

https://dspace.org/

Mediation in information and communication technology teacher development: towards effective ICT pedagogical integration in the classroom

Mbatha, Khanyisile

2021
https://hdl.handle.net/10539/32902

Downloaded from a DSpace repository. https://dspace.org/



NAME: **KHANYISILE MBATHA**

STUDENT No.: **512377**

ETHICS NO.: **2016ECE025D**

RESEARCH TOPIC: **Mediation in information and communication technology teacher development: towards effective ICT pedagogical integration in the classroom**

SUPERVISORS: DR IAN MOLL AND DR NOKULUNGA SITHABILE NDLOVU

YEAR: **29 DECEMBER 2020**

A research Report submitted to Faculty of Humanities, School of Education, University of the Witwatersrand, in fulfilment of the requirements of a PhD degree

Declaration

I, Khanyisile Mbatha, hereby declare that this study is my own and unaided work. Wherever other resources have been used, they have been acknowledged. It is being submitted in fulfilment of the PhD degree requirements in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other institution.



…… 29…DECEMBER 2020

Abstract

In recent years, there has been growing interest in the integration of information and communication technology (ICT) in the education systems of countries across the globe. Such interest has often been premised on the assumption that ICT has great potential for improving the quality of education, yet it has contributed immensely to challenges teachers face in our society. ICT has brought rapid developments and advancements in the education space. As a result, knowledge is expanding rapidly and modern technologies used in the classroom are demanding that teachers possess certain skills and competencies in order to succeed in the increasingly competitive space. ICT training is assumed to be the source to develop these core sets of skills and competencies. A plethora of studies have been conducted to understand the effects of ICT in education; however, there have been limited studies that focused on understanding how teachers as participants in ICT training learn. This leaves a void in understanding how teachers learn during ICT training; what the best instructional strategies are that can be replicated into other training sessions; and which model results in the effective imparting of ICT pedagogical skills that promote creativity and learner achievement in the classroom. These limitations and uncertainties point to the need for a rigorous and multifaceted approach to understand instructional strategies to teach teachers ICT pedagogical skills. This study reports on the mediation in ICT training that is supposed to leverage effective ICT pedagogical integration in the classroom.

This is a qualitative study that deployed ICT training observations, semi-structured interviews and classroom observations to understand the mediation that takes place during ICT training and subsequently in the classroom. The participants were three ICT trainers from three different training centres and four further education and training commerce teachers. The study used a multiple case study design with three case studies where each trainer is treated as a case. The findings of the study indicate that mediation that takes place in

ICT training is mostly provided by teachers and there is a huge difference between the skills learned during ICT training and what teachers are doing in class. The study concludes that ICT training does not help give teachers the needed ICT pedagogical skills but expose them to basic computer skills. Thus, after ICT training teachers have to improvise to integrate ICT into teaching and learning.

Key words: ICT integration, mediation, ICT pedagogical skills, professional development, curriculum content, context, modelling, mediated learning experience

Acknowledgement

This PhD thesis is the result of a challenging journey to which many people had contributed and given their support. At the end of this journey, it is a pleasant task to express my gratitude to everyone who made this thesis possible and an unforgettable experience for me.

I sincerely appreciate the almighty God for His grace, strength, sustenance and, above all, His faithfulness and love from the beginning of my academic life up to this doctoral level. His benevolence has made who I am today.

I am deeply indebted to my supervisors, Dr Ian Moll and Dr Nokulunga Sithabile Ndlovu, for their expert guidance and keen interest throughout the course of this study. If it were not for them, this study would not have been possible. Enikwenze kimi nikwenze nakwabanye!

I gratefully acknowledge the funding received towards my PhD from the National Institute for the Humanities and Social Sciences (NIHSS). Your financial assistance has made this journey possible.

I am forever grateful for the support received from the Educational Information and Engineering Technology Division, especial from Dr Reuben Dlamini and his colleagues whom I had the opportunity to work with.

I am also deeply thankful to my informants and the organisations whose names cannot be disclosed, but I want to acknowledge and appreciate their help and transparency during my research. Their information has helped me complete this study.

Getting through my dissertation required more than academic support. I have many, many people to thank for listening to me and, at times, having to tolerate me over the past years. I cannot begin to express my gratitude and appreciation for their friendship. I take this opportunity to extend my sincere gratitude and appreciation to all my friends for their valuable contribution to this journey.

Most importantly, none of this could have happened without my family. To my mom, Funani Florence Simelane, I am forever grateful for your inspirational words of wisdom. I have been blessed with magnificent siblings in my life, who kept me going by providing a stimulating and fun filled environment; especially my sister, Lindiwe Gugu Mbatha, who provided moral support whenever I needed it, either directly or indirectly. Words are limited to express my gratitude towards you, Ndabezitha. This dissertation stands as a testament of the unconditional love and encouragement I receive from my family.

May the Almighty God richly bless all of you.

Dedication

This thesis is heartily dedicated to Umamkhulu Makhosazane Martha Simelane, who took the lead to heaven before the completion of this work. I promised her that we would attend the graduation ceremony together but usulele ngeke ngisakuvusa Magutshwa!

Table of Contents

DECLARATION ..... **I**

ABSTRACT ..... **II**

ACKNOWLEDGEMENT ..... **IV**

DEDICATION ..... **VI**

TABLE OF CONTENTS ..... **VII**

LIST OF FIGURES ..... **XIII**

List of Tables xiv

CHAPTER 1: INTRODUCTION **1**

Background 1

Problem Statement 2

Rationale of the Study 4

Aims of the Study 4

The Importance of the Study 5

Research Question 5

Research Sub-questions 5

Structure of the Study 5

1.1.1 Chapter 1: Introduction 6

1.1.2 Chapter 2: Theoretical framework and literature review 6

1.1.3 Chapter 3: Analytical framework 7

1.1.4 Chapter 4: Research design and methodology 7

1.1.5 Chapter 5: Data analysis, interpretation and presentation of findings 8

1.1.6 Chapter 6: Thematic discussion and synthesis of findings 9

1.1.7 Chapter 7: The contribution of the study and conclusion 9

Conclusion 10

CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW 11

Introduction 11

Theoretical Framework 11

2.1.1 Cultural-historical psychology 11

2.1.2 Sociocultural theory 13

Semiotic Mediation 14

Application of Sociocultural Theory in the Development of Teachers' ICT Pedagogical Skills 15

The Zone of Proximal Development 20

Teacher ICT Competence 22

ICT Professional Learning and Development 26

Integration of ICT into Teaching and Learning 27

ICT Pedagogical Integration 29

ICT Professional Development Context 32

ICT Professional Development Programmes 35

Content of ICT Professional Development 39

Modelling as Teaching Approach 44

Table1: Mentoring roles in modelling (Levy, 2007) 45

Conceptual Framework 45

Mediated Learning Experience in ICT Training 48

2.1.3 Intentionality and reciprocity 52

2.1.4 Transcendence 53

2.1.5 Mediation of meaning 53

The Interactive—Non-Interactive 55

Teacher Interventions 55

CHAPTER 3: ANALYTICAL FRAMEWORK 57

Introduction 57

ICT Training 59

ICT Pedagogical Skills 59

ICT Trainer's Intervention 60
ICT Mediation Criteria 61
ICT Meaning-Making Process 62
Operationalising MLE in ICT Training 62
3.1.1 Mediated learning experience in ICT training 63
3.1.2 The interactive—non-interactive 70
3.1.3 Teacher interventions 71
Conclusion 72
CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY 73
Introduction 73
Research Paradigm 74
4.1.1 Interpretivism 75
4.1.2 Strengths of interpretivism 76
Methods of Data Generation 77
Case Study 78
4.1.3 Strengths of the case study 81
4.1.4 Model of the case studies 82
Data Sampling 83
Purposive and Convenience Sampling 84
Observation 86
4.1.5 Advantages of observation 87
Semi-Structured Interviews 88
Field Notes 90
ICT Training 92
Pilot 92
Data Analysis 92
Issues of Trustworthiness 95
Ethical Considerations 97

Limitations of the Study 99
Conclusion 100
CHAPTER 5: DATA ANALYSIS, INTERPRETATION AND PRESENTATION OF FINDINGS 102
Introduction 102
ICT Training Context 103
5.1.1 Teachers' details 104
5.1.2 Bheki 104
5.1.3 Tumi 105
5.1.4 Sive 105
Research Question 105
Research Sub-questions 106
Mediation 107
Modelling of ICT Skills 107
Modelling Approach 107
Actual Mediation 108
ICT Pedagogical Skills in the Training 113
Discussion and Interaction as Learning Strategy 115
Subject Knowledge and ICT Basic Skills 127
ICT Technological Knowledge 130
ICT Pedagogical Integration in the Classroom 133
ICT Pedagogical Integration Learned During ICT Training 138
Conclusion 140
CHAPTER 6: THEMATIC DISCUSSION AND SYNTHESIS OF FINDINGS 141
Introduction 141
Mediation of ICT Pedagogical Skills in ICT Training 141
ICT Trainers' Intervention During ICT Training 142
Modelling of ICT Skills (Approach and Actual Practice) 152
6.1.1 ICT Pedagogical skills in the training 159

6.1.2 Subject specific pedagogy 163
Appropriation of ICT Pedagogical Skills in the Classroom 163
Understanding Teachers' ICT Integration in Light of ICT Pedagogical Skills Learned 166
Conclusion 169
CHAPTER 7: THE CONTRIBUTION OF THE STUDY AND CONCLUSION 170
Introduction 170
The Contribution of the Study 171
Summary 174
Reflection on the Findings 175
Limitations of the Study 176
Recommendations 177
7.1.1 Develop ICT champion teachers 177
7.1.2 Training model 177
7.1.3 Subject specific ICT training 178
7.1.4 Qualified trainers 178
Conclusion 179
REFERENCES 180
APPENDIX A: APPLICATION FOR ETHICAL CLEARANCE 201
APPENDIX B: GAUTENG DEPARTMENT OF EDUCATION RESEARCH APPROVAL LETTER 203
APPENDIX C: INFORMATION SHEET FOR THE PRINCIPAL 205
APPENDIX D: PRINCIPAL'S CONSENT FORM 207
APPENDIX E: INFORMATION SHEET FOR ICT TRAINING INSTITUTION 208
APPENDIX F: CONSENT FORM: ICT TRAINING INSTITUTION 210
APPENDIX G: INFORMATION SHEET FOR ICT TRAINERS 212
APPENDIX H: CONSENT FORM: ICT TRAINER 214

APPENDIX I: INFORMATION SHEET FOR TEACHERS **216**

APPENDIX J: TEACHER'S CONSENT FORM **218**

APPENDIX K: INFORMATION SHEET FOR PARENTS **220**

APPENDIX L: PARENT'S CONSENT FORM **222**

APPENDIX M: LEARNER'S INFORMATION SHEET **224**

APPENDIX N: LEARNER'S CONSENT FORM **226**

APPENDIX 0: OBSERVATION FROM BHEKI'S TRAINING **228**

APPENDIX P: OBSERVATION **232**

APPENDIX Q: OBSERVATION FROM TUMI'S TRAINING **241**

APPENDIX R: OBSERVATION FROM SIVE'S TRAINING **256**

APPENDIX S: LANGUAGE EDITING CERTIFICATE **265**

List of Figures

Figure 1 Interactions during ICT integration (Wang, 2008)..... 31

Figure 2 ICT pedagogical integration that involves mediation..... 31

Figure 3 Categories for ICT in teacher training (Collis & Jung, 2003, p. 176) . 42

Figure 4 Conceptual framework 46

Figure 5 Three ICT training objects 58

Figure 6 Analytical framework..... 58

Figure 7 Multiple case study model for this study..... 83

Figure 8 ICT training sites and data collection instruments used in the study 91

Figure 9 Phases of thematic analysis used in the current study..... 94

Figure 10 ICT training sessions 102

Figure 11 Manual formula that teacher asked Tumi about 119

Figure 12 Teacher 2's alternative way to solve the question 120

Figure 13 Income statement that Teacher 2 asked Bheki about..... 122

Figure 14 The income statements that Teacher 3 used to answer Teacher 1's question about formulas in income statements. 123

Figure 15 Template option in Excel that Teacher 1 was asking Bheki about 124

Figure 16 Pictures 1–4 showing the back and forth between Tumi and Teacher 3. 125

Figure 17 Hand-drawn shapes that can be converted to objects..... 126

Figure 18 Hand-drawn shapes converted to objects. 127

Figure 19 Demand-and-supply graphs used as example by Teacher 2 in Tumi's class 128

Figure 20 Teacher 4's example of his general journal and ledger, in Bheki's class 129

Figure 21 General Ledger 129

Figure 22 Table that a teacher in Tumi's class wanted to automate 144

Figure 23 Alternative offered by another teacher to a question in Tumi's class 145

Figure 24 A teacher explaining to another teacher how to draw a demand-and-supply graph in Excel 146

Figure 25 Demand-and-supply graph manually drawn by a teacher in Tumi's class 147

Figure 26 Automated Excel demand-and-supply graph..... 148

Figure 27 Hand-drawn shapes Sive drew as examples to convert to objects . 149

Figure 28 Analytical framework..... 170

Figure 29 Effective mediated ICT training model..... 173

List of Tables

Table1 Mentoring roles in modelling (Levy,2007)..... 45

Table 2 Types of teacher interventions and their focus points (Mortimer & Scott, 2003)..... 56

Table 3 Types of teacher interventions and their focus points (Mortimer & Scott, 2003)..... 71

Table 4 Training facilitators' qualifications and experience details.....103

Table 5 Teachers personal details.....104

List of Abbreviations

ICT	Information and Communication Technology
MLE	Mediated Learning Experience
TPACK	Technological Pedagogical and Content Knowledge
ZPD	Zone of Proximal Development
UNESCO	United Nations Educational, Scientific and Cultural Organization

Chapter 1:
Introduction

This chapter introduces the study, which is titled *Mediation in ICT Teacher Development: Towards Effective ICT Pedagogical Integration in the Classroom,* and systematically provides an outline of the entire study and the steps taken to elicit this research. In this regard, the chapter unpacks the background to the study by seeking some understanding of mediation in information and communication technology (ICT) training that develop ICT pedagogical skills and enhance the teaching thereof in the classroom. The problem and rationale for undertaking this research are presented. The chapter also elaborates on the aims, objectives and research questions directly generated from the phenomenon under study.

Background

The permeation of ICT in the education system has required educators and managers to rethink the curriculum, policies and pedagogies. This new phenomenon in education has also placed the focus on teachers' ICT pedagogical skills: Are they are ready to integrate ICT or not? If they are, it is a question of how effective their ICT pedagogical skills are. In an attempt to address these questions, both international and local governments have intervened by investing in infrastructure and ICT teacher training to equip teachers with relevant ICT pedagogical skills. Buabeng-Andoh (2012) noted that between 2008 and 2009, the UK invested €2.5 billion in ICT in education and the USA spent $4.7 million for both schools and higher education; New Zealand invests $410 million every year. All these investments encompass ICT teacher training.

There are also investments on the African continent, though the figures cannot be traced in African countries other than South Africa, where numerous initiatives to ensure that schools keep pace with technology development in education have been started. Gauteng Online, the Khanya project in the Western Cape and The Intel Teach programme were all initiatives aimed at helping

teachers be more effective through ICT professional development. The focus of these were on how to integrate technology into the lessons and promote problem solving, critical thinking and collaboration skills among their students. Gauteng province is believed to have invested about R3 billion rand in ICT projects (Rasool, 2011), which is also the highest amount invested on the African continent. These investments were geared towards providing access to ICT (software and hardware) and to help to integrate it into teaching and learning.

Problem Statement

According to the PanAfrican Research Agenda (2008–2011), teachers in most public schools in South Africa are not effectively integrating ICT into teaching and learning, despite the gigantic investments made to improve ICT in the classroom. The input in ICT in education does not match the quality of ICT pedagogical integration in the classroom. This is noted in the research by Pearson and Somekh (2006) and PanAfrican (2009), who reported that lower levels of usage and minimal pedagogical change in the classroom still persist, regardless of the ostensibly high level of investment in access to ICT and ICT teacher training.

