of using discipline-specific ICTs in teaching and learning. They regarded ICTs as catalysts to maximise students’ self-confidence and to boost their motivation as a result, and learning becomes fun as these students interact with technology at their own space, time, and pace. Therefore, regardless of students’ diverse learning styles, the teachers indicated that most of the students were dazzled when they used ICTs in learning. One teacher stated:

“Our students are highly inclined to technology and their attention is high when using them and they enjoy doing tasks using ICTs” (Teacher C).

The digital generation is characterised by learning by doing. The teachers’ responsibility as a leader and catalyst is therefore emphasised. Teacher C acknowledged that ICTs make his students see things beyond the scope of what a teacher may cover in his or her class:

“When using ICTs, students’ interests go high because it makes things simple” (Teacher G).

To add to the above virtues of ICTs, ICT aptitude was linked to other aspects. Utilising discipline-specific ICTs allows both cooperative learning and individual active learning be to effectively carried out. The teachers clarified that, although computer laboratories were busy most of the time, they usually tasked their students to research using cell-phones and come to class to discuss their findings in groups. The teachers interchangeably used individual and cooperative learning as learning processes in their teaching. This was asserted by the following comment:

“I give my students a group work; that is, each group is going to present their work, and each group tries its level best to perform in presentations” (Teacher F).

4.5.3.3 Level 3.3: Delivery of subject matter

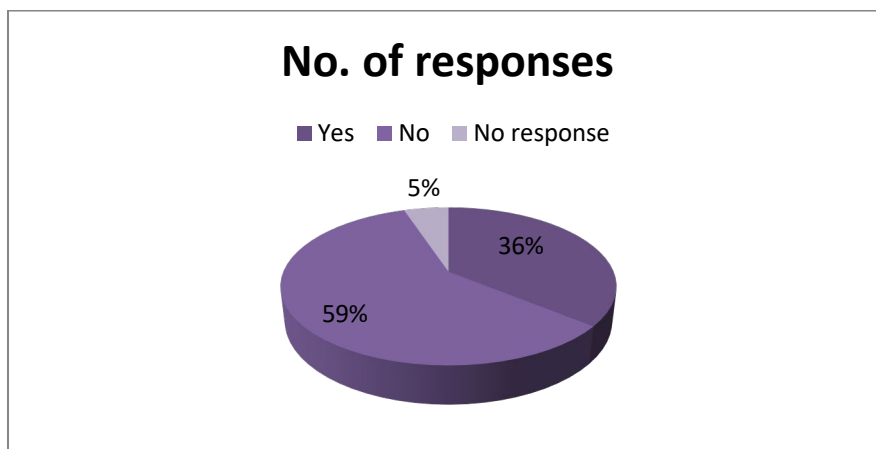


Figure 4.8: Tasks that prompt Internet usage

Figure 4.8 illustrates tasks that prompt the use of the Internet. The question was: Do you give your learners activities that require or prompt the use of wi-fi or the Internet when teaching technical subjects? Teachers’ responses were 36% (n=14) yes, 59% (n=23) no, and 5% (n=2) did not respond. The 59% (n=23) teacher participants indicated that they did not give learners such tasks, followed by 36% (n=14) teachers

who indicated that they did give learners tasks that prompt the use of ICTs. Only 5% (n=2) of teachers did not answer the question. Nevertheless, the replies from the interview refuted the information above as follows:

“I usually give learners problems using Internet and they are always stimulated as their interests are uplifted by the use of ICTs” (Teacher G).

“Learners are able to acquire knowledge through research on the Internet” (Teacher E).

4.5.4 Theme 4: Using ICTs to teach

Teachers need to be capable of or skilled in integrating ICTs into their lessons. Technical education teachers should be able to utilise their pedagogic knowledge, discipline-specific pedagogic content knowledge, content knowledge, and knowledge of existing technological advancements within their disciplines to teach the required technical education content, skills, and habits of mind with ICTs (Teis, 2014; Makgato, 2017; Timire, 2018).

Teachers should use various disciplines to connect with their students to simplify classroom teaching activities to capture the students' attention. The teacher participants stated the following:

“I use an overhead projector and transparencies at my school. I draw on the transparency everything regarding the topic I want to teach my students, then place the transparency on the overhead projector, which projects every information on the wall for all learners to see” (Teacher E).

“I prepare the slides to be used on the overhead projector regarding the topic to be taught” (Teacher D).

“I for one put the information on the transparency paper, put it on the projector and it reflects on the board, whereby I am able to increase or decrease the size of the image that I want to show to my learners” (Teacher B).

Teachers use transparencies in conjunction with overhead projectors to enhance teaching in the classroom. They considered the use of this tool to be more engaging for the learners and stated the following:

“Learners are engaged as they are free to come to point to areas where they are not clear and sometimes they operate it themselves” (Teacher B).

“When you use overhead projector, you help them [learners] to understand much better because the pictures are very clear when they are being projected to the wall using projectors” (Teacher D).

Computers play a vital part in the Information Age because they deeply impact the area of education to enhance the value of teaching and learning (Dabas, 2018). Dabas (2018) further explained that teachers are expected to be conscious of the influence of computers on the field of education and their subject area to make teaching and learning effective. Some teachers basically rely on using computers, the Internet, and their phones for research to update their skills and to gather the information they will give to their students. The teacher participants explained how they integrated the Internet, mobile phones, and computers into teaching and learning:

“We just apply these ICTs during teaching, just by using our cell phones to research. We use our cell phones to Google some of the information so that from there we can jot it down and give to our students as written notes” (Teacher A).

“Supposing we are dealing with woodwork tools, I usually involve my learners to Google for equipment [tools] and then we discuss in class” (Teacher B).

“When teaching Basic Handcrafts, we normally incorporate ICTs in our computer lab, for example when teaching Metalwork, we normally give them some topics to research about, say to research about ferrous and non-ferrous metals” (Teacher E).

“I Google for information, for example, let’s talk of Google. If we say we talk of theme analysis, we normally Google how we analyse themes”
(Teacher F).

From the above information, it can be concluded that some teachers were trying to use ICTs to their lessons, but it was done minimally and irregularly. They cited that it was not easy to use ICTs to their lessons and named some obstacles impeding them from doing so; for example:

“We do not have full support from the management of the school. They don’t support us at all” (Teacher H).

From the above responses, it can be seen that teachers still find it difficult to implement ICTs into the teaching and learning of technical subjects.

4.6 DOCUMENT ANALYSIS

Mukhari (2016) referred to “documents” as a broad scope of printed, tangible resources and visual, objective resources that have been developed and recorded without a searcher’s interference. McMillan and Schumacher (2010) explained that documents can be approved or personal, which incorporate notes, and letters.

In this study, the documents are lesson plans, schemes and records of work, the syllabus, and Lesotho’s ICT Policy.

Bowen (2009) and Wach (2013) defined document analysis as an organised process for assessing documents, both written and electronic. The aim is to draw out meaning, to acquire a thorough considerate knowledge of the contents, and to increase practical knowledge. For a detailed assessment of the subject, interpreting and assigning meaning in the document-analysis process, the analyst should be able to draw out and read information. As per Wellington’s (2015) statement, documentary analysis was chosen as the third approach in this research, as it worked well in conjunction with qualitative interviews and can “enrich a study throughout the research process”. The researcher should therefore be in a position to read thoroughly and fully comprehend

and synthesise the information contained in the documents. Researchers should also be in a position to prepare the levels and themes of study units.

The study intended to understand the integration of ICTs into technical subject teaching in Lesotho. The researcher should therefore understand teachers' views and experiences using discipline-specific ICTs into their lessons when teaching. The researcher consequently used lesson plans, schemes and records of work, the syllabus, and Lesotho's ICT Policy to gain a thorough perspective of teachers' views and perspectives integrating ICTs into the teaching and learning of technical subjects in Lesotho.

Table 4.2: Documents and data analysed

Documents used	Analysed data
Syllabus	The mission statement, approaches, and objectives for secondary technical education
Schemes and records of work	Resources and work done regarding use of ICTs in teaching
Lesson plans	Objectives of the lessons that involve the use of ICTs
ICT Policy 2005	Policy goals and objectives for effective integration of ICTs in education

4.7 DOCUMENT ANALYSIS PROCEDURE

A deductive reasoning method to qualitative document analysis established on the themes that surfaced via the levels and thematic analysis of teachers' interview data was used in this study. In gathering data to confirm the findings of the interviews and the content analysis, the researcher used the established codes and themes for triangulation purposes (Eisner, 1991).

4.7.1 Theme 1: ICT training and skills

One of the overall objectives regarding ICT Policy focuses on increasing ICT literacy levels in the country, particularly in teaching and learning (Ministry of Communications, Science and Technology, 2005). However, some teachers fail to use ICTs in the teaching process, yet the objectives of the policy are clear in equipping every person with literacy to deal with ICTs. The teachers said:

“I need ICT training so that I can confidently integrate ICTs into my teaching” (Teacher A).

“I rely on using the traditional way of teaching because I am not fully knowledgeable about the use of ICTs. I don’t feel comfortable to use it” (Teacher H).

4.7.1.1 Level 1.2: Skills

The Lesotho ICT Policy (Ministry of Communications, Science and Technology, 2005) requires the following: “create and support platforms and plans for improving ICT skills within the current workforce in educational institutions, industry.”

4.7.1.2 Level 1.3: Competencies

The mission statement of the J.C Syllabus of Basic Handcrafts (2002) stated that the subject Basic Handcrafts will assist students to extend an awareness of the needs of the human being in this age of technology.

4.7.1.3 Level 1.4: Interest in the use of discipline-specific ICTs in teaching and learning

No traces of ICTs used in the lesson plans of the teachers in the learning outcomes and even in the schemes and records of work or the resources were found not to show any use of ICTs.

4.7.2 Theme 2: ICT infrastructure

To efficiently and productively use discipline-specific ICTs in schools, an ICT infrastructure is the main priority and one of the most important strategic objectives and conditions that should be provided for.

Lesotho as a nation requires an up-to-date and proficient infrastructure, such as roads, utilities, and communications networks with the aim to recognise the benefits ICTs offers in teaching and learning.

Without such infrastructure, it becomes difficult and impractical to produce telecommunications, broadcasting, computing, and information services such as the Internet, mobile/cellular communications, digital television and radio, interactive multimedia, telemedicine, and distance learning (Ministry of Communications, Science and Technology, 2005).

4.7.3 Theme 3: Benefits of discipline-specific ICTs in teaching

The government of Lesotho with its national target of attaining a knowledge-based society stated that the education system is expected to develop citizens who can enthusiastically contribute to the system globally, as well as delivering valuable education for fiscal and social advancement. Integrating ICTs into teaching and learning can be used to enhance teaching and learning by using discipline-specific teaching tools.

4.7.3.1 Level 3.1: Teaching and learning methods

ICTs can be utilised in learning to speed up the development process of the learner and of the teacher as well. ICTs can be used to deliver information faster and more efficiently than before through the use of videos, voice, data, text, and graphics. It is for this reason that the government of Lesotho, via its ICT, Policy emphasised:

Educational institutions should perform a main role in enlightening teaching and learning devices that develop a society that is ICT informed and efficient of making local ICT products and services. They must guarantee that ICT knowledge is part of core curricula and must use ICTs to grow access to education as well as enhancing the quality of education (Ministry of Communications, Science and Technology, 2005).

4.8 CONCLUSION

The purpose of the present chapter was to provide the empirical research findings on how the integration of ICTs into technical subjects may enhance teaching and learning and the analysis of the documents regarding the integration of ICTs in teaching and learning. There were three data analyses: teachers' interview transcripts and four main themes appeared the analysis on the survey questionnaire and lastly the document analysis was the third analysis where three main themes appeared.

The next chapter will be the summary, conclusions and the recommendations on the study.

CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous chapter discussed the results of the empirical study as well as the literature analysis. It also dealt with the levels and themes from the research data. The present chapter offers a full analysis of the entire research. The present chapter again focussed on deducing whether the study achieved the aims of the research. The researcher conducted a literature study and empirical research to answer the research questions. The TPACK conceptual framework was used as the model that embraces how the integration of discipline-specific ICTs into technical subjects may enhance teaching and learning in Lesotho. The present section offers the summary, conclusions, and recommendations of the research.

The opening section of current chapter centres on giving an outline of the literature review and the empirical study. Discussions of the conclusions of the study as they link to the research questions follow after the synthesis of the research findings. The chapter ends with recommendations made by the researcher, a review of the limitations of the study, a discussion of the conclusions, and suggestions for further research.