There are few studies that focus on ICT training that provide a meaningful understanding of the mediated learning that takes place during this training and how this influences ICT integration into the classroom. The construct of mediation is used in this study to better understand teachers' cognitive development in ICT training as well as develop a possible teaching method that promote meaningful learning. Mediation in this context happens when the ICT trainer mediates between ICT content and the trainee teachers. Unwin (2009) argued that, out of the numerous ICT trainings provided to teachers worldwide, due to a lack of research our understanding is limited about what this training entails, what teachers learn from it, and its influence on effective ICT pedagogical integration. This perspective indicates that there is a missing piece in the ICT integration puzzle.

It is pertinent to note that the criteria by which ICT integration is measured are insufficient; so we cannot establish the adequate use of ICT in teaching and learning, either in terms of evaluation of what is or of what should be the case. The studies that have investigated ICT training, such as those by Du Plessis and Webb (2012) and Nkula and Krauss (2014), have been limited to teachers' perceptions about the ICT training they have attended. According to Lawless and Pellegrino (2007), ICT professional development has typically been judged by measuring participants' satisfaction, their experiences and their assessment thereof. Congruent to this view, Guskey and Spark (1991) argued that the effectiveness of professional development is usually limited to self-reported changes in knowledge, beliefs and behaviour. Hence, teachers' perceptions about ICT training receives the most documentation in research findings. Less attention has been paid to investigating the influence of ICT training (content, context and pacing); the mediation that is taking place during ICT training; and how it influences ICT pedagogical integration in the classroom.

The notion of mediation is used in many studies, such as those by Donato and McCormick (1994) and Lantolf (2000), which investigated the learning of languages. However, the mediated learning in ICT training is yet to be established in the literature and this study seeks to fill this gap. According to Pachler and Pelletier (2010), proper evaluation of ICT training can be achieved by having a clear understanding of how learning happens during this training. This means having knowledge of what is happening when teachers are learning. A more elaborate evaluation of ICT training is crucial if we are to grow our knowledge about its influence on ICT pedagogical integration to transform our practices in the classroom. Guskey (2003, p. 46) maintained that "professional development should be a purposeful endeavor", and further explained that this can be achieved by investigating to determine whether it serves its purpose. This means that ICT training ought to be investigated to gauge its importance and effectiveness in the capacitation of teachers.

Rationale of the Study

It is noted in the problem statement that current studies on ICT training focus mainly on perceptions and experiences about ICT training provided for teachers. These studies seem to ignore investigations into teaching and learning that take place during ICT training. Guskey (2003) explained that these types of studies do not provide much insight about whether the training is effective or not, or whether it serves the primary purpose of developing teachers. The absence of empirical research informing the teaching and learning that occurs during ICT training and the way in which it influences ICT pedagogical integration has given rise to the knowledge gap. This motivated this study to investigate and address the question: How does mediation in ICT training influence effective ICT pedagogical integration in the classroom? The importance of investigating ICT teacher training is noted by Bliss and Bliss (2003), who stated that training must be assessed in order to document its value for the school as well as to evaluate its impact on improving instructional practices and learner achievement. Therefore, there is a pressing need for this study to investigate ICT teacher training to determine its appropriateness in providing the effective ICT pedagogical skills required by teachers to relay effective ICT pedagogical integration in the classroom.

Aims of the Study

This study examined mediated learning in ICT training for teachers and how it influences ICT pedagogical integration in the classroom. It also sought to determine whether there is coherence between what teachers are learning in ICT training and how they integrate it into teaching and learning. In view of this, the study analysed the way in which ICT content is mediated in training to develop teachers' ICT pedagogical integration. In relation to the above, the study designed a distinct model that explicitly establishes the relationship between ICT training and the subsequent use thereof in the classroom, which will ensure effective

training and ICT integration into the classroom that is based on sociocultural theory.

The Importance of the Study

This study is important, because it has the potential to provide significant insight into mediated learning in ICT training and the way in which it influences effective ICT pedagogical integration in the classroom. Moreover, this study bridges the knowledge gap by contributing to the existing literature about ICT professional development in South Africa and elsewhere. This study also developed a model that shows the relationship between ICT training and ICT integration in the classroom based on cultural-historical psychology. This is an important contribution of this study as the findings could inform educational reform at policy design and implementation level, thereby facilitating effective ICT pedagogical integration training.

Research Question

How does mediation in ICT training influence effective ICT pedagogical integration in the classroom?

Research Sub-questions

1. What mediational role does the ICT trainer play in the development of teachers' ICT pedagogical skills?
2. How do teachers appropriate the ICT pedagogical skills that aid their instructional practice in the classroom?
3. What is the relationship between ICT pedagogical skills learned during ICT training and the subsequent use of ICT in the classroom?

Structure of the Study

This section provides an overview of the entire study by delineating the core elements of each chapter. The study contains seven chapters.

1.1.1 Chapter 1: Introduction

Chapter 1 provides the introduction for the entire study. This chapter develops the significance of the study by describing how this study is unique or different from other studies and how it addresses something that is not already known or has not been studied before. It presents the background to and rationale for the study as well as focus on the aims, objectives and research questions, with emphasis on mediation in ICT training. Chapter 1 introduces the problem statement for this study and identifies the local and international knowledge gap and uses it to locate the study in the bigger debate on local and international issues on ICT training that promote effective ICT integration in the classroom.

1.1.2 Chapter 2: Theoretical framework and literature review

This chapter presents the theoretical framework for the study that was used as a lens to zoom into (1) the research problem statement and (2) the rationale for investigating mediation in ICT training. It is also connected to and compatible with the research design and methodology chosen for this study. The purpose is to demonstrate that the mediation in ICT training properties and relationships proposed in this study are not based on the personal instincts or guesses but on facts obtained from proponents of mediation in teaching and learning. Furthermore, the chapter provides a literature review of both local and international work on each of the following main concepts: ICT pedagogical integration, ICT training, modelling, and ICT teacher development. The study engages with various perspectives on ICT training that influence the thinking about mediation that promotes meaning making. Thus, Vygotsky's cultural-historical psychology and sociocultural theory for socially mediated knowledge construction were incorporated. The reviewed literature describes how this study is related to prior studies and highlights existing gaps in mediation in ICT training.

1.1.3 Chapter 3: Analytical framework

This chapter presents the analytical framework for the study. In order to conduct a good analysis of mediation in ICT training and go through all the steps in the analysis spectrum, the study used an analytical framework that was designed to structure my thinking and to ensure logical thought about mediation in ICT training in a systematic manner. The study used qualitative research to answer a theoretical research question; that is, it used substantive theories on social reality to point out something that is not known. In order to answer the theoretical questions using qualitative empirical data, an analytical framework was incorporated with the important aim of guiding and facilitating meaning making and the understanding of ICT mediation in ICT training. The analytical framework focused on the study's research questions and systematic, comprehensive, transparent and reduced biases that could have swayed the study's interpretation. Therefore, an analytical framework was used to link the theoretical question to the empirical analysis by summarising what is theoretically known about mediation in ICT training as an empirical phenomena. The chapter ends with mediation properties, actions, conditions of action and effects, as well as assumptions about their relationships.

1.1.4 Chapter 4: Research design and methodology

Chapter 4 describes the path along which the study was conducted. It describes and explains the research methodology, starting with the research design, which is a qualitative approach and an interpretivist paradigm that underpins the concepts of mediation in ICT training. The study draws from hermeneutic research because it emphasises the subjectivity of interpretations in the research of meanings of mediation in ICT training. It includes the research methodology of the study from the research strategy to the study's findings. Moreover, it provides a detailed description of the data collection process that followed and that can allow the replication of the study by another researcher. It includes all sources of data and methods used, including semi-structured interviews and

structured observations and data sampling. The study employed a multiple case design approach, which ensured validity and reliability because each case was viewed as an experiment and the presumption was that the greater the number of case studies that show replication the greater the rigour with which the theory would have been established. The ethical considerations that were envisaged are also discussed in detail, together with the steps taken to ensure that the research were conducted within an ethic of respect to those who participated. The chapter presents how the collected data was sufficient in breadth and depth to answer the research questions. Finally, this chapter shows how the research findings were analysed and interpreted to satisfy aims of this study.

1.1.5 Chapter 5: Data analysis, interpretation and presentation of findings

This chapter explains the data analysis procedures followed, presents the main categories and themes that emerged from the data, and offers a discursive analysis and interpretation of the findings. The study used the theoretical framework in Chapter 2 and the analytical framework in Chapter 3 as lenses to zoom in on the collected data. It presents an analysis and interpretation of the data using the three methods of data generation. The data was divided into three themes (mediation of ICT pedagogical skills in ICT training; appropriation of ICT pedagogical skills in the classroom; and teachers' understanding of ICT pedagogy integration in relation to ICT training provided) with categories articulating patterns and trends that emerged in the data. Each theme begins with an introduction of what the theme represents and how it has been informed by the literature. It proceeds to present the direct quotations and iterations of the participants in response to each category conditioning the theme. Following this, the category provides analysis and interpretation as well as making inferences between findings and the literature cited. Once each category has been explored, a final analysis and interpretation is presented at the end of the theme. The data

was analysed to bring order, structure and meaning to the collected evidence from ICT training through observation and interviews.

All themes generated were used to answer the research sub-questions. Theme 1 (mediation of ICT pedagogical skill in ICT training) answers the first research question (What mediational role does the ICT trainer have in the development of teachers' ICT pedagogical skills?). Theme 2 (appropriation of ICT pedagogical skills in the classroom) responds to the second research question (How do teachers appropriate the ICT pedagogical skills that aid their instructional practice in the classroom?). Lastly, theme 3 (teachers' understanding of ICT pedagogy integration in relation to ICT training provided) answers the third question of the study (What is the relationship between ICT pedagogical skills learned during ICT training and the subsequent use of ICT in the classroom?). To conclude, all the themes are summarised and it is discussed how they contribute to the research questions.

1.1.6 Chapter 6: Thematic discussion and synthesis of findings

Chapter 6 focuses on the thematic discussions and the synthesis of the findings from the previous chapter. It provides a summary of the main findings and concludes how these findings provide answers to the three research sub-questions, and subsequently, the main research question. It continues to provide a critical reflection on the research process used and presents an account of how the theoretical framework, literature and data analysis dovetail with making meaning of mediation in ICT for this study. The discussion goes beyond the themes and deeper into the content of the findings and draws conclusions.

1.1.7 Chapter 7: The contribution of the study and conclusion

This chapter presents the unique knowledge contribution of the study to the field of ICT integration in education by trying to establish whether the transferred ICT pedagogical skills from ICT training align with ICT integration in the classroom. ICT training observations, interviews and classroom observations were

concerned about how ICT trainers' mediate ICT pedagogical skills to teachers, and subsequently, how teachers integrate learned skills into their everyday teaching. After interrogating the findings of the study, gaps are identified and the model for effective ICT integration in ICT training is developed and presented in this chapter. This model seeks to bring alignment between ICT training and ICT integration in the classroom and to support effective ICT integration at large. The chapter concludes by providing an explanation of the effective ICT integration model. It first narrates the views as the key insights emerging from the study, then provides the reflection on how the research questions were answered, and finally, answers the main research question. It also elaborates on the possible implications for research and theoretical considerations, methodological implications and those for ICT teacher development. This chapter also presents the limitations to the study. Finally, it concludes by proposing recommendations for future research.

Conclusion

This chapter is the introductory chapter to the study. Therefore, this chapter presented a general introduction to the study as well as a detailed background. This background explicitly discussed the importance of ICT teacher training for effective ICT integration in education because of global competitiveness and as a tool for 21st century development. This led to the rationale of the study, which essentially blueprinted the need and reason for conducting the research. The study's aims, objectives and research questions were explicitly stated since these guide and frame each chapter. The next chapter articulates the first instalment of the theoretical framework and literature review embraced in this study.

Chapter 2:
Theoretical Framework and Literature Review

Introduction

The preceding chapter provided a map of the whole study and highlighted the aims of this study, which claims that ICT training is key to developing teachers' ICT pedagogical skills that they need to integrate ICT into teaching and learning. Against this backdrop, the context of this chapter provides a comprehensive account of the related literature concerning ICT training, locally and internationally, that can help generate factors that can improve ICT integration in the classroom. A literature review is an evaluative account of studies related to a selected domain of knowledge (Boote & Beile, 2005). It provides a theoretical base to enable further research by identifying and articulating relationships between earlier studies and the current study. Moreover, Onwuegbuzie, Leech and Collins (2008) posited that a literature review intertwines theory or concepts and practice in accordance with the phenomenon of a study; discusses main research methodologies and design; and identifies contradictions and inconsistencies that spark further interest in the field. Therefore, based on the phenomenon of the study (understanding mediation in ICT training), a theoretical framework is presented in the next section using the lens of cultural-historical psychology and sociocultural theory to discuss how the study is located in the literature of teacher ICT professional development. Thereafter, it discusses the conceptual framework of the study, which is shaped by theoretical lens of the sociocultural theory.

Theoretical Framework

2.1.1 Cultural-historical psychology

Cultural-historical psychology is also known as the school of Vygotsky, sociocultural psychology, socio-historical psychology, activity theory, cultural psychology, cultural-historical activity theory, and social development theory. It

is a psychological theory formed by Lev Vygotsky in the late 1920s and further developed by his students and followers in Eastern Europe and worldwide. The theory focuses on how aspects of culture, such as values, beliefs, customs and skills, are transmitted from one generation to the next (Van der Veer, 2012). According to Vygotsky, social interaction, especially involvement with a knowledgeable community or family members, helps children acquire the thought processes and behaviours specific to their culture or society (Bertau, 2009). The changes or growth that children experience as a result of these interactions differs greatly between cultures. This variance allows children to become competent in tasks important or necessary in their particular society. Another major characteristic of cultural-historical psychology is its integration with various approaches and methods used to consolidate knowledge about humanity (Van der Veer, 2007).

The focus is on human development for making genetic claims regarding the function of the mind during activity. These claims could be part of or a basis for a return to the unity of human science. A basic distinguishing feature of cultural-historical psychology is that the species-specific characteristic of human beings is their need and ability to inhabit an environment transformed by the activity of prior members of their species. This study draws from this theory, which constructs transfer and transformation to try to understand how ICT pedagogical skills are transferred to teachers during ICT training. Such transformations and the mechanism of the transfer of these from one generation to the next are the result of the ability of human beings to create and use artefacts. Artefacts are aspects of the material world that are taken up into human action as modes of coordinating with the physical and social environment.

Teachers' ability to benefit from ICT training depends on their initial developmental level from the training because children can profit from external information only when their cognitive structure is sufficiently prepared (Van der Veer, 2012). Interest and learning are best facilitated if the experience presented to children bears some relevance to what they already know but that is at the

same time sufficiently novel to present incongruities and conflicts. Children's interest is aroused when an experience is moderately novel (Ginsburg & Opper, 1979).

The social interaction between the learner and a knowledgeable adult is essential to cognitive development. In case of this study, 'knowledgeable adult' is the ICT trainer that interacts with the teachers during ICT training to mediate the content. The development of the higher cognitive functions depends on situations in which the adult commands the learner's attention, focuses their perception, or guides their conceptual thinking. Formally stated, any higher cognitive function, such as self-regulated attention, categorical perception, or conceptual thinking, was first external in the form of a social relationship between two people. Then, through the learner's activity, it becomes internalised as an intracognitive function (Van der Veer & Valsiner, 1991).

2.1.2 Sociocultural theory

Sociocultural theory emphasises the interdependence of social and individual processes in knowledge construction. At the core of this theory lies the understanding that human cognition and learning are a socially constructed phenomenon rather than individual phenomenon (Kozulin, 2003). Vygotsky (1978) maintained that social interaction and cultural institutions, such as schools, communities and training institutions, have an important role to play in an individual's cognitive growth and development. This theory focuses on the connection between people and the sociocultural context in which they interact and share experiences. Kozulin (2003) explained that Vygotsky's approach emphasises the importance of sociocultural forces in shaping learning and development where parents, teachers and peers play a crucial role in the process, and his approach also define the types of interaction between children and their environment. Therefore, the sociocultural perspective focuses on the role that participation in social interactions and organised cultural activities plays in influencing psychological development. Wertsch (1991), from Vygotsky's

writings, noted three central tenets (social sources of development, semiotic mediation and genetic laws) that explain the nature of interdependence between individual and social processes in learning and development.