5.2 SUMMARY OF RESEARCH FINDINGS

The results of the research revealed that the teachers viewed ICTs only as the basis, that is, the use of computers, overhead projectors, mobile phones, and the Internet, and they consider ICTs as teaching tools or discipline-specific teaching tools and did not necessarily consider ICTs as teaching tools or discipline-specific tools to improve teaching and learning (cf. 4.5.4). The results also encapsulated the factors that promote or hamper the integration of the discipline-specific ICTs in schools, namely the absence and shortage of infrastructure, training, and the absence of a specific education policy that clearly defines the goals and objectives schools should meet. The findings of this study are backed by the literature reviewed in Chapter 2, which helped to answer the research questions stated in Chapter 1, and are uniform with the conceptual framework

as clarified in the same chapter. The results of the literature review, the empirical investigation, and the document analysis are dealt with hereafter.

5.2.1 The summary of the results of the literature review

The TPACK model was utilised as the conceptual framework in this research. It shows the importance of the components of TPACK, which are CK, PK, and TK in an ICT-integrated teaching and learning environment (cf. 2.2.2). The TPACK conceptual framework emphasises the need for teachers, together with their learners, to truly integrate discipline-specific ICTs to improve teaching and learning in a technical subject classroom.

It is maintained that effective technology integration into pedagogical activities involve the mastery of three core knowledge components (Dong, Chai, Sang, Koh & Tsai, 2015). Therefore, it could be concluded that teachers, learners, and entire schools must be involved in the acquisition of knowledge. This is because the creation of highly educated staff is strongly emphasised in spite of the poor ICT conditions and skills in several schools. Via the application of the TPACK framework, it was found from the literature review that teachers should be fully knowledgeable and skilled in the integration of discipline-specific ICTs in teaching and learning. The TPACK conceptual framework, as the insights from the literature showed, offered information that affirms the incorporation of discipline-specific ICT tools in teaching activities. The information gained from this enabled the researcher to respond to the main research problem. After coding, the researcher identified levels and themes that appeared from the collected data, and it was affirmed that most of the schools in Lesotho, if not all, still struggle to fully integrate discipline-specific ICTs into the teaching and learning of technical subjects in Lesotho.

In Chapter 2, the literature review helped the researcher to address the related research problem. The importance of utilising discipline-specific tools such as 3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers in schools was emphasised by the literature and affirmed by various studies, for instance, Mwalongo's

(2011) and UNESCO's (2012) studies. The studies show the effect of ICTs on learner-centred pedagogy. Learner-centred pedagogy means that learners are intensively engaged in learning activities. It plans and provides possibilities for the students to learn in their own time, space, and pace (Darsih, 2018; Klemenčič, 2019). The literature illustrates that teachers in the 21st century need to be radical on the creation of information, adaptation, and purpose (Hennessy, 2010). Shan Fu (2013) shared a similar view that 21st-century teachers are bound to gain new teaching approaches so that they can offer engaging and exciting classes. The literature stresses that discipline-specific ICTs provide teachers with enhanced tools for teaching and learning. It was also revealed that discipline-specific ICTs give teachers means to access and to gain information about ways to interact and exchange ideas with their learners.

The literature demonstrated that principals as the heads of schools should encourage the employment of ICTs in schools (see Section 2.6.2).

5.2.2 Summary of the findings of the empirical research

This part discusses the results obtained in Chapter 4, namely the levels and the main themes of the study (cf. 4.3.1 to 4.3.3) that emerged from teachers' and a principal's views regarding the integration of discipline-specific ICT platforms into the teaching and learning in technical subjects in Lesotho. The participants accepted the significance of the use of discipline-specific ICTs in teaching and noted that the use of new discipline-specific ICT platforms in schools conforms with the principles of the TPACK framework (cf. 2.2.2).

The findings on the empirical data are based on the factors that support or hinder the integration of discipline-specific ICT tools to enhance teaching and learning.

However, teachers view ICTs only as the basis, that is, the use of computers, mobile-phones, overhead projectors, and the Internet, and they do not necessarily consider ICTs as teaching tools or discipline-specific teaching tools. For example:

“I use Internet for referrals because in teaching and learning things do change from time to time, so to be always updated, I always refer to the Internet” (Teacher C).

“I use the computer and Internet for certain topics, particularly for senior classes and play some slides” (Teacher E).

The literature shows that the failure of teachers to integrate ICTs is related to a lack of training. Cubukcuoglu (2013) argued educators should be skilled to improve the pedagogical use of technology, as well as training in basic technology skills. This would allow them to be furnished with the necessary competence to permit them (teachers) to incorporate ICT innovations to enhance teaching in the classroom. Cubukcuoglu (2013) further pointed out that this type of preparation will not only enable teachers to feel assertive in teaching and learning, but they will also be competent in utilising ICTs at the right time and for good purposes. Moreover, this training will assist teacher trainees to know the best approach and time to integrate discipline-specific ICTs in teaching and learning.

The empirical data show that most of the teachers found it difficult to integrate discipline-specific ICT tools to improve teaching and learning, and the teacher participants were quoted as saying:

“It’s really difficult to integrate ICTs into our teaching because students’ equipment namely as the laptops and smart-phones are prohibited in the school campus and even if they were allowed, Wi-Fi coverage is limited to a certain range and it’s weak” (Teacher F).

“The financial constraints impede us from integrating ICTs into our teaching and our leadership does not see necessity of availing all the resources” (Teacher C).

The literature postulated that one more intricate obstacle is the lack of right of entry to ICT resources and failure to connect to the Internet (Mathipa & Mukhari, 2014).

However, Cubukcuoglu (2013) insisted that, if teachers can easily access the Internet, it might give them enough time to prepare their lessons and do research other Internet.

The empirical data showed that teachers lacked competence in integrating ICTs to enhance teaching because of a lack of training. For example:

“I need ICT training so that I can confidently integrate ICTs into my teaching” (Teacher A).

The literature also showed that confidence is another obstacle associated to lack of competence in teachers. Teachers struggle to use discipline-specific ICTs in their teaching as they lack the knowledge and skills to utilise them (Tedla, 2012). Teachers’ competence can assist to encourage methods, values, and harmonisation of ICT duties, the knowledge of ICT equity, utilisation and maintenance of ICT, implementation of ICT training, assessment and evaluation, development of ICT, dissemination of PK, professional development etc. (Tedla, 2012).

The empirical data show that, due to a lack of access to the Internet, discipline-specific ICT tools are used minimally to improve teaching and learning. One teacher was quoted saying:

“Due to financial constraints, it’s not easy to access wi-fi because it is sometimes switched off and opened at certain time” (Teacher C).

Teacher G also reiterated that *“At our school we don’t have Internet or wi-fi at all”*

Little or a lack of ICT infrastructure seems to pose problems at schools, which, as a result, hinders students from studying effectively and fruitfully. One teacher had this to say:

“We have shortages of computers in our school and some of them are also old” (Teacher E).

It is evident that a lack of access to the Internet or wi-fi and a lack of space because of big groups of students in one class make it difficult to integrate discipline-specific ICT tools to enhance teaching and learning.

Proper integration of discipline-specific ICT tools in teaching and learning is preferable to the following merits.

The literature showed that there are different discipline-specific ICT platforms that could be used to improve teaching and learning; for instance, 3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers, to name a few. These current innovations could be utilised to improve teaching and learning in technical subject classes.

The empirical findings show that discipline-specific tools are seen as effective pedagogical teaching and learning tools that make the job easier. Teacher B was quoted saying:

“These kids learn a lot because, finding information for themselves... makes them eager to learn more, rather than you as a teacher coming with a certain information” (Teacher B).

The same sentiments were shared by teacher C when saying:

“Our students are highly inclined to technology and their attention is high when using them and they enjoy doing tasks using ICTs” (Teacher C).

Discipline-specific ICTs are believed to be allowing teachers to approach teaching and learning differently, and as a result students become more interested and engaged in the subject matter.

“When using ICTs, students’ interests go high because it makes things simple” (Teacher G).

Technical subject teachers stress that discipline-specific ICTs make easy fascinating lessons (cf. 2.3.6). In support of this affirmation, teacher G submitted that:

“Since it’s technology, students like technology nowadays and like to concentrate more on technology because it makes learning very easy” (Teacher G).

With the use of discipline-specific ICTs, Lesotho schools still have much more work to do before they can be fully sourced with the needed ICTs in the education system.

“We just apply these ICTs during teaching, just by using our cell phones to research. We use our cell phones to Google some of the information so that from there we can jot it down and give to our students as written notes” (Teacher A).

The study findings showed that discipline-specific ICTs are a pedagogical discipline which are efficient and make things simple, although they are rarely utilised. One of the teachers said:

“When you use an overhead projector, you help them [learners] to understand much better because the pictures are very clear when they are being projected to the wall using projectors, but these transparencies are teachers’ property and not for students” (Teacher D).

This is to say that it is really very difficult for students to utilise these tools for the improvement of their studies, and that teachers think that regular utilisation of these transparencies will damage them, so they rather always keep them away from students after lessons.

ICTs permit and empower teachers to alter the way they carry out their approaches in teaching, because the mission is to ensure that all learners become interested in what is being taught.

“With the use of ICTs, i am able to connect with my kids anywhere anytime” (Teacher A).

“I use the Internet to research information and it makes my teaching simple” (Teacher B).

When learners are fully engaged in utilising computers, together with the Internet, the teacher has their maximum attention, they observe ideas, their hands are fully engaged, and they understand what they are taught (Mukhari, 2016), rather than a teacher researching information for some of his or her teaching.

The following are the factors that concern teachers in teaching and learning:

Competence, limited of access and space, Internet connectivity, insufficient computers, lack of training, lack of interest, lack of ICT skills.

Some teachers showed interest and a high level of confidence in integrating ICTs in teaching and learning and cited the following concerns: adequate training, Internet connectivity, confidence, adequate computers or ICT tools, and professional development.

5.2.3 Summary of the document analysis

The following are the most salient points derived from the document analysis:

- Teachers still rely on using traditional teaching methods that are old-fashioned compared to the requirements of the 21st century.
- Teacher training is needed to help teachers positively integrate ICTs into teaching and learning.
- Teachers view ICTs only as a basis; in other words, the use of computers, cell phones, overhead projectors, and the Internet, and they do not necessarily consider ICTs as teaching tools or discipline-specific teaching tools.

- In fostering a society that is ICT-educated and efficient in making local ICT products and services, educational institutions must perform a main part in enhancing teaching and learning mechanisms,

5.3 RECOMMENDATIONS

The study revealed that teachers in Lesotho find it difficult to integrate ICTs to enhance teaching and learning. There are various dilemmas surrounding the difficulty to integrate ICTs into teaching and learning: Inadequate ICT tools, inadequate training, and teachers view ICTs only as a basis, that is, the use of computers, mobile phones, and projectors and do not necessarily consider ICTs as teaching tools. Therefore, resolutions should be made with the aim of helping teachers to embrace the integration of ICTs to enhance teaching.

- In the 21st century, learners are cognisant of ICTs, and they enjoy using them. Therefore, teachers have an obligation to understand the importance of teaching digital-era learners using ICTs. It is important for teachers to know how 21st-century learners prefer to learn. Teachers are urged to attend weekly or monthly gatherings of learning to assist each other with the use of ICTs, issues arising in the daily teaching using ICTs, and share their knowledge. This could assist to build their confidence when using ICTs and also help to instil positive attitudes when integrating ICTs to enhance teaching and learning.
- Teaching the 21st-century learners requires classrooms that are digitally furnished to accommodate learning. Therefore, it is the obligation of each school, the Ministry of Education and Training, and the government to ensure that ICT tools are available to learners to learn effectively and teachers should always have easy access to these (ICT) tools.
- Lack of space and time reserved for ICTs is found as one of the stumbling blocks to the integration of ICTs to enhance teaching and learning. The

recommendation is that the school heads (principals and heads of department) should make reservations for time slots at least twice a week. Arrangements should also be made to allow teachers to meet and discuss issues regarding the integration of ICTs in teaching and learning, as this could help them to refresh their knowledge.