According to Wertsch (1991), individual development, including higher mental functions, has its origin in social sources. This means that individual development heavily relies on social interaction. Vygotsky explained human development in the following way:

> *Every function in the cultural development of the child comes on the stage twice; first in the social, later in the psychological, first in relations between people as an interpsychological category, afterwards within the child's head as an intrapsychological category (cited in Valsiner, 1987, p. 67).*

This means that social engagement helps a learner to develop from the social structure that is outside them to individual cognitive development, where all higher psychological functions are internalised relationships of the social kind and constitute the social structure of personality

Semiotic Mediation

Wertsch (1991) noted that human actions on both the social and individual planes are mediated by tools and signs (semiotics). Vygotsky (1981) listed the following examples of semiotic means: "language; various systems of counting; mnemonic techniques; algebraic symbol systems; works of art; writing; schemes, diagrams, maps and mechanical drawings; all sorts of conventional signs and so on" (p. 137). Other tools that are gaining familiarity in sociocultural discourse include paintbrushes, computers, calendars and symbol systems. These tools are central to the appropriation of knowledge through representational activity by the developing individual. Kozulin (2003) explained that appropriation relates to change occurring in the individual because of their involvement in mediated activities. Mediation is the process that helps aid cognitive change. Jacob (1992) argued that "change is, a social process and sociocultural mediation is a central means through which change occurs" (p. 323). Semiotic tools enable the co-

construction of knowledge and the means that are internalised to support future independent problem-solving activity. In essence, internalisation is the process that gives rise to higher forms of mental functions. The concept mediation emphasises the role played by human and symbolic intermediaries between the individual learner and the material to be learned. In the learning context, teachers are seen as mediators instead of disseminators of knowledge. Vygotsky (1978) considered mediation an important element in the learning and development process and saw it as an "engine that drives development". To echo this view, Wertsch (1994) argued that mediation is the core of understanding Vygotsky's contributions to psychology and education by noting that:

> *Mediation is the key in his approach to understanding how human mental functioning is tied to cultural, institutional, and historical settings, since these settings shape and provide the cultural tools that are mastered by individuals to form this functioning. In this approach, the mediational means are what might be termed the 'carriers' of sociocultural patterns and knowledge (p. 204).*

Therefore, mediation in the teaching and learning environment assists learners to internalise the dialogue that brings the powerful tools for higher-order thinking, which is so important to learning and development. Bruner (1962) maintained that it is the tools that aid the developing streams of internalised language and conceptual thought that sometimes run parallel and sometimes merge, each affecting the other.

Application of Sociocultural Theory in the Development of Teachers' ICT Pedagogical Skills

This study draws significantly from the views of the four constructivists scholars Thomas Guskey, Sally Zepeda, David Jonassen and Hilda Borko. In this literature review, I suggest that between them these theorists cover the theoretical scope of the current research and that their ideas dovetail with one

another and are all informed by sociocultural theory, which I have established as the core of the theoretical framework adopted in this study.

Thomas Guskey (2002) made a profound contribution to teacher professional development. He suggested that the constructivist approaches used to teach students should also be applied to teacher development. Guskey drew his views from Ball, a constructivist who attempted to accommodate both constructivist and sociocultural theory in mathematics teaching where teachers are working with learners to co-construct mathematics meaning. Ball (1993) viewed mathematics learning as active construction and also suggested that mathematical learning is a situation of enculturation. Both constructivist and sociocultural theory note the important role goal-orientated activity plays in learning and development. Guskey's professional development is directly connected to Vygotsky's theory of development, not only with the notion of development they share, but also because they both consider social interaction to be the main source of underlying human development. Guskey (2002) explained that professional development requires mentoring, which involves a more experienced teacher guiding the less experienced one in the process of development. This alludes to Vygotsky's conceptualisation of the zone of proximal development (ZPD). Both Vygotsky and Guskey strongly believed that social interactions embedded in purposeful activities directed at achieving specific goals result in development. Guskey (2002) argued that training that leads to professional development "typically involves a presenter or a team of presenters that shares its ideas and expertise through a variety of group-based activities" (p. 22). Therefore, Guskey's views resonate with the theoretical framework of this study and will be used to foreground the understanding of professional development arguments.

Sally Zepeda (2011) strongly believed that professional development should be job-embedded. She argued that "it is time to recognise the need to acknowledge the importance of job-embedded, ongoing, and career-long professional development for teachers" (p. xxi). Through a job-embedded professional

development approach to apprenticeship, interaction and participation occur and teachers develop their skills. She draws from various theorists (Brown, Collis & Duguid, 1989; Lave & Wenger, 1991; Rogoff, 1991) who elaborated on notions developed by Vygotsky and placed certain emphasis on cognitive apprenticeship. The notion of guided participation highlights that cognitive development occurs in a social context while extending sociocultural theory beyond language-based dialogue. Importantly, guided participation builds on and extends Vygotsky's notion of ZPD. Rogoff (1990) explained that "children's cognitive development is an apprenticeship which occurs through guided participation in social activity with companions who support and stretch children's understanding of and skill in using the tools of the culture" (p. vii). Rogoff has a similar view to Ball (1993), who argued that learning is a process of active construction that occurs in the classroom. So, Zepeda's views of job-embedded professional development locate learning in a participative learning environment. Her views are consistent with this study and will be used to explain job-embedded ICT professional development.

Hilda Borko's work in professional development includes teacher cognition and the process of learning to teach, emphasising changes in novice and experienced teachers' knowledge. Borko (2004) argued that novice teachers can become experts through communities of practice, a concept that embraces the social nature origin of individual development, while recognising the importance of continuous, school-based collaborations among all members of the teaching and learning process (e.g. principal, teachers, parents, students) based on a common goal (Du Four, 2005). Communities of practice promote the notion of apprenticeship that Zepeda argued for. Again, the notion of teachers supporting each other towards skilling for the workplace builds on Vygotsky's tenets of ZPD. Above all, communities of practice provide teachers with ongoing support that Guskey believed leads to effective professional development. These scholars' arguments form the basis of the arguments based on the sociocultural theory forwarded for this study.

David Jonassen suggested that constructivism engages the learner in operations while constructing knowledge that they would not have been able to accomplish otherwise. He believed that learning is gained through personal experience. Jonassen approached learning from a constructivist view and related it to using technology to engage meaningful learning. He worked with problem solving through designing a constructivist learning environment. In problem solving, learners collaborate to solve problems, and in that collaboration there is an element of social interaction that resonates with Vygotsky's theory of development. Rogoff (1990), who is a Vygotskian theorist, explained that learners are already engaged in a social activity when they actively observe and participate with others. This echoes the perspective of this study, which does not aim to measure whether teachers are competent or not; although Jonassen (2000) also used to explain competency in constructivist terms.

The four theorists, Thomas Guskey, Sally Zepeda, David Jonassen and Hilda Borko, on whom this study draws extended their analysis across interconnected notions of learning and development that foreground teaching and learning in ICT training and showed their respective theoretical projects to be rooted in sociocultural theory.

The role played by mediation in human development is an essential aspect of the Vygotskian framework and provides an overarching theme for this study. This study focuses on the role of mediation in influencing ICT pedagogical skill during ICT training. Vygotsky (1978) viewed the human mind as mediated, which refers to interaction that includes dialogue and participation within ICT training, between ICT trainer and teachers, and their social interaction shaping ICT pedagogical skills and knowledge. Professional development and Vygotsky's theory of development are compatible because both focus on development through interaction. Vygotsky's theory is useful for understanding ICT teacher professional development as it allows the researcher to examine the complexities involved in teachers' learning through interaction with other teachers in ICT training and the professional development of ICT content learned in the training.

Teachers assume the role of learners in ICT training programmes, so during the ICT training, they interact with ICT trainers, who mediate ICT training content, the tools or artefacts of the training, as well as with other teachers. According to a Vygotskian view, humans use tools to mediate their social environment. Therefore, according to this perspective, mediation is an action constituted by helping teachers form connecting links in a process of understanding ICT pedagogical skills. Vygotsky (1978) explained that knowledge is a social construction learned and developed through social interaction. Therefore, teachers are expected to construct ICT knowledge through interaction with the ICT trainer and with others.

Mediation that takes place in ICT training is likely to have direct implications for how teachers are integrating ICT into teaching and learning. Doughty and Williams (1998) argued that interaction provides opportunities for learners not only to negotiate the message input, but, in doing so, to focus on its form as well. This shows that in the process of interaction the ICT trainers do not transmit pre-existing knowledge to teachers but instead afford teachers with the opportunity to participate and construct ICT skills and knowledge. The involvement of the ICT trainer as human mediator is important in the enhancement of teachers' ICT pedagogical skills because they help teachers to articulate their reasoning and to reflect upon their ICT knowledge. Therefore, mediation is an important element in the learning process that Vygotsky considered to be the "engine that drives development" (Donald, Lazarus & Lolwana, 2002, p. 59). Mediation provides developmental processes that could not be achieved without it.

I contend that ICT professional development can be achieved through learning ICT pedagogical skills. Vygotsky (1978) wrote that "learning is a necessary and universal aspect of the process of developing culturally organised, specifically human psychological functions" (p. 90). So, in this view, learning ICT pedagogical skills will precede development. The view of learning and development is what makes Vygotsky differ from Piaget's theory that cognitive development precedes

learning. Vygotsky (1978, p. 89) emphasised that "the only good learning is that which is in advance of development". Therefore, learning ICT pedagogical skills has an effect on the development of ICT pedagogical skills in the classroom. According to Williams and Burden (1997), a sociocultural approach to education advocates not just theory-based learning but also develops skills and strategies that enable individuals to continue to learn in order for them to grow as a whole person. Learning occurs in social contexts first. As Vygotsky (1978) explained, human mental processes begin as an actual social relationship between or among people that is on an interpsychological plane, and later on an intrapsychological plane, where the individual construct their own knowledge. In other words, knowledge is constructed from social interaction down to the individual. From this perspective, as teachers participate in a broad range of ICT activities and internalise the effect of working together, they acquire new skills and strategies to integrate ICT into teaching and learning. Vygotsky (1978) argued that all higher mental processes (mental processes that are mediated and internalised) originate as actual relations between human individuals. In other words, learning occurs first on the social plane (interaction between facilitator, teachers and ICT tools) and then in the teachers' head. To understand learning and development in ICT training between ICT trainers and teachers, Vygotsky's notion of ZPD will be used. Vygotsky (1978) explained that to understand the relationship between learning and development, the actual and potential levels of development must be differentiated. The 'actual' refers to what the learner can do alone without any assistance or perform independently; the 'potential' is explained in the next section.

The Zone of Proximal Development

Vygotsky (1978) explained that the potential development level is what one can achieve independently and what one can only do with the assistance of a knowledgeable person. In ICT training, trainers are seen as more ICT competent, whereas teachers in training are regarded as less ICT competent. The interaction between teachers, as the learners in this case, and trainers' skills and knowledge

become internalised. Later, teachers construct their own new meaning out of what was learned during training. ZPD is regarded as a better, more dynamic and more relative indicator of cognitive development than that which the learner can achieve without assistance, where interactions orientate instructional towards the ZPD. ICT trainers are important to guide and support teachers and are seen as mediators that provide the necessary skills and knowledge to integrate ICT effectively in the classroom. Guidance is important to teachers' learning until they internalised the skills and knowledge that have been modelled by the trainers. Guidance should continue in schools where teachers participate in professional communities of practice to support one another and where novice teachers are guided by experts or experienced teachers to construct meaning through reflective dialogue, peer guidance and feedback. This is congruent with what Guskey (2002) argued for: Continuous follow-up and support are important for teacher development. It is through ICT support that teachers will be able to navigate ICT pedagogical integration in the classroom. In addition, Zepeda (2011) argued for job-embedded professional development because skills and knowledge will be learned on the job. In this type of development, teachers are supported and guided in ICT skills and knowledge by knowledgeable colleagues, until the knowledge modelled for them is learned.

Vygotsky's theory is based on the notion of a more capable person (in relation to the task at hand) supporting the development of a less competent person by mediating the less competent person's interactions with the environment through providing symbolic mediators (skills and knowledge) or external mediators (tools or artefact) and supporting their use until the less competent becomes able to use them on their own. The lens of sociocultural theory is considered able to interpret learning that is taking place in ICT training and to look at individual development based on their participation in ICT goal-orientated activities. This theory were used to evaluate ICT training as a programme to look at how it is structured and how the ICT programme allows for the interaction to occur that will lead to ICT teacher development. It will also

assist in examining how the mediator (ICT trainer) is supporting and guiding teachers during the ICT training to become more competent in the pedagogical integration of ICT in the classroom.

Teacher ICT Competence

Today's classroom teachers need to be prepared to provide technology-supported learning opportunities for their learners. Being prepared to use technology and knowing how that technology can support learners' learning have become integral skills in every teacher's professional repertoire. They need to be prepared to empower learners with the advantages technology can bring. Schools and classrooms, both real and virtual, must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills. Interactive computer simulations; digital and open educational resources; and sophisticated data-gathering and analysis tools are only a few of the resources that enable teachers to provide previously unimaginable opportunities for conceptual understanding. Therefore, teachers who work in an ICT environment (classroom with ICT, computer laboratory) are expected to integrate ICT into teaching and learning in a way that is of educational benefit. Thus, teachers require a certain level of skill, knowledge, values, attitude and support to integrate ICT into teaching and learning. Hargreaves and Fullan (2012) argued that professionals have specialised skills, knowledge, expertise and shared standards of practice. In other words, by virtue of being teachers, they are expected to have certain skills that allow them to carry out their everyday duties of teaching. However, given the history of ICT in education, it cannot be assumed that, all teachers have ICT skills. Some teachers have limited ICT skills, which are inadequate for effective ICT integration.

ICT teacher training is believed to provide teachers with ICT skills that will enable them to integrate ICT effectively into teaching and learning. It is noted in the *Guideline for teacher training and professional development in ICT* (2007;

hereafter called the Guideline) that ICT training should provide teachers with competencies (skills, knowledge, values and attitudes) that will assist them in their everyday practice to integrate ICT in a meaningful way. The Guideline further outlines the competence statements of what teachers should be able to do at the end of ICT training. According to the Guideline, once teachers have gained these competencies, they will be able to effectively integrate ICT into teaching and learning. Rowe (1995) and Teodorescu (2006) noted that competence is a measurable, desired and specific milestone, explaining what an individual is expected to achieve in their given role. It is seen as the end product where individual performance is stated. They present competency or competencies as skills, knowledge, behaviour and attributes an individual attains through training and development programmes. According to this view, competence prescribes which skills teachers ought to have to be able to integrate ICT into teaching and learning. Jonassen (2000) contended from a constructivist approach that definitions of competency and competence reflect an underlying behaviourist perspective where teachers are seen as passive participants in the training. This means that ICT training shapes teachers' ICT skills, knowledge, attitude and behaviour. Furthermore, training is viewed as the process wherein ICT competence skills are disseminated to teachers, and not as a mediation process where ICT pedagogical skills and knowledge are co-constructed by both teachers and ICT trainers.

The way in which competencies are outlined in the Guideline (2007) is a very narrow, behaviourist approach that might result in giving teachers challenges when they want to integrate ICT into teaching and learning. The Guideline stipulates that:

> *The purpose of this document is to identify the ICT knowledge and skills that teachers require to integrate ICT into the curriculum to support curriculum delivery in specific contexts. The development of teachers' ICT knowledge, skills, values and attitudes is therefore a personalised activity that depends on each teacher's unique ICT experience. This development*

> *cannot be a rigid linear progression. The approach should be customised to respond to particular needs, interests and contexts within which teachers will use ICT. Providers should be mindful of individual differences and provide flexible, responsive training programmes and modules. (2007, p. 5)*

Teachers are specifically positioned at the intersection of policy and practice. As such, teacher professionalism is key to the integration of ICT policy in their teaching and learning repertoire. Beastall (2006), Chen (2008), Lim and Chai (2008), Younie (2006) and Sang et al. (2009) argued that the introduction of ICT in education did not have the complementary effect of increasing the professional development of teachers. Furthermore, they claimed that changing teachers' classroom practices to embrace the new technology did not unfold naturally as expected by policymakers, even in countries with the most developed ICT education policies. Although numerous ICT initiatives and policy intentions had been established and supported through government interventions, "the impact of it on the actual practice of teaching and learning has not been significant" (Belawati, 2003, p. 110; Ertmer & Ottenbreit-Leftwich, 2010).