- The empirical findings revealed that, in the documents reviewed, there is a little said about ICT integration in teaching and learning. The suggestion is that schools should formulate a school-based ICT Policy. The policy should be informative, understandable and binding to every teacher. The principal and heads of department should ensure that the school-based policy is fully implemented in teaching activities.
- On the empirical findings, teachers showed that they had little knowledge about ICTs and TPACK knowledge; hence they are incompetent to integrate ICTs to enhance the teaching and learning of technical subjects. This calls for the Ministry of Education and Training to hold workshops for ICT training followed by regular refresher workshops every month so that teachers have one common understanding about the integration of ICTs to enhance and teaching and learning.
- The current study used the TPACK framework. The TPACK framework involves effective teacher knowledge of technology. TPACK links classroom practices to theory through what to teach (CK), how to teach (PK), and using technology (TK). Therefore, it is imperative that teachers acquire technological knowledge to be able to deal with ICTs and combine them with pedagogical content to create Technological Pedagogical Content knowledge. It is this knowledge that will help teachers to use discipline-specific ICTs to teach effectively.

Lastly, the ICT policy for the country is vitally important at this juncture to regulate every teaching activity. It has to be explicit and directive; that is, The ICT policy must be specific and must clearly define what teachers should do to ensure that they integrate

ICTs to improve classroom activities. It should also take into consideration the socio-economic status of schools in Lesotho and be based on the present state of discipline-specific ICTs in the Lesotho context (cf. 2.3) rather than adopting the practices of the most developed countries in the world.

5.4 CONCLUSION

Some schools seem to invest more in discipline specific ICTs with the purpose to enhance teaching and learning activities. Some schools have computer laboratories to make these tools for the 21st century accessible to everybody. Furthermore, the government of Lesotho took the initiative to ensure that the country adopts an ICT Policy that will be used to avail these discipline-specific ICTs tools for teaching and learning across all subjects.

According to Cuban (2013), the induction of ICTs in teacher education programmes and in schools is generally expected to shift classrooms practice from “chalk and talk” to more authentic and innovative classes. However, in the study at hand, the findings revealed that teachers viewed ICTs only as the basis, in other words, the use of computers, cell phones, overhead projectors, and the Internet and they do not necessarily consider ICTs as teaching tools or discipline-specific teaching platforms for teaching enhancement in the classroom. The literature revealed that, in order to enhance teaching and learning, discipline-specific teaching tools such as 3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers should be used (cf. 2.2.2.1).

The main research aim seeks to understand how technical subjects’ teachers in a specific schools district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects (cf. 1.6). The data in the empirical study and the document analysis demonstrated teachers’ and a principal’s views regarding the integration of discipline-specific ICTs in teaching and learning of technical subjects in Lesotho. This study’s

conclusions are declared as solutions to the sub-research questions and are explained in the next section.

- a) **Sub-Research Question A:** What is the educational relevance and value of the integration of ICTs into technical education subjects?

In response to the research question one (1), the researcher referred to the review of the literature and the empirical study. The literature revealed that the TPACK model was the conceptual framework most relevant to this study because it combines effective teaching with technology. TPACK is a framework that can significantly assist teachers to integrate educational technology into teaching and learning. The use of 3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers, to name a few are some of the discipline-specific ICTs that can be utilised to involve learners and to promote more complex intellectual skills when learning. In that way, the adoption of ICTs in the classroom will give learners enough information of definite subject areas, thereby encouraging purposeful teaching and learning, as well as enhancing professional productivity (Shadreck, 2015).

The empirical study revealed that most of the teacher participants tried to use discipline-specific ICT platforms; in particular the Internet, computers, projectors, and phones (Smartphone's and iPads) to give explanations and simplify the subject matter to enable learners to be fully committed to enhanced knowledge of the learning material (Teachers B, C, and E). This is in accordance with Mishra and Koehler's (2006) statement that TPACK is important to teaching and learning because it stresses that teachers require a profound, more crucial consideration and mastery of ITCs for information dispensation, interaction, and problem solving.

- a) **Sub-Research Question B:** What factors influence technical teachers' effective integration of relevant ICTs into technical education classes?

Teachers are seen as important components in the use of discipline-specific teaching technologies to enhance technical teaching in the classroom. As indicated in the literature, teachers should implement and utilise ICTs and related technologies applicably when teaching and employ the adjustments anticipated in pedagogy (Ang'ondi, 2013). In a quest to promote discussions amongst learners and to groom them to partake in a community of lifelong learning, technical subject teachers should encourage resourceful and participatory learning (Aguti, 2016). A shortage of qualified teacher training on how to integrate ICTs as relevant technologies in the technical educational context is a major obstacle (Mathipa & Mukhari, 2014; Timire, 2018).

In response to this research sub-question, it was found that teachers viewed ICTs only as the basis of teaching; that is, the use of computers, phones (Smartphone's, iPads), overhead projectors, and the Internet, but did not necessarily consider ICTs as teaching tools or discipline-specific teaching tools to enhance classroom learning activities. This was confirmed by the following teacher statements:

“Supposing we are dealing with woodwork tools, I usually involve my learners to Google for equipment [tools] and then we discuss in class”
(Teacher B).

“We just apply these ICTs during teaching, just by using our cell phones to research. We use our cell phones to Google some of the information so that from there we can jot it down and give to our students as written notes” (Teacher A).

The interview data and questionnaires showed that teachers have acquired PK and CK, but most of them lack TK, which is vitally important for the use of discipline-specific ICTs in teaching and learning. Therefore, it is either that teachers are finding it difficult or it could be that they struggle to integrate ICTs into teaching. Mishra *et al.* (2013) explained the link between the components of the TPACK framework (cf. 2.2.2). The connection of these components is meant to develop the knowledge and skills that teachers need to successfully integrate ICTs into their pedagogical practices.

It can therefore be concluded that teachers must be encouraged to acquire specific skills and additional dimensions of information to successfully use technology in their teaching (Jita, 2016). When teachers possess this information and competence, they will be well-placed to use discipline-specific ICT tools (3D printers, computerised lathes, fifth-generation wireless (5G) technology, wireless computing through IoT technologies, robotics, and programmable logic controllers) in this digital era to improve classroom activities in teaching.

b) **Sub-Research Question C:** What recommendations can be made to enhance discipline-specific ICTs when integrating them into teaching and learning?

This research showed that there were obstacles concerning the integration of discipline-specific ICTs among teachers and principals. Some suggestions were made, and if properly implemented, these could boost teachers' competence in the integration of discipline-specific ICTs in the teaching and learning of technical subjects. In conducting investigations, both qualitative and quantitative methods were utilised to investigate how the integration of ICTs into technical subjects may enhance teaching and learning in Lesotho. From the literature reviewed and the data collected, the researcher found that the findings responded to the main and secondary research questions.

This research aimed to answer the major research question, which was:

How do technical subjects' teachers in a specific schools district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects?

The main research question developed three subsidiary research questions, which were discussed above.

The data that were analysed provided an understanding of how the integration of ICTs into technical subjects may improve teaching and learning in Lesotho. The following paragraph is an outline of the data analysis, including the findings as per the main question.

Evidence obtained in the analysis of the data showed the importance of ICTs in teaching and learning. It was evidenced that students are highly inclined to technology,

their attention is high, and that they enjoy doing tasks using ICTs. A similar idea was shared in the literature review when it was shown that ICTs can improve the value of education by expanding learner enthusiasm and involvement and by facilitating the gaining of basic skills (Meenakshi, 2013). This evidence answers Research Sub-Question A (cf. 2.3.5 and 2.3.6). The data also showed that some teachers use discipline-specific ICTs in their teaching to improve the learning curve.

In today's world, 21st-century learners require teachers who integrate ICTs into pedagogical activities to enhance teaching and learning and prepare them for the world of work. Teachers are compelled to integrate ICTs to enhance teaching and learning in the 21st century. The TPACK framework allows the integration of ICTs for teaching and learning. The reviewed literature supports the integration of ICTs in schools so that teachers and learners benefit. The fruitful and efficient integration of ICTs to enhance teaching and learning produces a platform for effective teaching for the 21st-century generation.

Teaching and learning using ICTs appear to be fruitful and recommended to the entire world. However, irrespective of the benefits of the integration of ICTs to enhance teaching and learning, the literature has revealed barriers that impede the successful integration of ICTs in teaching and learning. Amongst them are inadequate ICTs and a lack of training. The study emphasised a handful enablers of successful integration of ICTs in teaching and learning, which are: adequate ICT tools, adequate training, and professional development.

Therefore, the current study calls for government with its Department of Education together with schools to avail all the necessary ICT tools that would assist teachers to enhance teaching. Also, the study suggests that teachers be trained or attend workshops so that their needs are met and they are assisted to enrich technological and pedagogical content knowledge, as this would enable them to integrate ICTs comfortably.

Lastly, it is found that teaching and learning resources tend to be silent with regard to the use of discipline-specific ICT tools in teaching and learning. Therefore, a clear school policy should be formulated and be binding to every teacher.

REFERENCES

- Abubakar, A. B., Elrehail, H., Alatailat, M. A. and Elci, A. 2010. Knowledge management, decision-making style and organizational performance. *Journal of Innovation & Knowledge* 4: 104–114.
- Abdulrasool, S.M. & Mishra, R. 2009. Using Computer Technology Tools to Improve the Teaching-Learning Process in Technical and Vocational Education: *Mechanical Engineering Subject Areas. International Journal of Learning*, 15(12):155-168.
- Adesote, S.A. & Fatoki, O.R. 2013. The Role of ICT in the Teaching and Learning of History in the 21st century. *Academic Journals*.8 (21): 2155-2159.
- Aduwa-Ogiegbean, S. E. & Iyamu, E. O. S. 2005. Using information and communication technology in secondary schools in Nigeria. *Educational Technology and Society*. 8(1): 104—112.
- Afari, E. & Khine, M. S. 2017. Robotics as an Educational Tool: Impact of Lego Mindstorms. *International Journal of Information and Education Technology*.7(6). June.
- Agbetuyi, P. A. & Oluwatayo, J. A. 2012. Information and Communication Technology (ICT) in Nigerian Educational System. *Mediterranean Journal of Social Sciences*. 3(3). September 2012.
- Aguti, J. N. 2016. ICT Integration and Digital Competencies – a must for 21st century teachers. Accessed on 08/03/2016 <http://dspace.col.org>
- Akilandeswari, V., Kumar, A. D., Pavithra, M., Mariyam, A.T. and Banu, J. N. 2015. Elements of Effective Communication. New Media and Mass Communication. Vol. 37
- Akom, K., Asante, G. & Adjei-Frimpong, B. 2016. An Investigation into the use of ICT Tools in the Technical Vocational Education and Training (TVET) Delivery – Evidence from Kumasi Metropolis. *International Journal of Computer Applications (0975 – 8887)* Volume 133(7), January
- Aladejana, F. 2007. The Implications of ICT and NKS for Science Teaching: Whither Nigeria. Ile-Ife: Complex Systems Publications, Inc.

Alazam, A. O., Bakar, A. R., Hamzah, R. & Asmiran, S. 2012. Teachers' ICT Skills and ICT Integration in the Classroom: The Case of Vocational and Technical Teachers in Malaysia. *Scientific Research*.3. Supplement 70-76

Albarkati, A. M. 2016. The Application of Computer in Education System and its Significance to Teaching and Learning. *International Journal of Computer Applications (0975 – 8887)* 134(9), January.

Al-Bataineh, A., & Brooks, L. 2003. Challenges, Advantages and Disadvantages of Instructional Technology in the Community College Classroom. *Community College Journal of Research and Practice*, 27: 473-484.

Alimisis, D. 2012. Robotics in Education & Education in Robotics: Shifting Focus from Technology to Pedagogy, in David Obdržálek (ed.) *Proceedings of the 3rd International Conference on Robotics in Education*, September 13 – 15, 2012, Charles University in Prague, Faculty of Mathematics and Physics, Prague, Czech Republic: 7-14.

Alkahtani, A. 2017. The challenges Facing the Integration of ICT in Teaching in Saudi Secondary Schools. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 13(1): 32-51.

Almadhour, B. 2010. The integration of information and communication technology into secondary technology teachers' pedagogy in New Zealand.

Almalki, S. 2016. Integrating Quantitative and Qualitative Data in Mixed Methods Research—Challenges and Benefits. *Journal of Education and Learning*, 5(3).

Al-Qirim, N. 2012. Adoption Vs. Usage of Interactive White Board Technology By Teachers in Higher Education Institutions. *23rd Australasian Conference on Information Systems Interactive White Board Technology Adoption*.