There is no clear indication how teachers are supposed to learn the aforementioned skills and knowledge, but there is a list of what they need to do. Jonassen (2000) called this behaviourist approach an input/output strategy. In this view, it is believed that ICT training transmits skill, knowledge, values and attitudes to teachers. Lester (1995) stated that specifying exactly what is to be achieved and the measuring of standards is purely behaviourist and serves accountability. According to this view, education reform uses this strategy to shape teachers' behaviour and skills and to hold them accountable for ICT integration in the classroom. If teachers are being trained in certain ICT skills, they are expected to have certain standards.

Teodorescu (2006) maintained that measuring competence will determine whether the person is competent or not, while measuring of competence does not involve grading—it is either pass or fail. Rowe (1995 p. 46) suggested that to

"…determine whether an individual is performing competently in their job it is concerned with the outcome of learning and previous experience as reflected in performance". If a teacher has skills, knowledge, behaviour, attributes and clearly determined competence, they can be judged as professional, or not. It is noted in literature that people have less difficulty determining who is competent than what makes one competent. A competence framework does not explain how teachers ought to apply their skills nor how teachers decide to use the knowledge gained from ICT training. Teachers are capable of doing far better than any of the parts that can be described in the term 'competence' (Lester, 1995). The focus should be on what teachers are learning from ICT training to develop their ICT pedagogical skills, because prescribing skills and knowledge that teachers need to produce after attending training is likely to limit them to what is described in the competence framework.

Zepeda (2011) noted that teachers have knowledge and skills that are acquired from the specialised training and formal education. In this way, she recognised teachers' prior knowledge. This is not the case with the Guideline (2007), which is noted to be a behaviourist approach. ICT training should stimulate the construction of knowledge, rather than providing teachers with knowledge and skills. In other words, ICT training should be concerned with teachers' abilities and allow them to participate actively in the training to construct their own meaning that will help them to integrate ICT effectively. It should, therefore, be taken into consideration what they bring to the training and how the interaction with other teachers, artefacts and the environment help them to construct meaning that will help them to integrate ICT effectively into their teaching and learning.

This study maintains that it is no longer adequate to base ICT professional development on transmitting existing knowledge or developing a prescribe range of competencies. Instead, ICT training should recognise the role of teachers in the development process and grant them the opportunity to construct the ICT

knowledge and skills they need to effectively integrate ICT into the teaching and learning of subjects.

ICT Professional Learning and Development

Professional development, like any other field, is evolving, and it has resulted in debate about whether it should be called professional learning or professional development. Scholars have various views on this issue. However, Zepeda (2011) argued in favour of professional learning by explaining that teachers engage in a learning system and acquire professional knowledge and skills and create new meanings. Zepeda viewed teachers as learners in a learning system who participate in an ongoing process of learning and enhancing their skills. In her view of professional development, she did not consider what happens during professional development that might result in learning take place. Timperley, Wilson, Barrar and Fung (2008) explained that professional development is linked to teachers who have received at least some primary teacher education and who are in the process of expanding their knowledge and enhancing their skills. They believed that it is professional development because teachers build on what they already know from pre-service training. However, their argument is similar to Zepeda's view of professional learning, because they also connote building knowledge, skills and attitudes. In addition, UNESCO (2011, p. 234) noted that:

> *Professional learning is the additional skills and knowledge which teachers acquire in their work, beyond what they learned to become qualified teachers. Teachers can develop knowledge and skill in various ways, through courses, programmes, conferences, seminars, events and workshops, from colleagues, through experience and experimentation, personal research and reflection, and through membership of professional networks and associations. At times it is referred to as 'professional development' or continuous professional development 'CPD'.*

In a broader sense, these arguments view professional learning or development as the process where teachers grow their abilities, skills and knowledge that equip them to intensify their instructional practice. According to UNESCO (2011), professional learning and professional development is the same thing, as is mentioned above. Therefore, this study will adopt professional learning and development and will use 'professional development' and 'professional learning' interchangeably. The study views teachers as learners who learn and develop their ICT knowledge and skills through interaction with other teachers in ICT training.

Integration of ICT into Teaching and Learning

There is a vast body of literature that revealed there are significant issues that influence the effective integration of ICT into the practices of teachers (Binglimas, 2009; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Gu, 2011; Inan & Lowther, 2010; Lim, 2007; Ng & Ho, 2012; Sherman & Howard, 2012; Tondeur, Van Keer, Van Braak, & Valcke, 2008; Underwood et al., 2007). Some of the critical issues are systemic, such as access to ICT resources, policy guidelines, policy overload, systemic support, national curricula, and ICT teacher training; and others are meso-micro level issues, such as school leadership, institutional culture, teacher competence, teacher professionalism and teacher ICT pedagogy. Technology in education can be traced back to the use of paintings and drawings, and later, to television and radio. It has evolved to the ICT that is used today in the classroom. Tinio (2003) understood ICT as the diverse set of technological tools and resources used to communicate, create, disseminate, and represent knowledge and manage information. These tools include digital cameras, video recorders, television and radio. For the purposes of this study, the term ICT is used to encompass the entire networked computing in teaching and learning (Toomey, 2001, cited in Lloyd, 2005).

There is an assumption that ICT integration involves the usage of basic computer skills during teaching and learning. However, Taylor (2000) explained that it is

"certainly a useful tool that enables us to link various learning communities together in new and different ways" (p. 4). Dron (2012) and Cartwright and Hammond (2003) advanced the above description by arguing that ICT integration is not just a simple application of technology in teaching, but a well-developed process that contributes to learning. In a properly crafted ICT integrated lesson, ICT and other crucial educational components, such as content and pedagogy, are moulded into one entity (Wang & Woo, 2007). Integration has a sense of completeness or wholeness through which all essential elements of a system are seamlessly combined to make a whole (Earle, 2002).

The main factor that influences the effectiveness of learning is not the availability of technology but the pedagogical design for the effective use of ICT (Mandell, Sorge & Russell, 2002). According to Wang and Woo (2007), ICT can be integrated on three levels, namely curriculum level, topic level and lesson level. The curriculum level is where ICT is integrated into the whole content of the subject; the topic level is where ICT is integrated to help explain a particular unit of knowledge; and the subject and lesson level is where ICT is integrated to help students understand certain concepts within a single lesson. The computers should be tailored to the curriculum, not the curriculum to the computer (Earle, 2002). ICT integration requires teachers to come up with logical plans on how to integrate ICT effectively, although the success of the process relies on systematic structures, such as school ICT policy, ICT training and ICT resources, that are available at school to support ICT teacher development.

Haslaman, Mumcu and Usluel (2007, p. 1) understood that ICTs are about the "convergence of pedagogical and technological points supports effective connections between suitable technology for content and pedagogical principles to design learning environments". Therefore, they acknowledged that ICT plays a significant role in creating an ideal learning environment. It can be said that the process of integrating ICT into teaching and learning requires teachers to have knowledge domains that will help them recognise relevant technology and how to use it to access and present content in the most effective ways (pedagogy)

to enhance learners' learning. However, the absence of this type of knowledge can be detrimental to the effective integration of ICT into teaching and learning. Appropriate ICT professional training could help overcome this challenge. According to Vygotsky (1978), computers are physical tools that can be used to support and transform mental functions, which would be impossible without them. Therefore, ICT integration is a comprehensive process of applying technology to the curriculum to improve teaching and learning. Its success depends not only on the availability of technology but also heavily depends on the pedagogical design. Other factors such as leadership, professional development, time and evaluation also have a great impact on the effectiveness of ICT integration (Honey, Culp, & Carrigg, 2000).

ICT Pedagogical Integration

Teaching strategies, techniques or approaches teachers use in the classroom are referred to as pedagogy. ICT pedagogical integration has been vaguely understood as the use of technology in teaching and learning. However, effective ICT pedagogical integration goes beyond simply adding an element of technology to the subject matter. According to William (cited in Wang & Woo, 2007), ICT pedagogical integration is the process of using any ICT resources in teaching to enhance learning. Dron (2012) similarly argued that ICT pedagogical integration is how technologies (ICT) are being used in the teaching and learning environment. Using Dron's (2012) example, an email is not an educational technology unless it is used to educate; and it becomes a totally different technology when it is used to enable dialogue than when it is used to broadcast an announcement. In this view, ICT pedagogical integration encompasses all the processes involved when teachers are planning what, how and when to use ICT in the classroom. Furthermore, Dron (2012) strongly believed that pedagogy should not be considered in isolation, but rather that in educational systems there should be an interrelationship between pedagogy and ICT.

Mishra and Koehler (2007) believed that at the heart of good teaching with technology there are three core components: content, pedagogy and technology. Furthermore, they explained that these components play out differently across different contexts, accounting for the wide variations seen in the extent and quality of educational technology integration. Some studies have shown that teachers who are trained in using linear instructional design models are often reluctant to apply them because of the impracticality of the models in a complex school environment (Mishra & Koehler, 2006; Neiss, 2005).

Social constructivists argue that collaborative learning, where students can learn from each other, promotes the construction of meaningful knowledge. According to Wang (2008), collaborative learning promotes a learner-centred approach and means that the teacher's role is to structure problem tasks, guide student understanding and support learners' collaborative projects. Thus, teachers must have the skills to help students create, implement and monitor project plans and solutions. ICT pedagogical integration that promote interaction and mediation should be generic in approach because when teachers integrate ICT into the class, it is not linear because of the uniqueness of the subjects and school context. Wang (2008) explained the interaction that takes place during ICT pedagogical integration by means of the diagram in Figure 1. He advocated for three components, as did Mishra and Koehler (2007), however Wang (2008) stressed the importance of interaction between people where content and technology are central for both teaching and learning. This is similar to a Vygotskian view of didactic pedagogy, where dialogue becomes a process through which learners engage and construct meaning. Therefore, effective ICT pedagogical integration will be realised through interaction between the content, people (learners and teachers) and technology in a particular context.

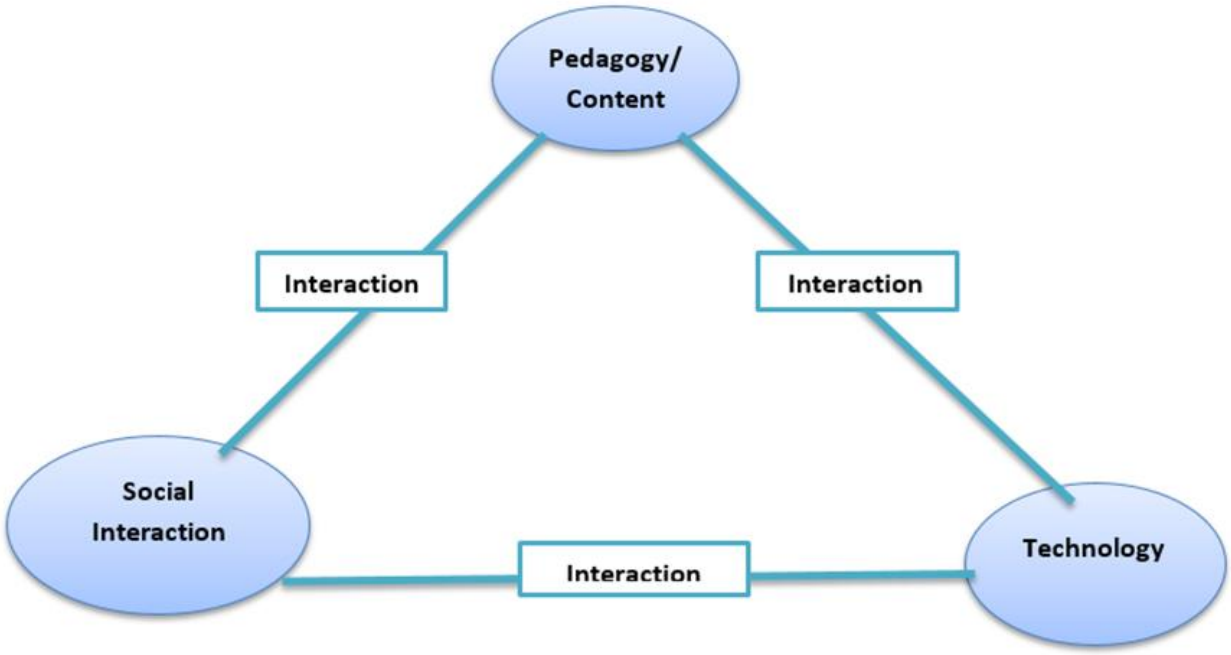


Figure 1 Interactions during ICT integration (Wang, 2008)

Wang's model in figure 1 seems to separate technology from pedagogy, so that technology is detached from the process. Dron (2012), however, believed that technology should not be treated as separate from pedagogy but that it must form part of the process as previously discussed. In the context of this study, ICT trainers mediate ICT pedagogical skills by not separating the process (methodology) and the technology. This study will advocate for ICT pedagogical integration as presented in the diagram in Figure 2.



Figure 2 ICT pedagogical integration that involves mediation

ICT Professional Development Context

Teachers need regular ICT training in order to keep up with new hardware and software tools. However, effective professional development in terms of developing the use of ICT to support teaching and learning should not focus only on how to use software but also on how to include time and space for teachers to share experiences and ideas (Bradshaw et al., 2011; Christensen, 2002; Franssila & Pehkonen, 2005; Pachler et al., 2010). Professional learning communities can be effective in developing ICT use (Duncan-Howell, 2010; McDermott & Archibald, 2010; Triggs & John, 2004; Wachira & Keengwe, 2011). Teachers who form communities of practice with colleagues and have technical and pedagogical support from the school are more successful with ICT integration (Donnelly et al., 2011; Lave & Wenger, 1991). Professional development should allow teachers to have positive experiences with ICT and observe others that are successful in order to develop positive views of ICT (Mueller et al., 2008). However, where effective ICT professional development should take place is debatable. In the literature, some scholars believe that it should take place on site, while others believe that it should be off-site.

Croft, Coggshall, Dolan and Powers (2010) contended that onsite professional development seems to have more benefits for teachers than off-site development because it allows teachers of the same grade and subject to engage in the learning process. Furthermore, given the fact that teachers are familiar with the school's environment and are used to each other as colleagues, onsite professional development allows them to work as a team within the school, set realistic goals and work together to achieve set goals. Guskey (2003) strongly argued that during onsite professional development staff members pay lip service and are more interested in programmes similar to those they are already using than in those producing results. According to his view, teachers' collegial relationships makes onsite professional development less effective. It is not clear what Guskey is referring to as 'lip service'. He could possibly be referring to teachers who 'sugar coat' what they do as part of teacher development. This

study differs from his view by considering that onsite ICT developments are advantageous based on the fact that less knowledgeable teachers are exposed to various forms of mentoring and coaching, which involve close interactions between them and more knowledgeable teachers. In this context, we see the notion of apprenticeship come into play. ICT skills are modelled to novice teachers, and through this, cognitive development can be matched.

In addition, matching professional development to fit teachers' needs can be an ongoing programme as ICT changes constantly. This places a burden on schools and teachers to provide and make use of this training alongside other development requirements. Focusing on pedagogy as opposed to specific tools is likely to be more productive because of the changing nature of these tools. However, as noted above, some teachers may require training in how to use ICT tools. An added advantage of communities of practice within the school is that they can be tailored to the individual needs of each teacher, thereby placing a burden on the school in terms of time and money. With a different view, Kopcha (2012) identified that individualised one-on-one mentoring is most successful. In reality, this is unlikely to be achieved due to time and money constraints. Communities of practice are important, both in developing teachers' own use of ICT and in allowing teachers to shape their beliefs around ICT.

According to Cushion, Armour and Jones (2003) onsite training is a continuous learning endeavour that helps teachers grow in their profession and gives them the support they need within their context. Developments that occur in their context empower teachers to construct meaningful ICT skills and knowledge that are tailored to suit their school and unique classrooms. However, off-site professional development usually takes place at a specific time with minimal follow-up, if any, and offers little opportunity or support to enable teachers to integrate new skills and knowledge with practice. Croft et al. (2010) emphasised that onsite development offers more benefits to teachers that cannot be achieved through off-site professional development. It is believed that onsite development has the advantage of developing staff teamwork as an essential vehicle to

successful professional development, because members interact regularly to share ideas and expertise and develop a common understanding within the same environment. Moreover, Elmore (2002) argued against off-site professional development, saying that it is a "gargantuan" task for teachers to apply what they have learned in an off-site workshop. Once teachers are back in their classrooms and isolated from other teachers, they struggle to apply the skills and knowledge in their own practice. Therefore, this study suggests that the physical location of learning should be as close as possible to where teaching takes place. Elmore (2002) also emphasised the importance of teacher support to improve the teaching profession and development and viewed off-site professional development as a far-fetched task for teachers.