Alshenqeeti, H. 2014. Interviewing as a Data Collection Method: A Critical Review. *English Linguistics Research*, 3(1).

Amani, M. A. 2016. The Application of Computer in Education System and its Significance to Teaching and Learning. *International Journal of Computer Applications (0975 – 8887)*,134(9), January.

American Association of Colleges for Teacher Education (AACTE) Committee on Innovation and Technology (Ed). 2008. *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators*. New York: Routledge/Taylor & Francis Group.

Ang'ondi, E. K. 2013. Teachers' Attitudes and Perceptions on the Use of ICT in Teaching and Learning as Observed by ICT Champions. *X World Conference on Computers in Education*, July 2-5, 2013; Toruń, Poland.

Aslan, A. & Zhu, C. 2016. Influencing Factors and Integration of ICT into Teaching Practices of Pre-service and Starting Teachers. *International Journal of Research in Education and Science (IJRES)*, 2(2): 359-370.

Babbie, E. 2007. *The Practice of Social Research*, 12th edition. Wadsworth

Babbie, E. 2010. *The Practice of Social Research*. Wadsworth, Belmont

Babbie, E. & Mouton, J. 2008. *The Practice of Social Research*. South African ed. Vasco, Boulevard, Goodwood, Cape Town: Oxford University Press. 674 p.

Bada, S.O. 2015. Constructivism Learning Theory: A Paradigm for Teaching and Learning. *IOSR Journal of Research & Method in Education (IOSR-JRME)*,5(6). Ver. I: 66-70

Belpaeme, T., Kennedy, J., Ramachandran, A., Scassellati, B. & Tanaka, F. (2018) Social robots for education: A review. *Sci. Robot.* 3, eaat5954

Basargekar, P. & Singhavi, C. 2017. Factors Affecting Teachers' Perceived Proficiency in Using ICT in the Classroom. *IAF OR Journal of Education*, 5(2). Summer.

Beauchamp, G. 2011. Interactivity and ICT in the primary school: Categories of learner interactions with and without CIT. *Technology, Pedagogy and Education*, 20 (2): 175-190

Benoit, A. 2018. Investigating the Impact of Interactive Whiteboards in Higher Education: A Case Study. *Journal of Learning Spaces*,7(1).

Berg, B. L. 2007. *Qualitative research methods for the social sciences*. London: Pearson.

Bezjak, J. 2010. Contemporary engineer pedagogics' project research – using multimedia at technology classes in technical and vocational school. *Procedia Social and Behavioural Sciences*, 2 (2): 407-411.

Blaxter, L., Hughes, C. & Tight, M. 2006. *How to Research*. (3rd Ed.) New York: McGraw-Hill Education.

Blumberg, B., Cooper, D. & Schindler, P.S. 2011. *Business Research Methods*. 3rd European ed. Maidenhead, Berkshire: McGraw-Hill Higher Education.

Bogdan, R. & Biklen, S. K. 1992. *Qualitative Research for Education: An Introduction to Theory and Methods*. London: Allwyn and Bacon.

Boell, S. K. and Kecmanovic, D.C 2015. What is Information Beyond a Definition? Thirty sixth International Conference of Information Systems, Fort Worth

Bowen, G. A. 2009. Document Analysis as a Qualitative Research Method. Western Carolina University: DOI: 10.3316/QRJ0902027.Paper in Brief 13 August 2013.

Bradley, J. 1993. Methodological issues and practices in qualitative research. *Library Quarterly*, 63(4): 431-449.

Braun, V. & Clarke, V. 2006 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2): 77-101. [Online].<http://dx.doi.org/10.1191/1478088706qp063oa>

Burrell, G. & Morgan, G. 1979. Sociological paradigms and organizational analysis. Portsmouth New Hampshire: Heinemann.

Bushnell, L.G and Crick, A. P. 2003. Control Education via autonomous robotics, Proceedings IEEE Conference on Decision and Control (Maui, Hawaii), December 2003.

Butcher, N. 2011. ICT, Education, Development, and the Knowledge Society: *Thematic Paper*: UN ICT Task Force.

Cavas, B., Cavas, P., Karaoglan, B., & Kislal, T. 2009. A study on science teachers' attitudes toward information and communication technologies in education. *The Turkish Online Journal of Educational Technology*, 8(2): 20-32.

Chai, C.S., Koh, J.H.L., Tsai, C. & Tan, L.L.W. 2011. Modelling primary school pre-service teachers' technological pedagogical content knowledge (TPACK) for meaningful learning with information and communications technology (ICT). *Computers and Education*. 57(2011):1184–1193. <https://doi.org/10.1016/j.compedu.2011.01.007>

Chatterjee, D. & Corral, J. 2017. How to Write Well-Defined Learning Objectives. *Journal of Education in Perioperative Medicine*, XIX(4)

Chere-Masopha, M. J. 2011. Integrating technology in classroom practices: the influence of teacher professional identities in secondary schools in Lesotho. *Doctor of Philosophy Thesis*. University of Wollongong: Wollongong.

Christiansen, I., Bertram, C. & Land, S. 2010. *Understanding Research*. Pietermaritzburg: UKZN Faculty of Education.

Coetzee, J. M. 2019. Eros and Education. *Journal of Philosophy of Education*, 53(3) <https://doi.org/10.1111/1467-9752.12380>

Cohen, L. & Manion, L. (Eds.). 1994. *Research methods in education* (4th ed.). London: Longman.

Cohen, L., Manion, L., & Morison, K. (2007). *Research Methods in Education*. (6th ed.). London: Routledge.

Cohen, D. & Crabtree, B. 2006. *Qualitative research guidelines project*. Retrieved 22 March 2017 [Http://www.qualres.org/HomeSemi-3629.html](http://www.qualres.org/HomeSemi-3629.html)

Collis, J. & Hussey, R. 2009. *Business Research. A Practical Guide for Undergraduate & Postgraduate Students 3rd ed.* Basingstoke. Hampshire: Palgrave Macmillan.

Comber, C., & Lawson, T. 2003. Education for managing ICT: Professional development for school leaders in Crawford, C., Davis, N., Price, R., Weber, R. & Willis, D. A. *Society for information technology and teacher education international conference annual*. New Mexico: Albuquerque.

Conversio. 2016. www.conversio-changepartner.com

Cook, S., & Brown, J. 1999. Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science*, 10(4): 381-400

Creswell, J.W. (Ed.). 2003. *Research design: Qualitative, quantitative, and mixed methods approaches*. (2nd ed. ed.). Thousand Oaks: Sage.

Creswell, J.W. 2007. *Qualitative Inquiry and Research design: Choosing among five approaches*. Second edition. London: SAGE Publications.

Creswell, J.W. 2013. *Qualitative inquiry research design. Choosing among five approaches*. Sage publications. Washington DC

Creswell, J., & Plano Clark, V. 2007. *Designing and Conducting Mixed Methods research*. Thousand Oaks, CA: Sage

Creswell, J.W. & Plano Clark, V. L. 2011. *Designing and Conducting Mixed Methods Research* (2nd ed.). London: Sage Publications Ltd.

Crittenden, J. C. 2009. *The attitudes and perceived self-efficacy of Mississippi career and technical educators toward information and communication technology*. Unpublished Doctoral Dissertation, Mississippi State University.

Cuban, L. 1993. Computers Meet Classrooms: classrooms wins, *Teachers College Record*, 95: 185-210.

Cuban, L. 2013. Why so many structural changes in schools and so little reform in teaching practice? *Journal of Educational Administration*, 51(2): 109-125.

Cubukcuoglu, B. 2013. Factors enabling the use of technology in subject teaching. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 9(3): 50-60.

Dabas, N. 2018. Role of Computer and Information Technology in Education System. *International Journal of Engineering and Techniques*, 4(1), Jan – Feb 2018.

Darsih, E. 2018. Learner-centered learning: What makes it effective. *Indonesian EFL Journal*, 4(1): 33-42. DOI: 10.25134/iefj.v4i1.796.

Das Gupta, C. &KPN, H. 2012. Role of ICT in Improving the Quality of School Education in Bihar. International Growth Centre.

Davies, R. S. 2011. Understanding Technology literacy: A framework for evaluating educational technology education. Brigham Young University

Dela Rosa, J. P.O. 2016. Experiences, perceptions and attitudes on ICT integration: A case study among novice and experienced language teachers in the Philippines. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)* 12(3): 37-57.

De Miranda, M. A. 2008. Pedagogical Content Knowledge and Engineering and Technology Teacher Education: Issues for thought. *Journal of the Japanese Society of Technology Education*,50(1): 17-26.

Denzin, N. K. & Lincoln, Y.S. 2000. *Handbook of Qualitative Research*. London: Sage Publications.

Denzin, N. K., & Lincoln, Y. S. 2005. *The Sage handbook of qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.

Devadason, R. P. 2010. *The State of use of ICT in the Teaching and Learning of Science and Mathematics among schools in SEAMEO Member Countries*. Seameo Recsam.

De Villiers, M.R. 2005. Interpretive research models for informatics: action research, ground theory, and the family of design and development research. *Alternation*, 12(2): 10-52.

De Vita, M., Verschaffel, L., & Elen, J. 2018. The Power of Interactive Whiteboards for Secondary Mathematics Teaching: Two Case Studies. *Journal of Educational Technology Systems*, 47(1): 50–78.

De Vos, A. S., Strydom, H., Fouché, C. B., & Delport, C. S. L. 2011. *Research at grassroots: for the social sciences and human service profession* (4th ed.). Pretoria, South Africa: Van Schaik Publishers.

Dietrich, C. 2010. Decision making: Factors that influence Decision Making, Heuristics Use and Decision Outcomes. *Inquiries Journal/ Student Pulse*, 2(02).

Dong, Y., Chai, C. S., Sang, G.-Y., Koh, H. L., & Tsai, C. C. 2015. Exploring the Profiles and Interplays of Pre-service and In-service Teachers' Technological Pedagogical Content Knowledge (TPACK) in China. *Educational Technology & Society*, 18(1): 158–169.

Dörnyei, Z. 2007. *Research Methods in Applied Linguistics: Quantitative Qualitative, and Mixed Methodologies*. Oxford: Oxford University Press.

Dostal, J. 2011. Reflections on the use of interactive whiteboards in instruction in international context. *The New Educational Review*, 25(3):205-220.

Dube, B. A., Nhamo, E. & Magonde, S. 2018. Factors affecting ICT integration in the Teaching and Learning of Physical Education in South Africa: A Case of Johannesburg East Cluster Primary Schools in the Gauteng Province. *International Journal of Sport, Exercise and Health Research*, 2(1): 88-92.

Earle, R. S. 2002. The Integration of Instructional Technology into Public Education: Promises and Challenges. 42(1): 5-13. January-February, ET Magazine Website: <http://BooksToRead.com/etp>

Eisner, E. W. 1991. *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. Toronto: Collier Macmillan Canada.

EZ Talks.com. 2017. Uses of interactive whiteboard in education. <https://www.eztalks.com/whiteboard/uses-of-interactive-whiteboard-in-education.html>

Farrell, G., Isaacs, S., & Trucano, M. 2007. *The NEPAD e-Schools Demonstration Project: a work in progress*. Washington, DC: infoDev / The World Bank.

Faulconer, E. K. 2017. Increasing Student Interactions With Learning Objectives. *Journal of CollegeScience Teaching*, 46(5).

Fischer, G. Miller & Sidney, M. S. (Eds.). *Handbook of public policy analysis: theory, politics, and methods* (pp. 405-416). Boca Raton, FL: CRC/Taylor & Francis.

Fu, J. S. 2012. ICT in Education: A Critical Literature Review and Its Implications. National Institute of Education, Singapore: *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 9(1): 112-125.

Fullan, M. 2013. The new pedagogy: Students and teachers as learning partners. *Learning Landscapes*, 6(2), 23-29.

Gentles, S. J. Charles, C., Ploeg, J. & McKibbin, K. A. 2015. *Sampling in Qualitative Research: Insights from an Overview of the Methods Literature*, 20(11).

Gephart, R. 1999. Paradigms and research methods. *[Online] Research Methods Forum*, 4 (Summer). Retrieved October 3, 2009 from the Academy of Management website.

Ghavifekr, S. & Rosdy, W.A.W. 2015. Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES)*, 1(2): 175-191.

Graham, C. R. 2011. Theoretical consideration for understanding technological pedagogical content knowledge (TPACK). *Computer and Education* 57.