Holloway (2000) asserted that effective professional development is likely to take place on site. However, this is seldom sufficient for the complete development of teachers. Holloway stressed that it should not be the only professional development at the school. In this view, teachers predominantly undergo onsite development and off-site development should be considered to determine what it can offer to intensify their onsite development. This is similar to Guskey's (2007) view, who explained that a carefully organised collaboration between onsite educators, who are keenly aware of critical contextual characteristics, and district-level personnel, who have a broader perspective on problems, seems essential to optimise the effectiveness of professional development. This argument is rooted in Vygotsky's development theory (1978), where teachers interact with the knowledgeable facilitators from the district to help them develop knowledge.

Onsite professional development provides teachers with the opportunity to observe one another's teaching, and this process may provide insight into aspects of their own teaching that would have gone unnoticed. According to Brandt, Farmer and Buckmaster (1993), apprenticeship in professional development in education takes place in five phases, namely modelling, approximating, fading, self-directing and generalisation. Modelling occurs when

experienced teachers with ICT in the school show novice teachers the tricks of integrating ICT into teaching and learning. Approximating what they have observed, new teachers try out the activity while articulating their thoughts about what they want to do and reflecting on what they did and how it is different from what they observed from experienced teachers. Drawing to a close when new teachers have learned what they were intending to learn, the support system starts to fade as teachers' abilities to integrate ICT increases. Self-directed in this phase, new teachers try to integrate ICT on their own, adapting what is necessary and only receiving assistance at their request. The last phase is generalisation, where new teachers generalise what they have learned to subsequent practice situations. This apprenticeship can only take place on site where a master and traineeship are involved in the task of teaching one another. Therefore, this study argues in favour of predominantly onsite professional development where teachers can be supported until they gain ICT skills. However, where there is a shortage of skills and knowledge, which is possible with ICT because of its ever-changing nature, teachers should seek help outside their school environment with the aim to develop themselves.

ICT Professional Development Programmes

There are a number of different aspects of professional development to include in order to support teachers in integrating ICT, such as software skills; using ICT to support the existing curriculum; changes to the curriculum and pedagogy; and changes to teachers' role that may occur as a result of using ICT. It is also important to focus on learner use of ICT and pedagogy rather than just teacher use of ICT, as this is highlighted as an area for development for many schools in a wide range of countries (European Union, 2013; Rezaei et al., 2011). Ertmer and Ottenbreit-Leftwich (2013) stated that ICT tools change regularly because of the pace of technology developments, but that it is likely that pedagogical goals remain generally constant; therefore, ICT integration and professional development programmes should focus on pedagogy rather than on technology. Teachers need to develop knowledge of pedagogy of ICT use to make the most of

ICT to support teaching and learning (Ertmer & Ottenbreit-Leftwich, 2013; Harris & Hofer, 2011). Teachers face pressure because of the rapid advances in technology, and therefore, a shared definition of the effective used of ICT, which includes the pedagogy of ICT use, is important to ICT professional development programmes (Ertmer & Ottenbreit-Leftwich, 2010).

Minaidi and Hlapanis (2005), Kirschner and Davis (2003) and Franssila and Pehkonen (2005) created models of progression for ICT-based professional development with three main phases: acquiring skills, integrating technology into the current educational process, and developing and changing practices through use of ICT. These phases can be summarised as follows:

4. Developing competency with ICT for personal use and principles for ICT use in teaching.
5. A range of pedagogical uses of ICT, including more interaction orientated ICT applications.
6. Using ICT for assessment and understanding policy and training to serve as pedagogical information technology support for other colleagues.

Most, if not all, professional development programmes are designed to equip teachers with skills and knowledge to enhance teaching and learning in the classroom. These programmes can be either short or long courses. However, there are issues in terms of timescale and the content of ICT teacher training, most of which have been conducted as workshops and short courses, to impart teachers with ICT skills. Guskey and Yoon (2009) explained that of all the professional development activities, none has been more criticised in recent years than workshops, particularly those of short duration. Does this mean that workshops and short courses have only a negative impact on ICT teacher professional development? Given the fact that ICT is new in education and that governments (nationally and internationally) are trying to find amicable ways to teach teachers ICT skills and ICT pedagogical skills, short courses and workshops seem to be beneficial. UNESCO (2004) advocated that professional

development should not be a once-off course or workshop but a process that will capacitate frontline users, mainly teachers, to gradually become experts in their practice.

Guskey and Yoon (2009) argued that short courses and workshops are the problem in professional development, hence they have been widely criticised. The challenge with many workshops and short courses is that they are poorly organised and focus on unproven ideas and strategies as a form of professional development; however, Guskey and Yoon (2009) believed that they are not the 'poster child' of ineffective practice as they are often made out to be. Furthermore, they contended that short courses and workshops are over-disparaged in professional development, noting that "ironically, *all* of the studies that showed a positive relationship between professional development and improvements in student learning involved workshops or summer institutes" (Guskey & Yoon, 2009, p. 496). It is questionable whether the problem is short courses or how these courses are planned. Short courses seem to lack connection with what is happening in class after training because their time frame does not allow such connection and support.

Guskey and Yoon (2009) also disapproved of a variety of short courses and workshops that offer no follow-up or sustained support. In addition, Villegas-Reimers (2003) contended that short courses are ineffective and most are irrelevant to teachers. It is believed that the ineffectiveness and irrelevance of courses point to the planning. This means that even though training comes in the form of short courses and workshops, they need to be in a certain order and linked to one another to have a meaningful impact on teachers. Short courses should be based on the implementation of research-based instructional practices, involve active-learning experiences for participants, and provide teachers with the opportunity to adopt the practices to their unique classroom situations (Guskey & Yoon, 2009). In conclusion, it is very important how ICT training or programmes are structured because it will determine their effectiveness in developing teachers. They should allow teachers to interact and

grow their knowledge and also give them the support they need until they are able to integrate their knowledge on their own.

Literature by Birman, Desimone, Porter and Garet (2000), Garet, Porter, Desimone, Birman & Yoon (2001), Lawless and Pellegrino (2007) and Royer (2002) advocated for ongoing processes for training teachers. Guskey (2002 p. 388) similarly noted that professional development ought not to be seen as an event but as a process and "ongoing endeavour". The understanding here is that even though training takes place in form of short courses, there should be an ongoing process that will influence teachers' instructional practices. Ongoing teacher training gives teachers time to deepen their understanding, settle into new skills and knowledge learned, and develop new pedagogical approaches. Guskey and Yoon (2009 p. 497) warned that "simply providing more time for professional development yields no benefit if that time is not used wisely. Presumably because doing ineffective things longer does not make them any better". This view also emphasises the importance of planning when it comes to teacher training. Having unplanned, ongoing teacher training will not bear any fruitful results for professional development. As Guskey and Yoon (2009) explained, "no improvement effort has ever succeeded in the absence of thoughtfully planned and well-implemented professional development".

Ertmer (1999) asserted that teachers need to access multiple types of training, where ICT pedagogy needs are addressed. This training could be in the form of ongoing short courses, that will provide teachers with shifts in their ICT pedagogy and help them improve their classroom practice. The effective use of ICT in learning is dependent on teachers' ability to use and understand the pedagogy of using ICT as a learning tool. De Clercq and Shalem (2014) explained that to teach well, teachers need a particular knowledge of what they teach, a broad sense of diverse methods of teaching, and most specifically, ways of explaining and representing the specific content they teach. In the ICT environment, teachers are presumed to have content knowledge of their subject and ICT training should provide them with the pedagogical skills that will help

them to integrate ICT into their subject content. Guskey and Yoon (2009) explained that effective professional development requires considerable time, which must be well organised, carefully structured, purposefully directed and focused on content, pedagogy or both. This study argues against once-off ICT professional development because it does not provide the extended support and guidance that teachers need to be able to apply what was learned during ICT training. Ongoing training is supported because it allows teachers to discuss challenges they encounter when integrating ICT into the classroom. Through that discussion, misconceptions can be cleared and can result in teachers learning. On–going professional development sits well with the idea of master in apprenticeship because the master supports the novice until the required skill is learned. However, this requires a sizeable amount of time.

Content of ICT Professional Development

It is not clear in the literature what ICT teacher training content ought to entail to have a positive impact on teaching and learning. Leedy and Ormrod (2010, p. 144) argued that content analysis involves "a detailed and systematic examination of the contents of a particular body of materials for the purpose of identifying patterns, themes, or biases". The content of ICT in-service training is a subject of debate that has been fuelled partly by the fact that less research has been done in this area to understand the nature of content knowledge that ought to be in ICT training. It is noted that ICT professional developments vary in many ways, as De Clercq and Shalem (2014, p. 153) noted:

> *Professional development differs in the form in which teacher learning is organised, duration and pacing of teacher learning, the types of resource material and artefacts selected to engage teachers in the learning process, the site of learning and participants selection criteria. Professional developments have different foci which refer to the content of the programme.*

The cause of the differences in ICT trainings were noted by UNESCO (2004). In countries where ICT teacher training is offered by different agencies, the content focus tends to differ. In most cases, agencies decide on the content of the training. This shows no difference with what is happening in South Africa, where ICT teacher training is offered by institutions of higher learning, service providers and Department of Education facilitators. Therefore, the ICT content of the training varies.

In relation to the content of the course, little is known about what is covered in ICT training to enhance effective ICT pedagogical integration in the classroom. The content of the training and its relevance to teachers' teaching is noted to be of dominant importance. Council (2001, cited in Guskey and Yoon, 2009, p. 495), asserted that "most effective professional development comes not from the implementation of a particular set of best practice but from the careful adaptation of varied practices to specific content, processes and context". Therefore, the content of ICT training that promotes effective pedagogical integration should be well structured in such a way that teachers have the prerogative to experience and modify the existing pedagogical knowledge. UNESCO (2004) strongly suggested that ICT teacher training content partly influences ineffective ICT pedagogical integration in the classroom. I agree with this view because if ICT training is poorly structured and poorly delivered, teachers are likely not to use the skills learned from the training.

Teachers are assumed to have a deep fundamental understanding of the subjects they teach, what Mishra (1986) called subject content. ICT training should help them to develop technological knowledge and pedagogical knowledge to deliver the subject. The selection of what should be the content of ICT training is arguable. Certain ICT content knowledge is regarded as appropriate for ICT teacher learning and development, while some is not. Bernstein (1996) described two types of pedagogic models (performance and competence) "on the basis of what counts as knowledge (curriculum); how learning takes place (transmission); and what counts as a legitimate display of learning (evaluation)" (Singh, 1997,

p. 118). These three concepts are of importance in relation to what counts as appropriate content for ICT teacher training and how that content is structured to enhance effective ICT pedagogical integration in the classroom.

Hoadley and Jansen (2009) pointed out that the competence model is characterised by the idea of integration between subjects, is learner-centred and makes strong links between school learning and real life. Competence content of ICT training will allow teachers to integrate that knowledge with their existing subject knowledge and create a new pedagogy for their classroom practice. This model is associated with Vygotsky's (1987) views of the content in a learning environment. He explained that content can be associated with two different conceptual processes: development of scientific and spontaneous knowledge. The competence model is linked to scientific knowledge in the case of this study: The ICT trainer mediates systems of interrelated ideas through interaction with teachers. In this competence model, teachers have "considerable control over the construction of spaces as pedagogic sites as there are no regulatory boundaries limiting access and movement" (Bernstein, 2000, p. 46).

On the other hand, the performance model stresses the importance of separate subject disciplines and does not draw extensively from real life. According to Vygotsky (1987), there should be a connection between spontaneous knowledge (everyday knowledge) and scientific knowledge because the former provides foundations for the latter. He believed that everyday concepts do not add much to student cognitive development because they are based on already existing cognitive mechanisms. If the curriculum does not have this connection, it may limit teachers' thinking. In the ICT training environment, the performance model has borders that limit teachers' creation of new knowledge. In my view, this model does not allow teachers to interact as learners in the system so that they can develop their knowledge. The performance model tends to be very specific about what content must be learned and in what order. It focuses on depersonalised, formal 'school knowledge', rather than on everyday knowledge and experiences, and it builds knowledge and understanding in a specific

sequence (Hoadley & Jansen, 2009, p. 177). This type of model is likely to promote ineffective ICT integration because technology is ever-changing and training teachers with a rigid approach will result in teachers acquiring knowledge and skills irrelevant to their classroom practices. The performance model is very close and tailor-made for teachers. This study advocates for the competence model as it is constructivist. This model takes into consideration what extant knowledge teachers bring to ICT training to connect with new knowledge. The structure of the competence model also allows teachers as humans with cognitive ability to interact and develop their ICT skills and knowledge.

Figure 3 shows that ICT teacher training has different content and can take many forms: Teachers can be trained to learn how to use ICT or be trained through ICT, and it can be used as central or complementary to the teacher training process. It is very rare that ICT teacher training can use all four quadrants (Collis & Jung, 2003).

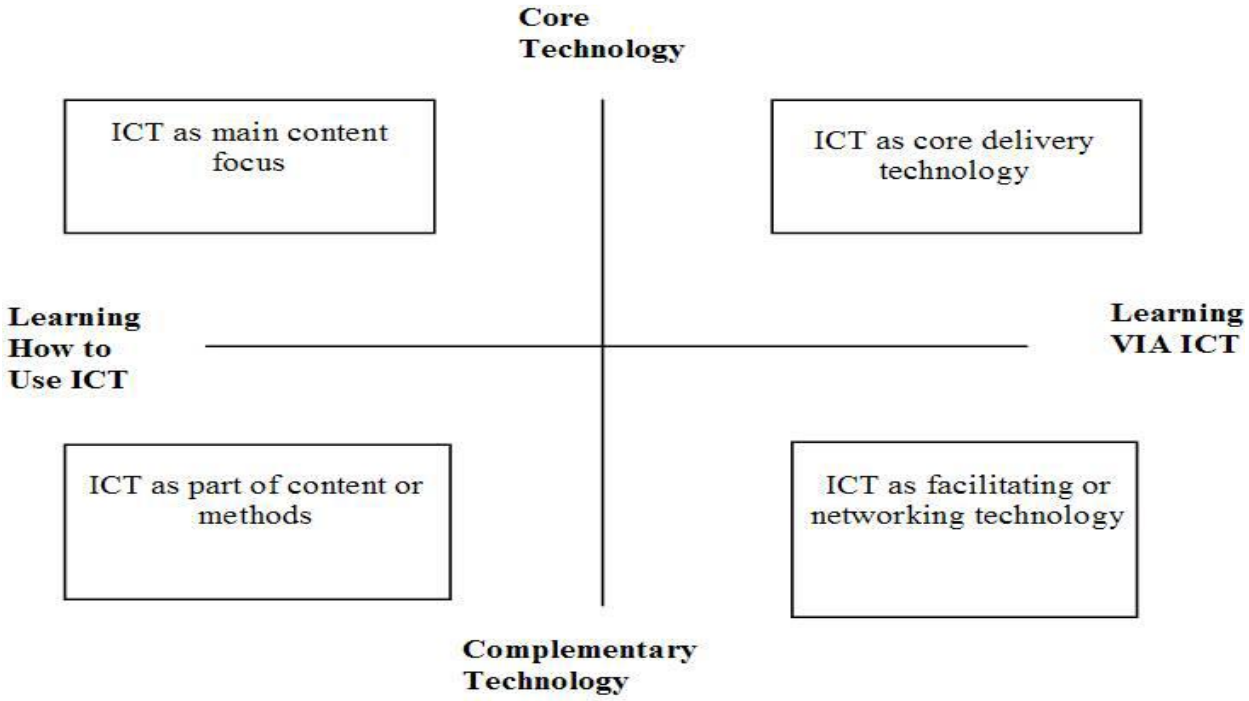


Figure 3 Categories for ICT in teacher training (Collis & Jung, 2003, p. 176)

According to Collis and Jung (2003), the core technology approach uses ICT as part of the content approach to equip teachers with ICT skills to be used in the classroom; for example, selecting appropriate ICT tools and supporting students in the use of those tools; using ICT to promote learning activities; developing new methods of facilitating learning; and evaluating student performance. In other words, ICT use in the classroom as a teacher training content focus refers to helping teachers gain ICT competence skills. This approach has lot to do with Bernstein's (1996) competence model where teachers are given the opportunity to experience different types of ICT skills and integrate them with their subject knowledge. This approach sits well with Vygotsky's (1978) idea of tools (computers) being central to the appropriation of knowledge in the teaching and learning environment.