Gregorcic, B., Etkina, E. & Planinsic, G. 2017. A New Way of Using the Interactive Whiteboard in a High School Physics Classroom: A Case Study.

Guba, E. & Lincoln, Y.S. 1994. Competing paradigms in qualitative research. In N.K.Denzin & Y.S. Lincoln (Eds). *Handbook of qualitative research*. California: Sage.

Gulbahar, Y., & Guven, I. 2008. A Survey on ICT Usage and the Perceptions of Social Studies Teachers in Turkey. *Educational Technology & Society*, 11(3): 37-51.

Guy, R. 2009. *The Evolution of Mobile Teaching and Learning*. California: Informing Science Press.

Hansen, J. W. 2003. To change perceptions of technology programs. *Journal of Technology Studies*, 29:16-19. International Society for Technology in Education.

Harlow, A., Cowie, B., & Heazlewood, M. 2010. Keeping in touch with learning: The use of an interactive whiteboard in the junior school. *Technology, Pedagogy and Education*, 19(2): 237-243. doi:10.1080/1475939X.2010.491234.

Harris, J., Mishra P., Koehler, M. 2009. Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *J. Res. Technol. Educ.* 41(4): 393-416.

Harwell, M.R. n.d. Research Design in Qualitative/Quantitative/Mixed Methods. University of Minnesota

- Hashemnezhad, H. 2015. Qualitative Content Analysis Research: A Review Article. *Journal of ELT and Applied Linguistics*, 3 (1).
- Hassan, S. n.d. Integrating ICT in Teaching and Learning: Country report: Malaysia: *Educational Technology Division Ministry of Education Malaysia*.
- Hassan, U. T. & Sajid, A. R. 2013. ICTs in learning: Problems faced by Pakistan. *Journal of Research and Reflections in Education June*, 7(1): 52 -64.
- Haydn, T. 2014. How do you get pre-service teachers to become 'good at ICT' in their subject teaching? The views of expert practitioners. *Technology, Pedagogy and Education*, 23(4): 455-469.
- Hechter, R.P. & Vermette, L.A. 2013. Technology integration in K-12 Science Classrooms: An analysis of barriers and implications. *Themes in Science & Technology Education*, 6(2): 73-90.
- Heick, T. 2015. 30 Incredible ways technology will change education by 2028. Retrieved March 02, 2019
- Hennessy, S. 2010. Teacher Factors Influencing Classroom Use of ICT in Sub-Saharan Africa. *Itupale Online Journal of African Studies*, 2:39-54.
- Hennessy, S., Onguko, B., Harrison, D., Ang'ondi, E. K., Namalefe, S., Naseem, A. & Wamakote, L. 2010. *Developing the use of information communication technology to enhance teaching and learning in East Africa schools: review of literature*. Cambridge: University of Cambridge and DFID.
- Hennessy, S., Wishart, J., Whitelock, D., Deaney, R., Brawn, R., La Velle, L., McFarlane, A., Ruthven, K. & Wintebottom, M. 2007. Pedagogical approaches for technology-integrated science teaching. *Computer and Education*, 48 (1): 137-152.
- Henning, E with Van Rensburg, W & Smit, B 2004. *Finding your way in qualitative research*. Pretoria: Van Schaik.

Hermanowicz, J. C. (2002). The great interview: 25 strategies for studying people in bed. *Qualitative Sociology*, 25(4): 479-499. <http://dx.doi.org/10.1023/A:1021062932081>

Higher Education Policy for the Kingdom of Lesotho. 2013.

Hirschheim, R., Klein, H., & Lyytinen, K. 1995. *Information Systems Development and Data Modeling: Conceptual and Philosophical Foundations*. Cambridge University Press

Hong, J. E. 2016. Social Studies Teachers' Views of ICT Integration. *RIGEO*, 6(1): 32-48. <http://www.rigeo.org/vol6no1/Number1Spring/RIGEO-V6-N1-2.pdf>.

Hunde, A.B. and Tacconi, G. 2013. Pulling and Pushing forces for ICT use in initial teacher preparation for secondary schools. *US-China Education Review*, 3(10).

Hussain, I., & Safdar, M. 2008. Note For Editor: Role Of Information Technologies In Teaching Learning Process: Perception of The Faculty. *Turkish Online Journal of Distance Education*, 9(2). <http://dergipark.ulakbim.gov.tr/tojde/article/view/5000102662>.

Hwang, D. J., Yang, H. and Kim, H. 2010. E-Learning in the Republic of Korea. UNESCO. Accessed on 09/02/2011 <http://iite.unesco.org>.

Isaacs, S. 2007. *Survey of ICT in education in Lesotho*. Washington, DC: InfoDev /World Bank.

Isaacs, S. & Farrell, G. 2007. Survey of ICT and Education in Africa. A summary report based on 53 countries survey.

Ivankova, N., Creswell, J. W. and Clark V.P. 2007. *Foundations and approaches to mixed methods research in First steps in Research*. Pretoria: Van Schaik

Jamsek, J.& Kocijancic, S. 2007. Computer based laboratory course-“From Electricity to Electronics”.ComLab Conference. Retrieved 14 August: <http://e-prolab.com/en/conf/paperspdf/janez.pdf>.

Jegade, P. O. 2008. ICT attitudinal characteristics and use level of Nigerian Teachers. *Issues in Informing Science and Information Technology*, 5:261-266.

Jimoyiannis, A. 2008. Factors determining teachers' beliefs and perceptions of ICT in education. *Encyclopedia of Information Communication Technology*, 321-334.

Jita, T. 2016. Pre-service teachers' competence to teach science through information and communication technologies in South Africa. *Perspectives in Education*, 34(3): 15-26.

Johnson, R. B. & Onwuegbuzie, A. J. (2004): "Mixed Methods Research: A Research Paradigm whose Time has Come" *Educational Researcher*, 33(7), 14-26S

Kadiri, K. M. 2015. Teacher-based factors influencing integration of information communication technology in teaching of English language in public secondary schools in Vihiga sub-county, Kenya

Kalanda, K. 2012. An investigation of ICT integration in the Lesotho secondary and high school science classroom. University of South Africa.

Kannan, S., Sharma, S. & Abdullah, Z. 2012. Principals' strategies for leading ICT integration: The Malaysian perspective. Accessed on 08/11/2012 <http://www.SciRP.org/journal/ce>.

Karsenti, T. 2016. The interactive whiteboard: Uses, benefits, and challenges. A survey of 11,683 students and 1,131 teachers. *Canadian Journal of Learning and Technology*, 42(5).

Kasworm, C.E., & Londoner, C.A. 2000. Adult learning and technology. In Wilson, A.L., & Hayse, E.R. (Eds.), *Handbook of adult and continuing education*. San Francisco, CA: Jossey-Bass.

Kaur, N. 2015. Using ICT in Empowering Teachers for Quality Education. *International Journal of Scientific Research Engineering & Technology (IJSRET)* ISSN: 2278-0882.

Kawulich, B. B. 2004. Data analysis techniques in qualitative research. State University of West Georgia.

- Kent, N. & Facer, K. 2004. Different worlds? A comparison of young people's home and School ICT use, *Journal of Computer Assisted Learning*, 20(3): 440-455.
- Khambari, M. N., Hassett, D., Thomas, M., & Wong, S. L. 2014. Interactive whiteboards in classrooms: Debates, issues, and impeding factors. In *Proceedings of the 22nd International Conference on Computers in Education, ICCE 2014*, 957-962.
- Khan, S. H., Hasan, M. & Clement, C. K. 2012. Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Bangladesh. *International Journal of Instruction*, 5(2), e-ISSN: 1308-1470.
- Khurshid, K., Shah, A. F. & Reid, N. 2016. Information and Communication Technology in Learning Physics at Secondary School Level in Pakistan. *Bulletin of Education and Research*, December 2016, 38(2): 135-151
- Kim, C., Kim, M., Lee, C., Spector, J. M., & De Meester, K. 2013. Teacher pedagogical beliefs and technology integration. *Teaching and Teacher Education*, 29: 75-85.
- Kim, S. 2003. Research Paradigms in Organizational Learning and Performance: Competing Modes of Inquiry. *Information Technology, Learning, and Performance Journal*, 21(1), Spring 2003.
- Kington, A., Harris, S., & Leask, M. 2002. Innovative practice using ICT in schools: findings in two case studies. *Management in Education*, 16(1): 31-35.
- Klemenčič, M. 2019. Successful Design of Student-Centered Learning and Instruction (SCLI) Ecosystems in the European Higher Education Area. A key-note at the XX Anniversary of the Bologna Process.
- Klen, H., & Meyers, M. 1998. A set of principles for conducting and evaluating interpretive field studies in information systems. Retrieved 12/9/2009 <http://www.auckland.ac.nz/msis/isworld/MMyers/Klein-Myers.html>.
- Koehler, M., Mishra, P. & Cain, W. 2013. What is technological pedagogical content knowledge (TPACK), *Journal of Education*, 193(3): 14-19.

Kothari, C. K. 2004. *Research Methodology*. College of Commerce of Rejasth an: New Age International Limited publishers.

Kuskaya, F.M. & Kocak, Y. U. 2010. In vocational and technical schools: teachers' instructional, managerial and personal use matters. *TOJET: The Turkish Online Journal of Education Technology*, 9(1): 107-113.

Kvale, S. 1996. *Interviews: An introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage.

Kwadwo Antwi, S. & Hamza, K. 2015. Qualitative and Quantitative Research Paradigms.

Laferrière, T. 1999. Benefits of using information and communication technologies (ICT) for teaching and learning in K-12/13 classrooms. Report for SchoolNet Program, Industry Canada. Retrieved April 22, 2005, <http://www.schoolnet.ca/snab/e/reports/benefits.pdf>.

Lateh, H. & Muniandy, V. 2010. ICT implementation among Malaysian schools: GIS, obstacles and opportunities. *Procedia Social and Behavioral Sciences* 2:2846–2850.

Laurillard, D. 2006. E-Learning in higher education. In P. Ashwin (Ed.), *Changing higher education: The development of learning and teaching*, 71-84. London: Routledge.

Layton, D. 1993. *Developing Science and Technology Education*. Bristol: Technology's challenge to Science Education.

LeCompte, M. D, & Schensul, J. J. (Eds.). 1999. *Ethnographer's toolkit* (Vol. 1-7). Walnut Creek, CA: Sage.

Leedy, P.D. and Ormrod, J.E. 2005. *Practical Research: Planning and Design*. 8th edition. New Jersey: Merrill Prentice Hall.

Leitch, C. M., Hill, F. M., & Harrison, R. T. 2010. The philosophy and practice of interpretivist research in entrepreneurship: Quality, validation, and trust. *Organizational Research Methods*, 13(1): 67-84.

Lesotho Communications Authority. 1999. Lesotho Telecommunications Policy of 1999. <https://www.lca.org.ls/download/lesotho-telecommunications-policy-of-1999/>

Lever-Duffy, J., McDonald, J., & Mizell, A. 2003. *Teaching and Learning with Technology*. Boston: Pearson Education.

Levinsen, K. T. 2011. Fluidity in the Networked Society – Self-initiated learning as a digital literacy competence. *The Electronic Journal of e-Learning*, 9(1): 52-62. And learning intersect. *British Journal of Educational Technology*, 39(3), 475-485. <http://dx.doi.org/10.1111/j.1467-8535.2007.00736.x>

Levinsen, K. T. 2010. To Deal with Fluidity in the Networked Society – Self-programming as a digital literacy competence. Accessed on 10/07/2011. <http://vbn.aau.dk/en/publications>.

Lisene, L. N. 2017. The Integration of Information and Communication Technologies into teaching of Physical Science in Lesotho. *Dissertation*, University of the Free State.

Littleton, K. 2010. Research into teaching with whole-class interactive technologies: Emergent themes. *Technology, Pedagogy and Education*, 19(2): 285-292.

Livesey, C. 2011. "A" Level Sociology: A Resource-Based Learning Approach. Theory and Methods. Unit M3: Methodologies[1]. Notes.

Livingstone, S. 2012. Critical reflections on the benefits of ICT in education. *Oxford Review of Education*, 38(1): 9–24. <https://doi.org/10.1080/03054985.2011.57793>

Lloyd, M. 2009. *Towards a definition of the integration of ICT in the classroom*. In AARE 2009, AARE, Eds. Proceedings AARE '05 Education Research – Creative Dissent: Constructive Solutions, Par-ramatta, New South Wales. Retrieved 12 May. <http://eprints.qut.edu.au/3553/1/3553.pdf>.

Mack, L. 2010. The Philosophical Underpinnings of Educational Research. *Polyglossia*, 19(1):5-9.

Mafang'ha, M. 2016. Teachers' Experience on the Use of ICT to Facilitate Teaching: A Case of Ilala District Secondary Schools University of Tanzania.

Mafuraga, M. & Moremi, M. 2017. Integrating Information and Communication Technology in English Language Teaching: A Case Study of Selected Junior Secondary Schools in Botswana. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 13(1): 142-152.

Maher, D., Phelps, R., Urane, N. & Lee, M. 2012. Primary school teachers' use of digital resources with interactive whiteboards: The Australian context. *Australasian Journal of Educational Technology*, 28(1): 138-158

Mahmud, R. & Mohd Arif, I. 2008. Factors Influencing ICT Integration in the Classroom: Implications to Teacher Education. EABR & TLC Conference Proceedings.

Makgato, M. 2012. Status of teachers' use of educational technology: a case of some schools in South African semi-urban locations. *International Proceedings of Economics Development and Research (IPEDR)*, 47(23).

Makhasane, S. D. & Fru, R. N. 2017. Students' Views on Integrating Technology in Learning at University in Lesotho, In Meda, L. & Makura, A. H. (eds), *Technology Driven Curriculum for 21st Century Higher Education Students in Africa*. Bameda:Langaa RPCIG.

Manning, S. & Johnson, K.E. 2011. *The technology tool belt for teaching*. San Francisco: John Wiley & Sons, Inc.

Maree, K. (Ed). 2007. *First Steps in Research*. Pretoria: Van Schaik.

Mathevula, M. D. & Uwizeyimana, D. E. 2014. The Challenges Facing the Integration of ICT in Teaching and Learning Activities in South African Rural Secondary Schools. *Mediterranean Journal of Social Sciences MC SER Publishing*, 5 (20), September 2014.

Matthew O. U. & Nwamaka U. O. 2019. Computer applications in education. Conference paper. University College Dublin, Republic of Ireland

Mathipa, E. R & Mukhari,S. 2014. Teacher Factors Influencing the Use of ICT in Teaching and Learning in South African Urban Schools. *Mediterranean Journal of Social Sciences* 5(23.)

Maxwell, G. 1997. Hotel general management: views from above the glass ceiling. *International Journal of Contemporary Hospitality Management*, 9(5/6): 230-235.

McMillan, J. H. and Schumacher, S. 2010. *Research in Education: Evidence-based Inquiry*. 7thedition. New Jersey: Pearson.

McNulty, L. 2013. Lockean Social Epistemology. *Journal of Philosophy of Education*, 47(4): 524-536.

McPheat, S. 2010. Emotional intelligence: MDT Training. 1st Ed. Book Boon: London, UK.

McQueen, M. 2002. Language and Power in Profit/Non-profit Relationships: A grounded theory of inter-sectoral collaboration. Retrieved 12/9/2009.http://au.geocities.com/dr_meryl_mcqueen/phd/mcqueench3.htm.

McTaggart, R. 1997. *Participatory action research: International contexts and consequences*. New York: Albany.

Meenakshi. 2013. Importance of ICT in Education. *IOSR Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320–7388,p-ISSN: 2320–737X 1(4): 03-08.May.–Jun.www.iosrjournals.org

Merriam, S. B.1991. *Case study research in education: a qualitative approach education*. The University of Michigan

Mertens, D. M. 2010. *Research and Evaluation in Education Psychology: integrating Diversity with Quantitative, Quantitative and Mixed Methods*. Sage publishers: Gallaudet University:

Mikre, F. 2011. The Roles of ICT in Education. Review Article with Emphasis to the computer and Internet. *Ethiopian Journal of Education and Science*, 6(2).

Ministry of Communications, Science and Technology. 2004. *National ICT policy for Lesotho draft*. 2004. [online]. Retrieved 27 July 2017 [http://www.lesotho.gov.ls/articles/2004/lesotho ICT Policy Draft.pdf](http://www.lesotho.gov.ls/articles/2004/lesotho%20ICT%20Policy%20Draft.pdf).

Ministry of Communications, Science and Technology. 2005. *ICT Policy for Lesotho: Final*, 4 March 2005. <https://www.lca.org.ls/download/ict-policy-for-lesotho-of-2005/>

Ministry of Education and Training of Lesotho. 2009. *Curriculum and Assessment Policy: For Individual and Social Development*. Maseru: Ministry of Education and Training of Lesotho.

Ministry of Education and Training of Lesotho. 2012. *National report in the development of education*. Maseru: Ministry of Education and Training of Lesotho. [Online]. Retrieved 27 July 2017 <http://www.lesotho.gov>.

Ministry of Education and Training of Lesotho. 2013. Higher Education Policy for Lesotho: November 2013.

Mishra, P. & Koehler M. J. 2006. Technological pedagogical content knowledge: a framework for teacher knowledge. *Teach Research*, 108:1017-1054.

Mishra P., Koehler, M. 2008. Introducing TPCK. In: AACTE Committee on Innovation and Technology (Ed). *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators*. New York: Routledge/Taylor & Francis Group.

Mishra, P.& Koehler, M. J. 2009. What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1): 60-70.

Mortari, L. 2015. Reflectivity in Research Practice: An Overview of Different Perspectives. Accessed on 27/09/2016 <http://www.griffith.edu.au>

Mouton, J. 1996. *Understanding social research*. Pretoria: JL van Schaik.

Mouton, J.& Marais, J. C. 1990: *Methodology of the social sciences: Basic concepts*. Pretoria: Human Research Council.

Msungu, A. & Mtenga, W.P. 2012. Using Mobile Cell phones for Teaching and Learning in Higher Institutions: The Case study of Sokoine University o Agriculture in Tanzania.

Mubin,O.,Stevens,C. J., Shahid,S.,Mahmud, A. A. & Dong, J. J.2013. A Review of the Applicability of Robots in Education. *Technology for Education and Learning*.

Mukhari, S. S. 2016. Teachers' experience of Information and Communication Technology use for Teaching and Learning in Urban Schools. University of South Africa.

Muniandy, J. & Shuib, M. 2016. Learning Styles, language Learning Strategies and Fields of Study among ESL Learners. *Malaysian Journal of ELT Research*, 12 (1): 1-19

Mutuku, M. N. & Ogutu, J.2018. An Investigation of the Factors Influencing the Integration of ICT in Teaching and learning Process in Public Secondary Schools in Machakos County, Kenya. *International Journal of Economics, Commerce and Management United Kingdom*, VI(4), April.

Mwalongo, A. 2011. Teachers' perceptions about ICT for teaching, professional development, administration and personal use. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 7(3): 36-49.

Neuman, W.L. 2003. *Social Research Methods: Qualitative and quantitative approaches* (5th ed.) Boston: Allyn & Bacon.

Neuman, W. L. (2007). *Social Research Methods: Qualitative and Quantitative Approaches*. 6th Ed. Boston: Pearson.

Nieman, R. 2000. Objectivity, Reliability and Validity in Quantitative Research. *South African Journal of Education*, 20 (4).

Nieuwenhuis, J. 2007. Qualitative research designs and data gathering techniques in First Steps in research: Introducing qualitative research. Pretoria: Van Schaik.

Nkula, K. & Krauss E. M. K. 2014.The integration of ICTs in marginalized schools in South Africa: Considerations for understanding the perceptions of in-service teachers and the role of training. *Proceedings of the 8th International Development Informatics*

Association Conference, held in Port Elizabeth, South Africa. ISBN: 978-0-620-63498-4
Pages 241-26.

Noblit, G. and Eaker, D. J. 1987. Evaluation designs as political strategies. Paper presented at the Annual Meeting of the American Education Research Association.

Norris, C. T., Sullivan, J., Poirot, J. & Soloway, E. 2003. No access, no use, no impact: Snapshot surveys of educational technology in K-12. *Journal of Research on Technology in Education*, 36(1): 15-27.

Odhiambo, O. S. 2013. Use of Information Communication Technology in Teaching and Learning Processes in Secondary Schools in Rachuonyo South District, Homa-bay County, Kenya. University of Nairobi.

Odiakaosa, O. J. & Jere, N. D. N. 2017. The Usage Pattern of Mobile Devices among High School Teachers in the Oshana and Oshikoto Regions towards the Adoption of Mobile Learning in Namibian High Schools. *International Journal of Science and Technology Education*, 1(1). <https://doi.org/10.26762/ijste.2017.50000001>.

Ollis, D. & Pearson, G. 2006. What is technological literacy and why does it matter? North Carolina State University.

Orlando, J. 2011. ICT, constructivist teaching and 21st century learning.

Owen, G. T. 2014. Qualitative Methods in Higher Education Policy Analysis: Using Interviews and Document Analysis. 19(26). *Georgia Institute of Technology*.

Palys, T. 2008. Purposive sampling. In L. M. Given (Ed.) *The Sage Encyclopaedia of Qualitative Research Methods*. 2:697-698. Sage: Los Angeles.

Papert, S. & Harel, I. (1991) Situating Constructionism. *Constructionism*, 36(2), pp.1-11.

Patel, P. & Patel, N. 2017. ICT Pedagogy for Effective Learning, Education and Quality Evaluation. *International Journal of Computer & Mathematical Sciences*, 6(5). ISSN: 2347-8527.

Patton, M. Q. 1987. *How to use qualitative methods in evaluative research*. London: Sage.

Pelgrum, W. J., Law, N. 2003. "ICT in Education around the World: Trends, Problems and Prospects *UNESCO-International Institute for Educational Planning*.
www.worldcatlibraries.org/wcpa/ow/02d077080fcf3210a19afeb4da09e526.html

Ponelis, S. R. 2015. Using interpretive qualitative case studies for exploratory research in doctoral studies: A case of Information Systems research in small and medium enterprises. *International Journal of Doctoral Studies*, 10: 535-550.
<http://ijds.org/Volume10/IJDSv10p535-550Ponelis0624.pdf>.

Powell, E. & Steele, S. 1996. *Collecting Evaluation Data: Direct Observation*. University of Wisconsin: Cooperative Extension.

Pudi, T. I. 2007. *Understanding Technology Education from a South African Perspective*. Pretoria: Van Schaik Publishers.

Rahman, A., Mahmood, S. & Farooqi, R. 2019. Management functions: a mechanism for interpersonal trust among college principals. *Indian Journal of Applied Science*, 9(4).

Rahman, M. D. S. 2017. *The Advantages and Disadvantages of Using Quantitative and Quantitative Approaches and Methods in Language*. Queens University Belfast.

Rampersad, C. A. 2011. *Teachers'perceptions of The Contribution Of Information And Communication Technology To The Teaching of Modern Studies, Using An Integrated System In An Urban Secondary School* (Doctoral dissertation, The University of the West Indies).

Raselimo, M. and Mahao M. 2015. The Lesotho curriculum and assessment policy: Opportunities and threats. *South African Journal of Education*, 35:1, February.

Reeves, T., & Hedberg, J. G. 2003. *Interactive learning systems evaluation*. Englewood Cliffs, NJ: Educational Technology Publications.

Robinson, V. M. J., Lloyd, C. & Rowe, K. 2008. The impact of leadership on student outcomes. An analysis of the differential effects of leadership types. *Educational Administration Quarterly*, 44(5): 635-674.

Roblyer, M.D. & Edwards, J. 2000. *Integrating educational technology into teaching*. Upper Saddle River: NJ: Prentice Hall Inc.

Roopa, S & Rani, MS. 2012. Questionnaire Designing for a Survey. *J Ind Orthod Soc* 46(4):273-277.

Rosnaini M. & Mohd Arif. Hj. Ismail. 2008. Factors influencing ICT integration in the classroom: Implication to teacher education. *EABR & TLC Conference Proceeding*. Austria.

Rouse, M. & Haughn, M. n.d. *Smart projector*.
<https://whatis.techtarget.com/definition/smart-projector>

Rovai, A. P., Baker, J. D., & Ponton, M. K. 2014. *Social Science Research Design and Statistics*. Chesapeake, VA: Watertree Press LLC.

Rubin, A. & Babbie, E. 2010. *Essential Research Methods for Social Work*. 2nd International Ed. Belmont, California: Brooks/Cole, Cengage Learning.

Rutten, N., Van Joolingen, W.R. & Van Der Veen, J. 2012. The learning effects of computer simulations in science education. *Computers and Education*, 58(1):136-153.