Complementary technologies are usually gained after core technology and in most cases training does not offer such. Most of the time, complementary technologies are not regarded as a requirement for teachers. However, research by UNESCO (2004) showed that training programmes in countries like Singapore, Austria, Malaysia and South Korea have gone beyond basic ICT training to using complementary technology and are said to be integrating ICT into teaching and learning effectively. This means that ICT teacher training need to expose teachers to both core and complementary technology. In search of ICT training content that will enhance effective pedagogical integration, it is worth noting that 'there is no one answer' to effective professional development, hence Guskey's study in search of the optimal mix (Guskey, 1994). He warned that an optimal mix can work in certain settings but not in others and that it changes over time. He stressed that there is no precise statement about effective professional development and provided six guidelines for optimal mix that can be followed in professional development.

Modelling as Teaching Approach

Modelling is an instructional strategy in which the teacher demonstrates a new concept, skill or approach to learning and learners learn by observing and practising (Eggen & Kauchak, 2001). It is a very simple apprenticeship model in which the teacher passes over their expertise to the learner in a series of staged, scaffolded steps. It also dovetails perfectly with what education research tells about effective teaching and mediated learning experiences (MLEs). The phases of modelling are noted by Hurley and Chater (2005) as follows:

- **I do:** This involves the teacher demonstrating to the class how to perform a task or procedure. This might be in any subject where a teacher is giving learners a clear instruction and demonstrates a certain skill. Herman (2002) maintained that modelling can also be scaffolded by a pre-written worked example. These are especially useful when they are labelled with the steps learners should go through. Models should always be deconstructed in the first instance.
- **We do:** This stage involves joint construction. Learners encounter a second problem that has the same deep-structure as the first problem covered in the I-do stage but with different surface features. In the we-do stage, teachers and learners collaborate in the building of a second example, usually through questioning and dialogue.
- **You do:** This stage involves independent practice. This means that the learner works alone on a third, similar problem. This might be a partially completed problem or task, and learners are expected to do it independently. Another approach is to ensure that the original model or worked example remains visible to remind them of the steps they need to take. At this stage, the teacher might be quietly intervening with individual learners who need extra support. The you-do stage should not be considered to be analogous with exam-conditions; instead, it is about withdrawing, or fading some level of support rather than removing it altogether.

The table below depicts mentoring roles as modelling takes place in the teaching and learning environment. It has the fourth layer, which is explained below the table.

Mentoring Roles & Responsibilities

	Teacher	Student
I do it *Direct Instruction*	▪ Provides direct instruction ▪ Establishes goals and purpose ▪ Models ▪ Think aloud	▪ Actively listens ▪ Takes notes ▪ Asks for clarification
We do it *Guided Instruction*	▪ Interactive instruction ▪ Works with students ▪ Checks, prompts, clues ▪ Provides additional modeling ▪ Meets with needs-based groups	▪ Asks and responds to questions ▪ Works with teacher and classmates ▪ Completes process alongside others
You do it independently *Independent Practice*	▪ Provides feedback ▪ Evaluates ▪ Determines level of understanding	▪ Works alone ▪ Relies on notes, activities, classroom learning to complete assignment ▪ Takes full responsibility for outcome
You do it together *Collaborative Learning*	▪ Moves among groups ▪ Clarifies confusion ▪ Provides support	▪ Works with classmates, shares outcome ▪ Collaborates on authentic task ▪ Consolidates learning ▪ Completes process in small group ▪ Looks to peers for clarification

Developed by Ellen Levy © E.L.Achieve/2007

Table1: Mentoring roles in modelling (Levy, 2007)

Levy (2007) advanced the above modelling phases by adding the fourth layer: you do it together. This phase is learners working together and the teacher providing fading support to ensure that they demonstrate the learned skills and to clear misconceptions.

Conceptual Framework

This section presents the conceptual framework formulated for this study. It illustrates what can be expected in this study, presents the relevant concepts for this study and maps out how they relate to each other. This is illustrated in Figure 4.

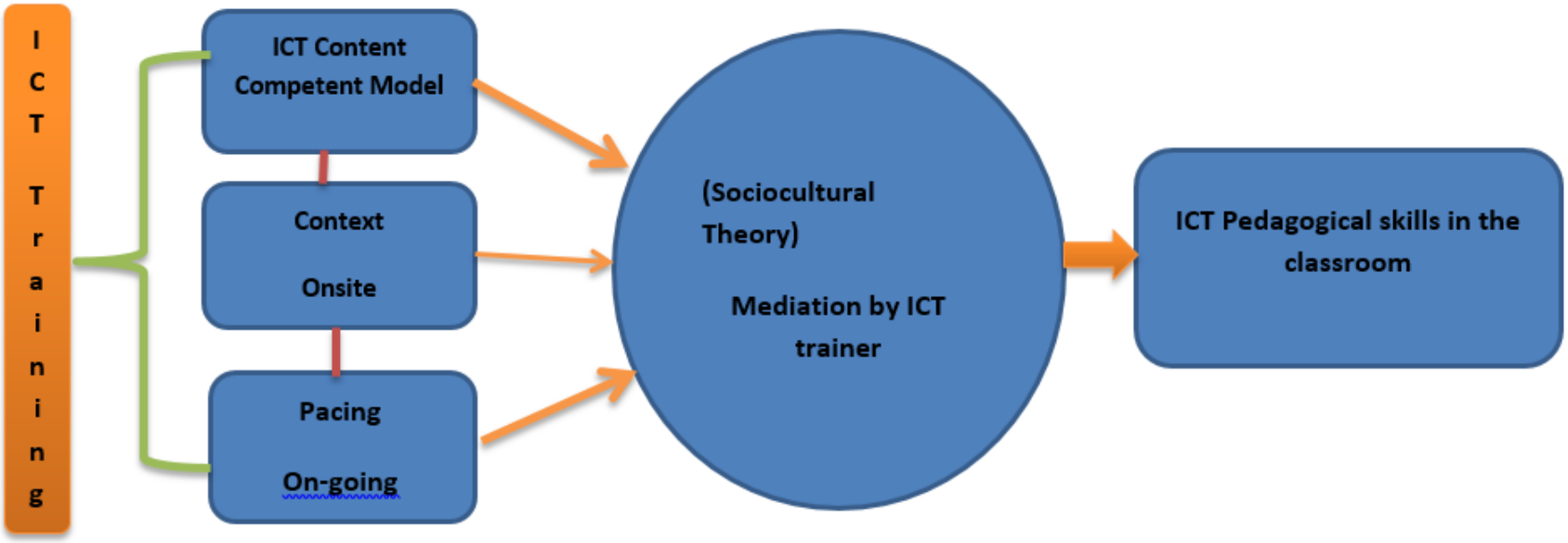


Figure *4* Conceptual framework

The conceptual framework in Figure 4 depicts the key elements (context, content and pacing of training) that constitute ICT training. This study investigated how mediation in ICT training ties these elements together to influence ICT pedagogical integration in the classroom. This study argues that the context of ICT training is important in promoting effective ICT integration and strongly believes that onsite ICT professional development is effective to give teachers the support and guidance that will help them develop ICT pedagogical knowledge and skills. As Guskey (2002) explained, onsite professional developments not only allow teachers to generate valuable knowledge and skills, but they also support the development of teachers' capabilities to work collaboratively in achieving a common goal. Onsite professional development also encourages the idea that schools are learning communities and that both teachers and learners are thriving.

This study advocates for open content in the competent model, which is based on the constructivist view and allows teachers to interact with one another during their training. In other words, the competent model content allows mediation to take place during training, which is important in developing ICT knowledge. The competence model can be modified by teachers to fit their own unique ICT context when integrating ICT into teaching and learning.

This study argues in favour of ongoing ICT training over once-off ICT training, because once-off training, as the name implies, happens infrequently and teachers do not receive follow-up support. Ongoing ICT teacher training is likely to promote effective ICT integration in the classroom because teachers get time to go and try what they have learned during training and challenges can be discussed in the next training session. Thus, ongoing ICT training offers teachers the opportunity for follow-up support, while helping them to develop their ICT skills and knowledge. Without forms of support, teachers will be unable to integrate what they have learned from ICT professional development. Vygotsky's theory indicates that internalisation is a prolonged process that requires continuous support from other people and symbolic mediators in addition to

time for individual reflection. Therefore, continuous support is the core of ICT teacher development.

Mediated Learning Experience in ICT Training

MLE has it root in sociocultural theory, which maintains that social interaction and cultural institutions, such as schools, classrooms and so on, have important roles to play in an individual's cognitive development. MLE in some respects is similar to Vygotsky's (1978) concepts of ZPD and internalisation and the concepts of scaffolding (Wood, Bruner & Ross, 1976). This has captured the interest of many developmental psychologists and educators, such as Rogoff, (1990), Valsiner, (1988) and Westsch (1985). This study is grounded in the sociocultural theory and it maintains that teachers learn ICT pedagogical skills through a MLE that emanates from ICT training. Both MLE and sociocultural theory emphasise the importance of sociocultural forces in shaping a child's development and learning (Kozulin, 2002).

It is well known that Vygotsky was concerned about the overly individualist focus of Piaget's theory. According to Vygotsky (1978), complex mental activities begin as basic social activities. I believe that socialisation and interaction between the ICT trainer and trainees (teacher) during training help teachers to learn ICT pedagogical skills. Building from Vygotsky's theory, Feuerstein (1991) focused on the issue of the concrete mechanisms of learning through the mediation of another human being (Kozulin & Presseisen, 1995). Teachers in ICT training do not learn in isolation but through guidance from the trainer and through other colleagues. MLE contends that interaction between individuals and the environment is never immediate but always mediated and that learning is achieved not through direct exposure but through the indirect experience or mediation provided by the presence of an adult (Kozulin & Presseisen, 1995). Feuerstein's (1980) theory emphasises the communal understanding of knowledge, not only in the collaborative sharing of experience, but in the sorting or categorising of ideas, and ultimately influences the potential ways that the

transfer of knowledge can occur in the student's thinking (Perkins & Salomon, 1988). The mediator helps the learner "frame, filter and schedule stimuli". Mediation assumes that instruction is more concerned with going beyond the giving information. It connects the present with both the past and in anticipation of the future "than with mastering specific bit of here-and-now data"(Kozulin & Presseisen, 1995).

Vygotsky (1978; 1986) maintained that high mental processes can be considered as functions of mediated activity. He pointed out three major classes of mediators: material tools, psychological tools, and other human beings. Vygotsky mentioned that concept formation and communication have one common crucial point. However, when conception formation hierarchy was considered, communicative situations could not elaborate beyond the general counter position of classroom instruction and spontaneous everyday learning. This left considerable missing sections in Vygotsky's theory of mediation. Kozulin and Presseisen (1995) noted:

> *Vygotsky and Feuerstein theories draw different conclusions from the above-mentioned limitations of the normative development model. Vygotsky argue that development is sociocultural specific and therefor the task that are used to evaluate children's functioning and the 'norms' can only be formulated in terms of social and cultural goals set by a given community. It is important to remember however, that Vygotsky himself was unequivocal in his conviction that cognitive functioning based on higher-order symbolic tools associated with literacy and numeracy is superior to that based on everyday experience and oral transmission of culture (Luria, 1976; Vygotsky & Luria, 1930/ 1993).*

MLE theory seems to be much more radical in its rejection of the normative development model. Unlike Vygotskian theory, it offers no age of psychological functions at practically any age and these conditions makes such a model unnecessary. The focus of discussion shifts towards the availability or lack of

MLE. The performance of the child before and after intensive mediation becomes an internal system of reference, replacing that of the external age-related norm. In practical terms, this means no predictions based on current performance are made regarding the child's ultimate performance level. The child is not measured against either their sociocultural group or the average performance in the society as a whole.

In Vygotsky's theory, no attempt was made to differentiate between human mediators beyond their function as vehicles of symbolic mediation. 'Mediation' serves as a key word in a considerable number of studies inspired by Vygotsky's and Feuerstein's ideas. There are, however, two faces of mediation: one human and the other symbolic. Approaches focusing on the human mediator usually try to answer the question: What kind of involvement on the part of the adult is effective in enhancing the child's performance? This study also seeks to answer a similar question: What mediational role does the ICT trainer have in the development of teachers' ICT pedagogical skills? However, those who focus on the symbolic aspect pose the question: What changes in the child's performance can be brought about by the introduction of the child to symbolic tool mediators?

The concept of learning that is mediated has been seriously examined as a construct for a better understanding of cognitive development in the classroom. There has been a growing body of scholars in the past three decades that have done intensive research on MLE, focusing on mother-to-child mediation, peer-to-peer mediation and also on teacher and learner mediation to enhance learners' cognitive development (Belsky, Goode & Most, 1980; Berk & Spuhl, 1995; Bornstein & Tamis-Lemoda, 1990; Bradley & Caldwell, 1984; Clarke-Stewart, 1993; Cristofaro & Tamis-Lemoda, 2012; Klein, 1996; Rodriguez et al., 2009; Tamis-Lemoda, Bornstein & Baumwell, 2001). These scholars support mediation to enhance learning. The focus in this study is on the mediation by the ICT trainers to enrich teachers' ICT pedagogical skills. However, Kozulin and Presseisen (1995) noted that the human aspects of mediation have confirmed its importance, but at the same time, have clearly revealed the episodic character

of our understanding of this phenomenon. It is generally agreed that the means of classifying mediational interactions is missing from Feuerstein's theory.

MLE processes describe a special quality of interaction between a mediator and a learner (Feuerstein, 1979; Tzuriel, 2002). In this qualitative interactional process, parents, or substitute adults or peers, interject themselves between a set of stimuli and the developing human (learner) and modify the stimuli for them. MLE processes are considered the proximal factor that explains cognitive development. It offers each individual learner a propensity to learn from new experiences and learning opportunities and to change their own cognitive development. The basic assumption of MLE is that individuals learn through the modalities of direct exposure and MLE.

According to Feuerstein and Feuerstein (1991, p. 5), MLE is broadly concerned with the interaction between a human being and its sociocultural environment. However, it does not include all interactions and focuses on experiences that influence the individual's "propensity to learn". Feuerstein and Feuerstein further explained that MLE as a quality or interaction is responsible for two major phenomena unique to human beings: modifiability and diversity. These two phenomena are closely intertwined and contribute to every human learner's considerable cognitive plasticity and flexibility. This quality is achieved by the interposition of an initiated and intentioned adult between the stimuli of the environment and the child. Feuerstein and Feuerstein (1991) suggested the following 12 major parameters or criteria of MLE: mediation of intentionality and reciprocity; mediation of transcendence; mediation of meaning; mediation of feeling of competence; mediation of regulation and control of behaviour; mediation of sharing behaviour; mediation of individuation and psychology differentiation; mediation of goal seeking; mediation of setting, planning and goal achieving behaviour; mediation for challenge; the search for novelty and complexity; mediation of awareness of the human as a changing entity; mediation of the search for an optimistic alternative; and mediation of the feeling of belonging. They further asserted that the first three parameters (mediation of

intentionality and reciprocity, mediation of transcendence, mediation of meaning) need to be accounted for in every learning exchange that constitutes a MLE. The other nine are not to be considered exhaustively, and are rather seen as a first selection of qualities of interaction that may not need to appear in each interaction in order to turn it into a mediating experience. Feuerstein referred to these criteria as secondary parameters and its presence is situationally determined and varies greatly according to societal environment and cultural factors.

The three primary parameters are responsible for the individual's cognitive development. Feuerstein (1990) maintained that the first three criteria are considered universal and can be found in all races, cultures and socio economic strata. These parameters are discussed in the following subsections.

2.1.3 Intentionality and reciprocity

In this criterion, an adult turns the interactive situation from a random, incidental experience into an intentional one. This intentionality has two foci: the object of learning and the child or the learner. The major task for an adult is to transform the object to be learned so that the object is experienced and not merely passively registered by the child. It is important to note that it is not the object per se, but the child's cognitive development that is primarily targeted in mediated interactions. In the learning environment, the learner should realise that the real objective of a learning activity is not a particular task or puzzle, but their own thinking. Mediation for intentionality is inadequate without the child's reciprocity because this interaction needs to be a two-way street where there is communication from both sides. It is through reciprocity where ideas are filtered and refined. This criterion is considered crucial for the 'ignition' of the mediation process.