Salehi, H. & Salehi, Z. 2012. Challenges for Using ICT in Education: Teachers' Insights. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 2(1), February.

Salehi, H., Shojaee, M. & Sattar, S. 2015. Using E-Learning and ICT Courses in Educational Environment: A Review. *English Language Teaching*, 8(1).

Sang, G., Valcke, M., Van Braak, J., Tondeur, J. & Zhu, C. 2008. Factors associated with the integration of ICT into Chinese primary school classrooms: an interplay of teacher-related variables.

Sangraa, A. & Mercedes, D. 2010. The role of information and Communication Technologies in improving teaching and learning processes in primary and secondary school. *Research in Learning Technology*, 18 (3): 207-220.

Saw, K. G., Majid, O., Abdul Ghani, N., Atan, H., Idrus, R. M., Rahman, Z. A. & Tan, K. (2008). The videoconferencing learning environment: Technology, interaction.

Scardamalia, M. & Bereiter, A. 2000. Computer support for knowledge building communities. *Journal of Learning Technology Science*, 4(2): 311-325

Schmidt, W.H., Cogan, L. & Houang, R. 2011. The role of opportunity to learn in teacher preparation: An international context. *Journal of Teacher Education*, 62: 138–153.

Schofield, A. 2019. JCSE-IITPSA ICT Skills Survey. Jo'burg Centre for Software Engineering (JCSE) and IITPSA (Institute of Information Technology Professionals South Africa) 10th edition.

Schostak, J. 2006. Interviewing and Representation in Qualitative Research.pdf

Scrimshaw, P. 2004. *Enabling Teachers to Make Successful Use of ICT*. British Educational Communications and Technology Agency (Becta), Coventry.

Selwyn, N. 2011. In praise of pessimism - the need for negativity in educational technology. *British Journal of Educational Technology*, 42(5): 713-718.

Shadreck, M. 2015. Integrating ICTs into the environmental science primary school classroom in Chegutu district, Zimbabwe: problems and solutions. *European Journal of Science and Mathematics Education* 3(1):90-96.

Shah, K., Ahmed, J., Shenoy, N., & Srikant, N. 2013. How different are students and their learning styles? International Journal of Research in Medical Sciences *Shah K et al. Int J Res Med Sci, Aug, 1(3):212-215* www.msjonline.org.

Shahnazarian, D. Hagemann, J., Aburto, M. & Rose, S. 2013. Informed Consent in Human Subjects Research. Accessed on 29/09/2016. <http://oprs.usc.edu.org>

- Shan Fu, J. 2013. ICT in Education: A critical literature review and its implications. *International Journal of Education and Development using ICT (IJEDICT)*, 9(1): 112-125.
- Sheikh A. & Siti H. 2016. Transforming science teaching environment for the 21st century primary school pupils. *Malaysian Online Journal of Educational Technology*, 4(4). 68-76. Retrieved from <http://www.mojet.net/>
- Shulman, L.S. 1986. Those who understand: Knowledge growth in teaching. *Educational Researcher*, Feb. 152: 4-14.
- Simon, H. A. (n.d) Decision making in schools
- Simon, M. K. 2011. Dissertation and scholarly research: Recipes for success. Accessed on 28/07/2013 <http://www.dissertationrecipes.com>
- Smith, C. L. 2015. Technology Literacy Skills Needed in Further Education and/or Work: A Delphi Study of High School Graduates' Perspectives. *Graduate Theses and Dissertations*. <http://scholarcommons.usf.edu/etd/5776>
- Srisawasdi, N. 2012. The role of TPACK in physics classroom: case studies of preservice physics teachers. *Procedia - Social and Behavioral Sciences* 46: 3235 – 3243.
- Tayo, B., Ajibade, A. & Ojedokun, O. 2009. Uses of computer and its relevance to teaching and learning in Nigerian educational system. *Educational Research and Review* 4(10): 443-447, October. <http://www.academicjournals.org/ERR>
- Tedla, B.A. 2012. Understanding the Importance, Impacts and Barriers of ICT on Teaching and Learning in East African countries. *International Journal for e-Learning Security*, 2(3 /4): 199-207.
- Teddlie, C. 2007. Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research*, 1(1): 77-100.

Teddlie, C. & Tashakkori, A. 2009. Foundations of mixed methods research. Integrating qualitative and quantitative approaches in the social behavioural sciences. Thousand Oaks.

Teddlie, C. & Yu, F. 2007. Methods Sampling: A Typology with Examples. *Journal of Mixed Methods Research*, 1: 77

Teis, N.J.P. 2014. Technology education: A framework for the development of critical competence.

Thanh, N. C. and Thanh, T.T. 2015. The Interconnection Between Interpretivist Paradigm and Qualitative Methods in Education. *American Journal of Educational Science*, 1(2):24-27.

Timire, J. 2018. Mechanical Technology Teacher Education Curriculum Alignment to Practice: Towards a Conceptual Framework. Unpublished Doctoral Thesis, University of the Free State: Bloemfontein.

Thite, L. T. 2012. The State of Information and Communication Technology in Lesotho.

Trauth, E. M. & Jessup, L. M. 2000. Understanding Computer-Mediated Discussions: Positivist and Interpretive Analyses of Group Support System Use, 24(1):43-79.

Tuli, F. 2010. The basic distinction between qualitative and quantitative research in social sciences: Reflection on ontological, epistemological and methodological perspectives. *Ethiopian Journal of Educational Science*, 6(1): 97-108.

Twenge, J.M. 2009. Generational changes and their impact in the classroom: Teaching generation me. *Medical Education*, 43(5): 398-405.

United Nations Educational, Scientific and Cultural Organization(UNESCO). 2002. *Information and Communication Technology in Education – A Curriculum for Schools and Programme for Teacher Development*. Paris: UNESCO.

United Nations Educational, Scientific and Cultural Organization(UNESCO). 2006. *ICT in Education*. Retrieved March 12th, 2010 <http://portal.unesco.org/ci/en/ev.php>.

United Nations Educational, Scientific and Cultural Organization(UNESCO). 2008. ICT competency for teachers –implementation guidelines, version 1.0. retrieved on 28th September 2009. <http://www.unesco.org/en/competency-standards-teachers>

United Nations Educational, Scientific and Cultural Organization(UNESCO). 2010. The ICT impact Report a review of studies of ICT impact on schools in Europe. UNESCO. 11 December.

United Nations Educational, Scientific and Cultural Organization(UNESCO). 2012. ICTs for curriculum change. Paris, UNESCO Policy Brief. Accessed on 18/10/2014 <http://www.iite.unesco.org>.

University of Pretoria. 2018. *Artificial intelligence for Africa: An opportunity for growth, development, and democratisation*. https://www.up.ac.za/media/shared/7/ZP_Files/ai-for-africa.zp165664.pdf

Vosloo, J.J. 2014. A sport management programme for educator training in accordance with the diverse needs of South African schools.

Wach, E. 2013. Learning about Qualitative Document Analysis.IDS practice.

Wahab, S.K., Rose, C.R. and Osman, S.I. 2012. Defining the Concepts of Technology and Technological Transfer: A Literature Analysis-International Business Research vol. 5 No. 1

Wahyuni, D. 2012. The Research Design Maze: Understanding Paradigms, Cases, Methods and Methodologies. *University of Jember, Indonesia and University of South Australia*. 1(1).

Wand, Y.& Weber, R. 1993. On the ontological expressiveness of information systems analysis and design grammars, *Journal of Information Systems* (3:4): 217-237.

Ward, L. & Parr, J.M. 2010. Revisiting and reframing use: Implications for integration of ICT. *Computers and Education*, 54 (1):113-122.

Waters, J. T., Marzano, R. J., & McNulty, B. 2003. *Balanced leadership: What 30 years of research tells us about the effect of leadership on student achievement* (Working Paper). Denver, CO: Midcontinent Research for Education and Learning. http://www.ctc.ca.gov/educator_prep/ASC/5031RR_BalancedLeadership.pdf

Wellington, J. 2015. *Educational research: Contemporary issues and practical approaches* 2nd ed. London, England: Bloomsbury Academic.

Welman, C., Kruger, F. & Mitchell, B. 2009. *Research Methodology*. 3rd ed. Cape Town: Oxford University Press.

Willis, J. W. 2007. *Foundations of qualitative research: interpretive and critical approaches*. London: Sage.

Wilson, B., Teslow, J., Cyr, T. & Hamilton, R. 1994. Technology making a difference: The Peak-view Elementary School study. Syracuse, NY: Eric Clearing house Information & Technology at Syracuse University.

Wisker, G. 2008. *The Postgraduate Research Handbook*. 2nd ed. Palgrave Macmillan: Basingstoke, Hampshire.

Wohlfarth, D., Sheras, D., Bennett, J., Simon, B., Pimentel, J. & Gabel, L. 2008. Student Perceptions of Learner-Centered Teaching. *InSight. A Journal of Scholarly Teaching*, 3

Wood, J. 2012. Using Qualitative Research Strategies for Public Health Law Evaluation. A Methods Monograph for the Public Health Law Research Program (PHLR) Temple University Beasley School of Law.

World Bank. 2018. *World Development Report 2018: Learning to realize education's promise*. <https://www.worldbank.org/en/publication/wdr2018>

World Economic Forum. 2016. *Global Challenge Insight Report: The future of jobs – Employment, skills and workforce strategy for the Fourth Industrial Revolution*. http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf

Yanow, D. 2007. Qualitative-interpretive methods in policy research. In F. Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Sage: Thousand Oaks, Calif.

Yanow, D. & Schwartz-Shea, P. 2011. *Interpretive Approaches to Research Design: Concepts and Processes*. Routledge: Netherlands.

Crotty, M. 1998. *The foundations of social research. Meaning and perspective in the research process*. Sage publications.

Yarwood, A. 1994. *The motivate. Technical drawing with design*.

Yousef, H. & Masoud, R. 2016. The Impact of Information and Communication Technologies on Teaching Performance at an Iranian University. *American-Eurasian J. Agric. & Environ. Sci.*, 16 (5): 910-916 ISSN 1818-6769. DOI: 10.5829/idosi.aejaes.2016.16.5.12888.

Yunus, M. M., Nordin, N., Salehi, H., Sun, C. H. & Embi, M. A. 2013. Pros and Cons of Using ICT in Teaching ESL Reading and Writing. *International Education Studies*, 6(7).

Yusuf, M.O. 2005. Information and communication technology and education: Analysing the Nigerian national policy for information technology. *International Education Journal*, 6(3): 316-321.

Zeng, N., Ayyub, M., Sun, H., Wen, X. Xiang, Ping & Gao, Z. 2017. Effects of Physical Activity on Motor Skills and Cognitive Development in Early Childhood: A Systematic Review. *Hindawi BioMed Research International*, Article ID 2760716. <https://doi.org/10.1155/2017/2760716>

Zikmund, W.G., Babin, B.J. & Griffin, M. 2010. *Business Research Methods*. 8th ed. Mason, Ohio: South Western Cengage Learning.

APPENDICES

APPENDIX A1: LETTER OF CONSENT: TEACHERS

INFORMED CONSENT: Integrating Information and Communications Technologies (ICTs) in the teaching of technical subjects in Lesotho.

29-01-2019

Dear Sir/Madam

My name is Pitso Enoch Mphunyane. I am a student in the University of Free-State under the guidance of Dr Nixon Teis. I would like to invite you to participate in this research project stated above. The aim of the study is **to understand how technical subjects' teachers in a specific schools district in Lesotho integrate ICTs to enhance teaching and learning of technical subjects?**

There are no risks to you on participation in this study. Certainly, your input will add value to this field of teaching and help to deepen the understanding of educational value of the discipline. While I greatly appreciate your participation in this important study and the valuable contribution you can make, your participation is entirely voluntary and you are under no obligation to take part in this study. If you choose to take part, and an issue arises which makes you uncomfortable, you may at any time stop your participation with no further implications.

If you experience any discomfort on the way the research is being conducted, please feel free to contact me directly to discuss it, and also note that you are free to contact my study supervisors (indicated below) if need be.

Your real name will not be used in my publications or reports on the study.

Yours sincerely

Pitso. E. Mphunyane

Dr Nixon Teis (Supervisor)

APPENDIX A2: LETTER OF CONSENT: PRINCIPAL

Phahameng
P.O. Box 100

Butha-Buthe 400
29/ 01/ 2019

The Principal
XXXXXX High School
Butha-Buthe 400

RE: PERMISSION TO UNDERTAKE RESEARCH IN YOUR SCHOOL.