In the ICT training environment, mediation of intentionality and reciprocity is observed between ICT trainer and teachers and among teachers themselves, and incidental ICT learning experiences are turned into intended experiences that

involve the exchange between the parties. The focus in this criterion is constantly on the development of teachers' ICT pedagogical skills.

2.1.4 Transcendence

In this criteria, the meditator expands learning opportunities for the learner by going beyond the goals of the particular interactions. Feuerstein (1990) explained that a mediator does not limit the length and breadth of an interaction to those parts of the situation that have originally initiated the exchange. Instead, they widen the scope of the interaction to goals that are more remote to the learners at that moment. The mediator provides both the immediate or concrete needs of the children and attempts to reach additional goals that are beyond the specific situation or activity. To clarify this parameter, Feuerstein (1990 p. 14) provided an example:

> *If a child points to an orange and ask what it is, to provide merely a label to name the object would be an unmediated response. A transcendent interaction would offer a broader definition, one that indicate categorical classification (it's the fruit of a plant/of a tree) and other reference to taste, smell etc. In order to help the learner make further connection.*

Transcendence as a mediating criterion not only provides the anticipated widening of cognitive factors in the information under question, but assumes the constant enlargement of the learners' own need system and their dynamic continuous changes. It has significance beyond a here-and-now situation.

Teachers learn their ICT knowledge through mediation and connect their 'remote' ICT skills with what they have learned during ICT training.

2.1.5 Mediation of meaning

Mediation of meaning refers to a mediator mediating meaning for learners. Feuerstein (1991) explained that mediation criteria deal with the questions of 'Why?' and 'What for?' and other reasons why something is to happen or be done.

The goal of this parameter is explicitly to make those didactic or parental understandings that are all too often implicit with children.

The trainer in this parameter explicitly attaches meanings to ICT skills that teachers are not sure about and also substantiate the reason behind these. For example, if the trainer teaches how to hyperlink a document and teachers do not seem to understand, the trainer will explain why they are learning it and how it will help them.

The above discussion presented MLE and its importance in learners' cognitive development. Despite the significance of MLE, Kozulin and Presseisen (1995) were concerned that it lacks the means to categorise mediational interactions. In Feuerstein's writings, there is a little insight into how meanings are made and interpreted in MLE. It only provides 12 parameters that are not arranged in a certain order or logical sequence to measure mediational interactions. Coupled with this is the fact that Feuerstein (1990) provided no clear analytical tool.

This study draws from Mortimer and Scott's (2003) theoretical constructs of meaning making as a dialogic process to address the identified gap. Even though Mortimer and Scott came from a science point-of-view, their theory of meaning making is grounded in sociocultural theory and they claimed that it is universal. Therefore, this study contends that the dialogic process as constructed by Mortimer and Scott (2003) is consistent with the overall framework that guides this study.

A dialogic process acknowledges the centrality of purposeful discourse between the teacher and the students in the classroom or learning environment. Mortimer and Scott (2003, p. 3) explained that "talk is central to meaning-making process and thus central to learning". Therefore, Feuerstein's theory of MLE and Mortimer and Scott's (2003) theory of meaning making are both rooted in the premise that learning happens because of social interaction. Cognitive development is the result of a meaning-making process. In their theory, Mortimer and Scott go beyond merely stating the central importance of interaction in the

classroom by setting out a multi-level analytic tools for characterising both teacher-student and student-student interactions in the classroom that enhance learning.

The Interactive—Non-Interactive

Interactive participation is structured to allow participation of other people, whereas non-interactive participation excludes participation of other people (Mortimer & Scott, 2003). When these two dimensions of the communicative approach are combined, four communicative approaches are formed. These are discussed in the next section.

Interactive dialogic means that the teacher and students consider a range of ideas together. If the level of interanimation is high, learners pose genuine questions as they explore and work on different points of view. If the level of interanimation is low, the different ideas are simply made available. In interactive/dialogic participation, the teacher revisits and summarises different points of view, either simply listing them (low interanimation) or exploring similarities and differences (high interanimation). According to Mortimer and Scott (2003 p. 38), the main point in this dimension is that, even though statements are made "that addresses student's" or others' points of view at the same time, the teacher does not call for any turn-taking interaction with the students. The interactive/authoritative–teacher focuses on one specific point-of-view and leads students through a question and answer routine with the aim of establishing and consolidating that point-of-view. Here, the class could be highly interactive yet authoritative because the teacher pays little attention to view. It involves the teacher presenting a specific point-of-view or concept in a formal lecture mode.

Teacher Interventions

Teacher intervention focuses on the ways in which the teacher intervenes to develop the content and make it available to all students in the classroom. It can take the form of a non-interactive/dialogic presentation, where the teacher

differentiates between everyday and school knowledge. Table below shows the different types of teacher interventions and their focus points.

Teacher Interventions	Focus
1. Shaping ideas	Working on ideas developing the content knowledge
2. Selecting ideas	Working on ideas developing the content knowledge
3. Marking key ideas	Working on ideas developing the content knowledge
4. Sharing Ideas	Making ideas available to all the students in a classroom
5. Checking students understanding	Probing specific students meanings
6. Reviewing	Return to and going over ideas

Table 2: Types of teacher interventions and their focus points (Mortimer & Scott, 2003)

Mortimer and Scott (2003) argued that the first three interventions (shaping ideas, selecting ideas and marking key ideas) relate to how the teachers act to introduce and develop content knowledge. The remaining ones refer to other aspects of staging the teaching performance. MLE and teacher interventions are at the heart of this study as they help trainers make meaning during ICT training.

Chapter 3:
Analytical Framework

Introduction

The previous chapter provided a critical account of the theoretical framework and of the literature. Integral concepts such as ICT pedagogical skills, mediation, interaction and participation were identified and interrogated to frame a disposition that enabled a theoretical base to implement further research for this study.

This chapter presents the analytical framework for the study that allows it to conduct a good analysis of mediation in ICT training and go through all the steps in the analysis spectrum. I designed an analytical framework to structure my thinking and to help logical thinking about mediation in ICT training in a systematic manner. In order to answer the theoretical questions using qualitative empirical data, an analytical framework was incorporated with the important aim to guide and facilitate meaning making and understanding of ICT mediation in ICT training. The analytical framework is illustrated in the diagram in Figure 8. The analytical framework focuses on the study's research questions and systematic, comprehensive, transparent and reduced biases that could have swayed the study's interpretation. It helps explain how a certain type of analysis were conducted, drawing from literature presented in the previous chapter, and shows syntheses between the concept, theory and data.

The concept of ICT training was critical in establishing three relative propositions that are illustrated in Figure 5: ICT trainee, ICT trainer and ICT content. These cautiously generated supporting factors through the selected studies. Inadvertently, these elements were crucial in exploring how mediation in the ICT training promotes ICT pedagogical skills that enhance effective ICT integration in the classroom.

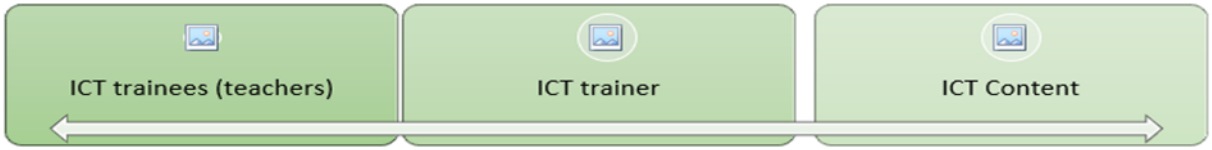


Figure 5 Three ICT training objects

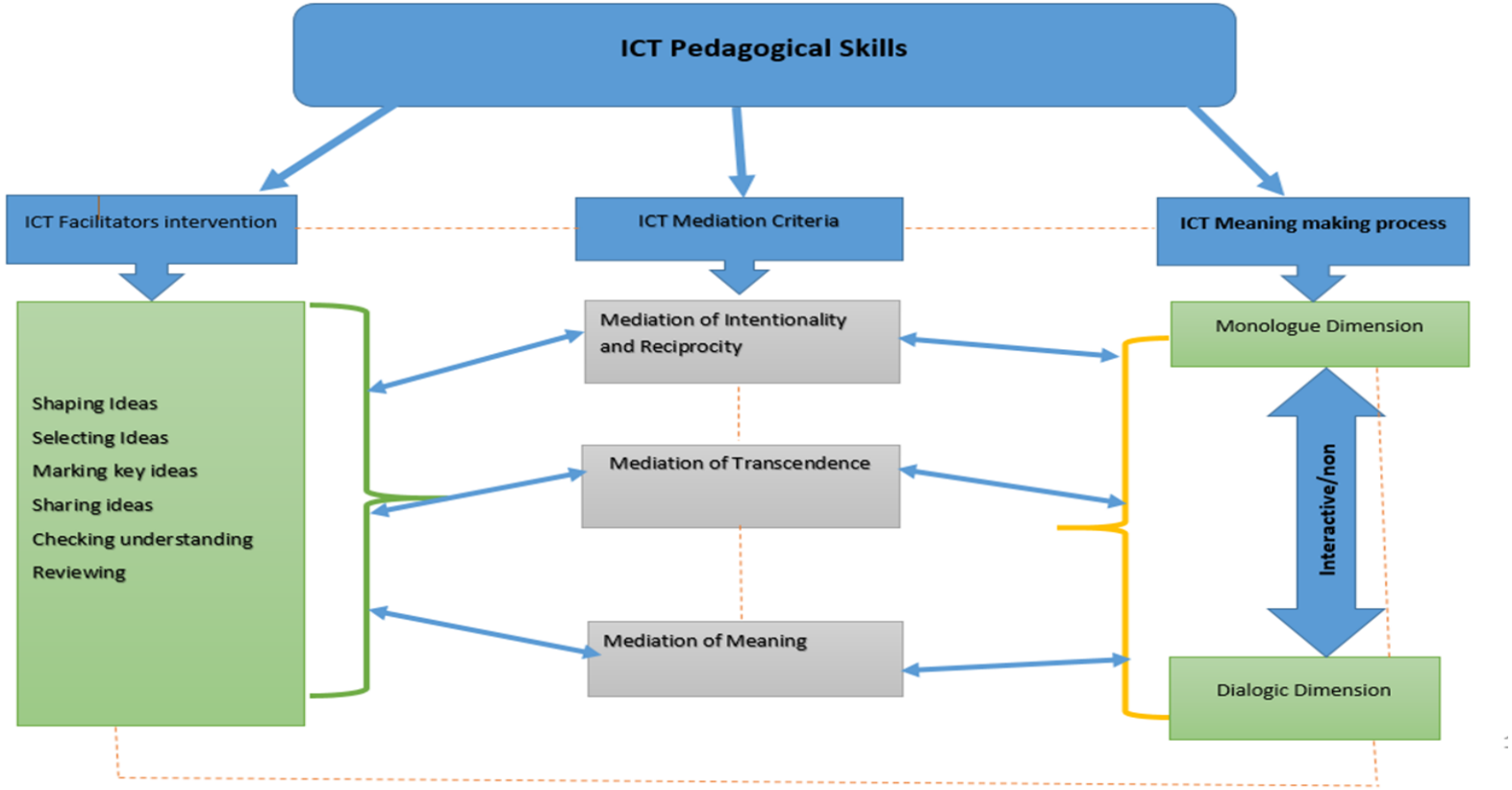


Figure *6* Analytical framework

ICT Training

Figure 6 presents the ICT training environment with three objects: ICT trainees (teachers), ICT content and ICT trainer. Teachers are taken as learners in the ICT training programme. The main aim of the teachers in this programme is to learn ICT pedagogical skills. In this study, these are understood as set of ICT skills or abilities that are intertwined with teaching methodologies to facilitate effective ICT integration that may be applied online and in hybrid and face-to-face learning environments. ICT trainers are assumed to have better ICT pedagogical skills than the trainees. Trainers mediate ICT content to be learned by putting themselves between the ICT content and the trainees. Arrows between the three objects depict the relationship that exists between the three constructs and also show the interaction that takes a two-way direction in collaboration and sharing of ICT pedagogical skills.

ICT Pedagogical Skills

ICT training should develop teachers' ICT pedagogical skills that are essential for effective ICT integration in the classroom. The analytical framework presented in Figure 6 depicts MLE, where ICT pedagogical skills are at the core of the discussions taking place during ICT training. Based on Underwood et al.'s (2007) and Ng & Ho's (2012) understanding of ICT pedagogical skills, this study maintains that ICT pedagogical skills include teaching strategies that use social constructivism, where negotiating is taken-as-shared meaning with teachers as students in the ICT training, class discussion, or small-group collaboration that may be personally meaningful for effective ICT integration in classroom. According to Kopcha (2012), an ICT pedagogy skill is associated with the approach that includes collaborative problem and project-based learning in which teachers explore a subject deeply and bring their knowledge to bear on complex, everyday questions, issues and problems.

An ICT trainer should construct ICT pedagogical scenarios in such a way that teachers can build on their prior knowledge. This will help teachers build new

knowledge on the basis of their earlier subject and ICT knowledge and communal understanding. Teachers are encouraged to work together and build new knowledge in cooperation with one another, while benefiting from the knowledge and skills presented. In ICT training, the trainer is expected to maintain dialogue and contact with the students in network-based education.

It is anticipated that ICT pedagogical skills developed through ICT training will help teachers improve ICT integration in the classroom, thereby moving them from having separate content knowledge and technology knowledge that they learned in isolation. Usually it is not easy to infuse the two, especially if they were learned in isolation. ICT pedagogical skills support technological, pedagogical and content knowledge (TPACK). With TPACK, teachers have a comprehensive understanding that a range of ICT tools exists for a particular task and the ability to choose a tool based on its fitness and strategies for using the tool's affordances to leverage teaching and learning. Teachers should also have the ability to apply learned strategies into everyday teaching. According to Koehler and Mishra (2009), teachers must have TPACK for them to maximise the potentials of technology and to encourage learners to construct new knowledge. Mishra and Koehler's (2009) TPACK framework guides how pedagogy, content and technology should be incorporated by teachers to create an effective ICT integration lesson. They acknowledge that technology affects both content and the way in which it is taught. They regard TPACK as specialised knowledge required for good teaching with technology. So, it is imperative that ICT pedagogical skills become a central element in the dialogue/discussions that take place during ICT training to strengthen teachers' TPACK.

ICT Trainer's Intervention

ICT trainers facilitate the training sessions and are seen as teachers in this regard. It could be said that the role of the teacher has always been of a mediator between the learner and the knowledge to be acquired. The teacher is responsible for introducing learners to new concepts and help them walk through this new

knowledge until the learners appropriates it. The contribution of the sociocultural theory to the field of education is making the role of the teacher much more interactive, dialogic and visible. Mortimer and Scott's (2003) construct of teacher intervention shows the teacher in the process of mediation by doing the following: shape ideas, select ideas, mark key ideas, share ideas, check understanding, and review ideas. These teacher interventions align with the Vygotskian concept of human mediation because the teacher is not the person who knows it all and transmits knowledge but rather a facilitator that helps learners to construct their own knowledge and invites them to be active participants in their learning process. It is through mediated interaction between the teacher and the learner that knowledge is created and learning and development take place. The role of the teacher is to mediate continuously the complexity of the activity systems of knowledge consumption and production for learners. However, the important thing is that all of this is done by the teacher in constant discourse with the learners and in active engagement with them.

ICT Mediation Criteria

MLE is measured with the following three parameters: mediation of intentionality and reciprocity, mediation of transcendence, and mediation of meaning. Feuerstein (1990) argued that for mediated learning to take place in the teaching and learning environment, these three parameters need to be present. ICT trainers as mediators facilitate learning in the classroom, as opposed to giving information or knowledge. In mediation of intentionality and reciprocity, the ICT trainer focuses on changing a random or incidental ICT learning experience to an intended learning experience; and in mediation of transcendence, the ICT trainer expands learners knowledge and opens avenues to connect with future knowledge. The ICT trainer goes beyond what is asked in the training during the training session and opens room for future developments. In the third parameter, mediation of meaning, the trainer explicitly attaches meanings to ICT skills that teachers are not sure about and substantiates the reason behind them. The

dotted lines in Figure 6 represent the teacher moving from one parameter to another, sorting and categorising ideas based on the scenario at hand.