I am a Master's degree student at the University of the Free State presently working on my dissertation. I am currently undertaking the study integrating Information Communication Technology in Teaching and Learning of Technical subjects in Lesotho. The study aims at understanding how ICTs integration in technical subjects may enhance teaching and learning in Lesotho. This project will be done both during working hours and after hours. The name of your school, teachers and principals involved will remain completely anonymous. Your support in this regard will immensely be appreciated.

If you require any further information, please feel free to contact me on pitsoenoch@gmail.com or +26658054459.

Yours sincerely

Pitso. E. Mphunyane

Dr Nixon Teis (supervisor)

APPENDIX B: ETHICAL CLEARANCE



Faculty of Education

16-Oct-2018

Dear Mr Pitso Mphunyane

Ethics Clearance: Integrating Communication and Information Technology (ICTs) in the teaching of technical subjects in Lesotho

Principal Investigator: Mr Pitso Mphunyane

Department: School of Higher Education Studies: Department (Bloemfontein Campus)

APPLICATION APPROVED

With reference to your application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence is: UFS-HSD2018/0157

This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours faithfully

Prof. MM Mokhele Mokgalwa
Chairperson: Ethics Committee

Education Ethics Committee
Office of the Dean: Education
T: +27 (0)51 401 3777 | F: +27 (0)86 546 1113 | E: MokheleML@ufs.ac.za
Winkie Direko Building | P.O. Box/Postbus 339 | Bloemfontein 9300 | South Africa
www.ufs.ac.za



APPENDIX C: QUESTIONNAIRE

Questionnaires

Part 1

Biographical information

Name of the school

Qualification

Teaching experience

Subjects taught

Grade/form

Part 2

Yes or No questions

1. Does your school have an Information Communication Technology laboratory?
Yes -
No -
2. Does the ICT laboratory functions very well at your school?
Yes -
No –
3. From your knowledge, have you attended ICT training on integration in technical subjects?
Yes -
No –
4. In teaching and learning of technical subjects, how confident are you in using discipline specific ICTs to teach your learners?

Yes -

No -

5. Do you possess the needed skills to integrate discipline specific ICTs in your daily teaching of technical subjects?

Yes -

No –

6. On daily teaching activities at your school, do all teachers integrate ICTs?

Yes -

No –

7. Does your management give you the necessary support on the use of the internet or wi-fi to improve teaching and learning?

Yes –

No –

8. Do you use discipline specific ICT tools when teaching technical subjects with the aim of providing new ways of enhancing learners experience to acquire knowledge?

Yes –

No –

9. Do you think the use of discipline specific ICTs is a better way of teaching learners as opposed to traditional methods of teaching?

Yes –

No –

10. Do you think learners can learn better when using ICTs in teaching your subject matter in a technical subject class?

Yes –

No –

11. Do you utilize various discipline specific tools (internet, ipad etc) to update your subject knowledge?
Yes –
No –
12. Does your school provide for wi-fi or internet access at your school?
Yes –
No –
13. Do you use internet or wi-fi to update your (knowledge of subject matter) professional development?
Yes –
No –
14. Do you give your learners activities that require or prompt the use of wi-fi or internet when teaching technical subjects?
Yes-
No –
15. Do you think it is important to use discipline specific tools when teaching technical subjects?
Yes –
No –
16. Do you use various discipline specific tools (watsapp, facebook, emails, tweeter) to give learners activities?
Yes –
No –

THANKS FOR YOUR PARTICIPATION!

APPENDIX D: CODING AND DATA THEMATIC ANALYSIS
THEMES (THEMATIC) ANALYSIS

CODING

Theme	Level (code)	Teacher's quotes	Question
Proficiency in teacher's when using ICTs	Lack of training and skills	<p><i>"I did not receive any training concerning the use of ICTs. I completed my degree way back in 1996"</i></p> <p><i>"I rely on using traditional way of teaching because I am not fully knowledgeable about the use of ICTs. I don't feel comfortable to use it"</i></p> <p><i>"I need ICT training so that I can confidently integrate them into my teaching"</i></p>	<p>From your knowledge, have you attended ICT training on integration of technical subjects?</p>
	2. Confidence	<p><i>"I use the Internet to research information for some of my teaching"</i></p> <p><i>"I own a smart-phone that I usually use for researches on certain topics"</i></p> <p><i>"Since I am not fully knowledgeable about the use of ICTs, I don't feel comfortable to use it"</i></p>	<p>Do you use or integrate ICTs when you teach technical subjects at your school?</p>
	Lack of interest	<p><i>"I don't use Internet for upgrading my professional development for I am not used to... I don't even give learners tasks prompting the use of Internet because they complain that it is too expensive to do so"</i></p>	<p>How often do you use internet to upgrade your professional development?</p>
		<p><i>"We've got very old teachers here. They are afraid of using these ICTs; they even call themselves BBTs [born before</i></p>	<p>What factors are seen as challenges by other teachers?</p>

		<p><i>time] .They are afraid to use it because to them it's very embarrassing to be corrected by students”</i></p> <p><i>“Concerning technology, these kids possess lots of knowledge than us as teachers and as time goes on, it will be very difficult to teach these kids because they are using cell-phones regularly to google for information”</i></p>	<p>What factors are seen by teachers as challenges in teaching and learning of technical subjects at your school?</p>
<p>Insufficient infrastructure</p>	<p>Inadequate computer</p>	<p><i>“We have shortages of computers in our school and some of them are also old”</i></p> <p><i>“We have computers in my school, but unfortunately they are all dead”</i></p> <p><i>“We need an ICT laboratory for our learners so that we do not rely on school computer lab, which is meant for computer education and also students should be allowed to bring their own laptops and cell-phones”</i></p> <p><i>“We are a big school here and the computer lab is small and it cannot accommodate classes the way we want it”</i></p> <p><i>“The groups are too big and time slot does not allow regular use of ICTs because whenever I want to use the computer lab, you will find that there is a class going on there”</i></p>	<p>Do you have an ICT lab at your school and is it functional?</p> <p>Do you usually use ICTs when teaching in a technical classroom at your school?</p>

		<i>school to source to students.</i>	

APPENDIX E: TEACHERS' INTERVIEW TRANSCRIPT

Transcript for teachers' interview

Good afternoon sir? My name is Pitso Enoch Mphunyane from the University of Free-state. I am researching on Integrating Information Communication Technologies into teaching of technical subjects in Lesotho. The interview is carried to seek to understand how ICTs are integrated into technical subjects' teachers to enhance teaching and learning. I selected you to be part of my interview because I believe you are a qualified teacher of technical subjects and your school has a computer laboratory. Our discussion will be kept confidential particularly what you said in this interview. Again be sure that your name will not be utilized to ensure the anonymity. Therefore my plea to you is to answer all the questions so that I will be able to get a better understanding of I am researching about. You may withdraw from this interview whenever you don't comfortable. I need your permission to proceed with the interview. You are going to be named teacher A.

Interviewer: Shall we start?

Participant: Yes we can.

Interviewer: What is the name of your school?

Participant: xxxxxxxxxxxxxx

Interviewer: What are your teaching qualifications?

Participant: Bachelor of Technical Education certificate

Interviewer: How long have you been a teacher at your school?

Participant: For 21 years now

Interviewer: What subjects do you teach?

Participant: I am teaching technical subjects, that is Basic handcrafts and Design and technology

Interviewer: How many are you in your department?

Participant: We are just three sirs.

Interviewer: Apart from your subjects of specialization, which other subjects do you teach?

Participant: Non sir. Only technical subjects

Interviewer: Do you have an ICT laboratory at your school?

Participant: Yes it is there.

Interviewer: Does it have enough ICT tools to use by teachers and learners?

Participant: Computers are there but they are worn out and others are very old.

Interviewer: Which ICTs do you have at your school?

Participant: There are computers in different departments and from there we have cell phones. From the headmasters office there is wi-fi and the computer too.

Interviewer: Do you have an access to the ICT laboratory?

Participant: We do not have access to the ICTs lab because it stated that computers belong to science and Technology department only.

Interviewer: In your staffroom, do you have a computer or other ICT tools?

Participant: Yes we have a computer from the department level

Interviewer: Ok, ok, ok. Which ICT tools do you have at your school?

Participant: No they are not there. Only our cell phones and computers

Interviewer: I see.

Participant: Yes.

Interviewer: Alright then. Regarding teaching and learning, do you use these ICTs you mentioned to teach?

Participant: Yes I do.

Interviewer: Do you integrate ICTs in your daily teaching activities?

Participant: I google for information before I go to class to update my knowledge.

Interviewer: Do all the teachers in your department use ICTs?

Participant: they are trying but it is not easy sir, not easy at all because it was stated that computers belong to science and Technology department.

Interviewer: Not easy I understand, but do you mean teachers cannot integrate ICTs because they are denied access to the computer laboratory

Participant: To be honest with you, there are no ICT tools here at school. We buy ourselves data and bring our own laptops.

Interviewer: What about the rest of the teachers at your school?

Participant: It is all the same sir. All the same.

Interviewer: Let's talk about skills to integrate ICTs. Do you possess the needed skills to integrate ICTs?

Participant: Yah! A little. I am able operate my cell-phone and little staff on the computer

Interviewer: Do you use those skills to deliver the content in your class?

Participant: Yes, sometime because I do not use it regularly.

Interviewer: When you teach, do you give your learners activities that require the use of WI-FI/internet?

Participant: No I have not yet given them tasks that require the use of ICTs because there will be no fairness because some will not be having data and lap tops at home. In class I do give them and allow them to use my lap top.

Interviewer: Do they really enjoy using the internet/wi-fi when they learn?

Participant: Yes, a lot sir. A lot. That time I gave them my lap top and the computer in the office, you will see them enjoying indeed.

Interviewer: Do you meet any challenges when giving learners activities that require the use of internet/wi-fi?

Participant: Oh! Yes. There are so many challenges. No data for learners, only few possess the lap tops; again cell-phones are prohibited from the school premises, so it is not easy to give learners activities that require the use of ICTs.

Interviewer: Do your learners learn efficiently and effectively due to the use of ICTs?

Participant: The reaction is positive although we are using these ICTs minimally. It really shows if we could have more of these tools, our learners will learn effectively.

Interviewer: From your observation, do they enjoy your lessons when using ICTs?

Participant: A lot sir

Interviewer: Ok, ok. Then, when using ICTs, does it prove to be an effective way of teaching and learning as compared to the old ways?

Participant: Hahahahahaha! You mean traditional ways?

Interviewer: Oh! Yes traditional way of teaching.

Participant: Yes, the use of ICTs helps a lot because the information is always there and they are finding information themselves.

Interviewer: Do you mean...

Participant: Look here sir, when somebody looks for information for himself or herself, that information is not forgettable as when somebody was told by the teacher.

Interviewer: From your experience then, do learners learn better as a result of using ICTs?

Participant: Yes, it has been proofed that the use of ICTs really is upgrading the standard of learning.

Interviewer: In terms of performance, can you provide any tangible information that there is improvement when using ICTs?

Participant: Really ICTs are important because there is great improvement on the performance of students and if the school can give students and teachers time to use school computers the performance of students is going to go higher and higher.

Interviewer: How are these ICTs important in the teaching and learning of technical subjects?

Participant: It is important in the learning of technical subjects because students are able to see pictures readily at any time

Interviewer: Do you allow your learners use ICTs to carry out their learning activities?

Participant: I have not yet given them activities because there is no fairness in that since some students do not have data even if they have cell phones.

Interviewer: Why do you feel it is essentially important to use ICTs to teach?

Participant: ICTs makes teaching simple, easier and interesting to learners because they enjoy using them.

Interviewer: Does the use of ICTs arouse interest to learners when learning?

Participant: It is aroused very considerably. They get motivated when they do work together, they really enjoy it.

Interviewer: How do you teach using ICTs?

Participant: We just apply these ICTs during teaching, just by using our cell phones to research. We use our cell phones to google some of the information so that from there we can jot it down and give to our students as written notes.

Interviewer: How do you see yourself as a teacher?

Participant: To some extent I see myself as both the facilitator and traditional teacher, that is, when ICT tools are available, I engage my learners fully and sometimes I find information for them.

Interviewer: Sir we have come to the end of our interview. I deeply thank you for taking part in this activity.

Participant: Thanks Mr P. Just shout anytime you need assistance, I'll be available.