ICT Meaning-Making Process

ICT meaning making is the result of a dialogic process that results in the development of ICT pedagogy (Mortimer & Scott, 2003). Figure 6 presents communication in ICT training that can be dialogic or authoritative in nature, and also, teachers' intervention in the dotted lines. Talk can move from being dialogic to authoritative, where the ICT trainer just focuses on one point-of-view, such as school content or intended curriculum and exclude participation from their talk. The aim is to communicate pre-set school knowledge. The authoritative process can be interactive, where the ICT trainer involves learners in talk but channels them to one school point-of-view, which is done through question and answer.

The dialogic or authoritative dimension can be either interactive or non-interactive, depending on the ICT trainer. If the trainer opens discussion to more than one point-of-view and allows teachers to participate in the exploration of ideas, then the process is an interactive dialogic communication approach. ICT trainers' focus on this process is to consolidate teachers' ICT knowledge and skills with the intended knowledge and skills for the session. However, if the trainer excludes teachers in their talk, the approach becomes non-interactive. This dimension can be observed in the three mediation criteria of mediation of intentionality and reciprocity, mediation of transcendence and mediation of meaning.

Operationalising MLE in ICT Training

MLE seem to lack levels to measure mediation, so this study seeks to bridge this existing gap in MLE theory by categorising it and assigning levels to it. MLE uses parameters/criteria as yardsticks to measure mediation in the teaching and learning environment that claim to have had a MLE. In operationalising MLE, this study believes that it is important to assign a level next to each criterion to

understand the level of mediation that take place during ICT training. According to Kozulin and Presseisen (1995), it is in the reciprocation where the mediator determines and calibrates their mediation to make learning accessible to learners. This mediation expands ICT skills and knowledge and opens possibilities for future ICT skills connection, thus enabling teachers to connect what was learned during ICT training and the real situation in the classroom. This mediation can happen as a result of an interactive dialogic approach where different ideas are explored and teachers are included in the discussion. Mediation becomes functional because more than one point-of-view is considered in the process of meaning making. This mediation can move from the lower level to the higher level, or vice versa, depending on the understanding of the learner. ICT meaning making can explicitly provide an understanding of ICT skills to be learned and substantiate why, what and the other reasons ICT skills has to be learned. This parameter is the result of an interactive dialogic process that allows teachers' participation and considers a range of ideas together. This mediation can be categorised from the progressive level of mediation to the high level of mediation.

In this study, to proclaim a meaningful ICT mediation, it should be an interactive dialogic approach where knowledge is explicitly discussed in class and there are open avenues for future development by both ICT trainer and teachers.

3.1.1 Mediated learning experience in ICT training

MLE has its roots in sociocultural theory, which maintains that social interaction and cultural institutions, such as schools and classrooms, have important roles to play in an individual's cognitive development. MLE in some respects is similar to Vygotsky's (1978) concepts of ZPD and internalisation and the concept of scaffolding (Wood et al., 1976). Which have captured the interest of many developmental psychologists and educators (Rogoff, 1990; Valsiner, 1988; Westsch, 1985). This study is grounded in sociocultural theory and it maintains that teachers learn ICT pedagogical skills through MLEs that emanate from ICT

training. Both MLE and sociocultural theory emphasise the importance of sociocultural forces in shaping a child's development and learning (Kozulin, 2002).

It is well documented that Vygotsky was concerned about epistemological individualism in Piaget's theory and the neglect of social interaction. According to Vygotsky (1978), complex mental activities begin as basic social activities. This study believes that socialisation and interaction between the ICT trainer and trainees (teacher) during training help teachers to learn ICT pedagogical skills. Building from Vygotsky's theory, Feuerstein (1991) focused on the issue of the concrete mechanisms of learning through the mediation of another human being (Kozulin & Presseisen, 1995). Teachers in ICT training do not learn in isolation, but through guidance from the trainer and other colleagues. MLE contends that interaction between the individuals and environment is never immediate because it is always mediated, and that learning is achieved not through direct exposure but through the indirect experience or mediation provided by the presence of an adult (Kozulin & Presseisen, 1995). Feuerstein's (1980) theory emphasises the communal understanding of knowledge not only in the collaborative sharing of experience, but in the sorting or categorising of ideas. This ultimately influences the potential ways that transfer of knowledge occurs in students' thinking (Perkins & Salomon, 1988). The mediator helps the learner "frame, filter and schedule stimuli". Mediation assumes that instruction is more concerned with going beyond the giving information. It connects the present with both the past and in anticipation of the future 'than with mastering specific bit of here-and-now data' (Kozulin & Presseisen, 1995).

Vygotsky (1978; 1986) maintained that high mental processes can be considered as functions of mediated activity. He pointed out three major classes of mediators: material tools, psychological tools and other human beings. Vygotsky mentioned that concept formation and communication have one common crucial point, but in an actual sense when conception formation hierarchy was considered, communicative situations could not elaborate beyond general

counter position of classroom instruction and spontaneous everyday learning. This left considerable gaps in Vygotsky's theory of mediation. Kozulin and Presseisen (1995) noted:

> Vygotsky's and Feuerstein's theories draw different conclusions from the above-mentioned limitations of the normative development model. Vygotsky argues that development is socioculturally specific and, therefore, the tasks that are used to evaluate children's functioning and the 'norms' can only be formulated in terms of social and cultural goals set by a given community. It is important to remember, however, that Vygotsky himself was unequivocal in his conviction that cognitive functioning, based on higher-order symbolic tools associated with literacy and numeracy, is superior to that based on everyday experience and oral transmission of culture *(Luria, 1976; Vygotsky & Luria, 1930/1993).*

The MLE theory seems to be much more radical in its rejection of the normative development model. The focus of discussion shifts towards the availability or lack of MLE. The performance of the child before and after intensive mediation becomes an internal system of reference, replacing that of the external age-related norm. In practical terms, this means no predictions based on current performance are made regarding the child's ultimate performance level. The child is not measured against either their sociocultural group or the average performance in the society as a whole.

In Vygotsky's theory, no attempt was made to differentiate between human mediators beyond their function as vehicle of symbolic mediation. In a considerable number of studies inspired by Vygotsky's and Feuerstein's ideas, mediation serves as a key word in a considerable number of studies. There are, however, two faces of mediation: human and symbolic. Approaches focusing on the human mediator usually try to answer the question: What kind of involvement on the part of the adult is effective in enhancing the child's performance? This study also seeks to answer a similar question: What

mediational role does the ICT trainer have in the development of teachers' ICT pedagogical skills? However, those who focus on the symbolic aspect pose the question: What changes in the child's performance can be brought about by the introduction of the child to symbolic tools mediators?

The concept of learning that is mediated has been seriously examined as a construct for better understanding cognitive development in the classroom. There has been a growing body of scholars in the past three decades that has done intensive research on MLE, focusing on mother-to-child mediation, peer-to-peer mediation and also on teacher and learner mediation to enhance learners' cognitive development (Belsky et al., 1980; Berk & Spuhl, 1995; Bornstein & Tamis-Lemoda, 1990; Bradley & Caldwell, 1984; Clarke-Stewart, 1993; Cristofaro & Tamis-Lemoda, 2012; Klein, 1996; Rodriguez et al., 2009; Tamis-Lemoda et al., 2001). These scholars support mediation in enhancing learning. The focus in this study is on mediation by the ICT trainers in enriching teachers' ICT pedagogical skills. However, Kozulin and Presseisen (1995) noted that human aspects of mediation have confirmed its importance, but at the same time, have clearly revealed the episodic character of our understanding of this phenomenon. It is generally agreed that the means of classifying mediational interactions is missing in Feuerstein's theory.

MLE processes describe a special quality of interaction between a mediator and a learner (Feuerstein, 1979; Tzuriel, 2002). In this qualitative interactional process, parents, substitute adults or peers interject themselves between a set of stimuli and the developing human (learner) and modify the stimuli for them. MLE processes are considered as the proximal factor that explains cognitive development. It offers individual learners a propensity to learn from new experiences and learning opportunities and to change their own cognitive development. The basic assumption of MLE is that individuals learn by way of two main modalities: direct exposure and MLE.

According to Feuerstein and Feuerstein (1991, p. 5), MLE is broadly concerned with interaction between a human being and their sociocultural environment. However, it does not include all interactions but focuses on experiences that influence individual's "propensity to learn". Feuerstein further explained that MLE as a quality or interaction is responsible for two major phenomena unique to human beings: modifiability and diversity. These two phenomena are closely intertwined and contribute to every human learner's considerable cognitive plasticity and flexibility. This quality is achieved by the interposition of an initiated and intentioned adult between the stimuli of the environment and the child. Feuerstein and Feuerstein (1991) suggested 12 major parameters or criteria of MLE. These criteria are mediation of intentionality and reciprocity; mediation of transcendence; mediation of meaning; mediation of feeling of competence; mediation of regulation and control of behaviour; mediation of sharing behaviour; mediation of individuation and psychology differentiation; mediation of goal seeking; mediation of setting, planning and goal achieving behaviour; mediation for challenge; the search for novelty and complexity; mediation of awareness of the human as a changing entity; mediation of the search for an optimistic alternative; and mediation of the feeling of belonging. He further asserted that the first three parameters (mediation of intentionality and reciprocity, mediation of transcendence, and mediation of meaning) need to be accounted for in every learning exchange that constitutes the MLE. The other nine are not to be considered exhaustively, but are seen, rather as a first selection of qualities of interaction that may not need to appear in each interaction in order to turn into a mediating experience. Feuerstein referred to these criteria as secondary parameters. Their presence is situationally determined and varies greatly, according to societal environment and cultural factors.

These three primary parameters are responsible for the individual's cognitive development. Feuerstein (1990) maintained that these first three criteria are

considered universal and can be found in all races, cultures and socio economic strata.

Intentionality and reciprocity: In this criterion, adults turn the interactive situation from a random, incidental experience into an intentional one. This intentionality has two foci: the object of learning and the child, or the learner. The major task for an adult is to transform the object to be learned so that the object is experienced and not merely passively registered by the child. It is important to note that it is not the object per se but the child's cognitive development that is primarily targeted in mediated interactions. In a learning environment, the learner should realise that the real objective of a learning activity is not a particular task or puzzle, but the learner's own thinking. Mediation for intentionality is inadequate without the child's reciprocity because this interaction needs to be a two-way street where there is communication from both sides. It is through reciprocity that ideas are filtered and refined. This criterion is considered crucial for the 'ignition' of the mediation process.

In an ICT training environment, mediation of intentionality and reciprocity is observed between the ICT trainer and teachers and among teachers themselves where incidental ICT learning experiences are turned into intended experiences that involve the exchange between the parties. The focus all the time in this criterion is on the development of teachers' ICT pedagogical skills.

Transcendence: In this criterion, the meditator expands learning opportunities for the learner by going beyond the goals of the particular interactions. Feuerstein (1990) explained that a mediator does not limit the length and breadth of an interaction to those parts of the situation that have originally initiated the exchange. Rather, they widen the scope of the interaction to goals that are at that moment more remote from the learners. The mediator provides for both the immediate or concrete needs of the children and attempts to reach additional goals that are beyond the specific situation or activity. To clarify this parameter, Feuerstein (1990 p. 14) provided an example:

If a child points to an orange and ask what it is, to provide merely a label to name the object would be an unmediated response. A transcendent interaction would offer a broader definition, one that indicates the categorical classification (it's the fruit of a plant/ of a tree) and other references to taste, smell etc., in order to help the learner make further connections.

Transcendence, as a mediating criterion, provides not only the anticipated widening of cognitive factors in the information under question, but assumes the constant enlargement of the learner's own need system and their dynamic continuous changes. It has significance beyond a here-and-now situation. Teachers expand their ICT knowledge through mediation and connect their 'remote' ICT skills with what they have learned during ICT training.

Mediation of Meaning: This refers to a mediator mediating meaning to learners. Feuerstein (1991) explained that mediation criterion deal with the question of why, what for and other reasons for which something is to happen or be done. The goal of this parameter is to make explicit those didactic or parental understandings that are, all too often, implicit with the children. The trainer in this parameter explicitly attaches meanings to ICT skills, that teachers are not sure about and also substantiates the reason behind the skills.

The above discussion presented MLE and it importance in learners' cognitive development. Despite the significance of MLE, Kozulin and Presseisen (1995) were concerned that it lacks the means to categorise mediational interactions. In Feuerstein's writings, there is a little insight into how meanings are made and MLE is interpreted. It only goes as far as providing 12 parameters that are not arranged in a certain order or logically sequenced to measure mediational interactions. Coupled with this is the fact that Feuerstein (1990) provided no clear analytical tool. This study draws from Mortimer and Scott's (2003) theoretical constructs of meaning making as a dialogic process to address the identified gap. Even though Mortimer and Scott came from a science point-of-

view, their theory of meaning making is grounded in a sociocultural theory and they claim it is universal. Therefore, it is the study's contention that the dialogic process as constructed by Mortimer and Scott (2003) is consistent with the overall framework that guides this study.

A dialogic process acknowledges the centrality of purposeful discourse between the teacher and the students in the classroom or learning environment. Mortimer and Scott (2003, p. 3) explained that "talk is central to meaning-making process and thus central to learning". Therefore, Feuerstein's theory of MLE and Mortimer and Scott's (2003) theory of meaning making are both rooted in the premise that learning happens because of social interaction. Cognitive development is the result of a meaning-making process. In their theory, Mortimer and Scott go beyond merely stating the central importance of interaction in the classroom to setting out a multi-level analytic tool for characterising both teacher-student and student-student interactions in the classroom that enhance learning.

3.1.2 The interactive—non-interactive

Interactive participation is structured to allow for participation of other people, whereas non-interactive participation excludes the participation of other people (Mortimer & Scott, 2003). When these two dimensions of the communicative approach are combined, they form the four communicative approaches discussed next.

Interactive dialogic: Teacher and students consider a range of ideas together. If the level of interanimation is high, they pose genuine questions as they explore and work on different points of view. If the level of interanimation is low, the different ideas are simply made available.

Interactive/dialogic: The teacher revisits and summarises different points of view, either by simply listing them (low interanimation) or by exploring similarities and differences (high interanimation). According to Mortimer and

Scott (2003 p. 38), the main point in this dimension is that even though statements are made, such as, "That addresses student's or others' points of view", the teacher does not call for any turn-taking interaction with the students.

Interactive/authoritative: The teacher focuses on one specific point-of-view and leads students through a question and answer routine with the aim of establishing and consolidating that point-of-view. Here the class could be highly interactive, yet authoritative, because the teacher pays little attention or view. It involves the teacher presenting a specific point-of-view or concept in a formal lecture mode.

Teacher interventions: Teacher intervention focuses on the ways in which the teacher intervenes to develop the content and make it available to all of the students in the classroom.

3.1.3 Teacher interventions

The teacher intervention can take the form of a non-interactive/dialogic presentation, where they differentiates between everyday and school knowledge. Table 3 shows the different types of teacher interventions and their focus points.

Teacher Interventions	Focus
1. Shaping ideas	Working on ideas developing the content knowledge
2. Selecting ideas	Working on ideas developing the content knowledge
3. Marking key ideas	Working on ideas developing the content knowledge
4. Sharing Ideas	Making ideas available to all the students in a classroom
5. Checking students understanding	Probing specific students meanings
6. Reviewing	Return to and going over ideas

Adopted from Mortimer and Scott (2003)

Table 3 Types of teacher interventions and their focus points (Mortimer & Scott, 2003)

Mortimer and Scott (2003) argued that the first three interventions (shaping ideas, selecting ideas and marking key ideas) relate to how the teachers act to introduce and develop content knowledge, and that the remaining interventions refer to other aspects of staging the teaching performance.

Conclusion

This chapter presented the analytical framework of the study that was used to guide data generation techniques and its analysis. The analytical framework helped explain how a certain type of analysis was conducted, drawing from literature presented in the previous chapter and showing a syntheses between the concept, theory and data

Chapter 4:
Research Design and Methodology

Introduction

The previous chapter provided an extensive account of the analytical framework and concepts that were used in this study to understand mediation in ICT training. This chapter presents the methodology and methods that were used in this study to generate valid answers to the key research question, which asks how mediation in ICT training influences effective ICT pedagogical integration in the classroom. Furthermore, the chapter provides justification for the identification of participants, and describes how the study ensured the objectivity of the data (trustworthiness) and how the data was analysed. Lastly, matters of research ethics clearance are discussed.

Specific research design, methodology and methods were incorporated to justify the underpinning of the data. According to Rowley (2002), a research design is the logic that links the data to be collected and the conclusions to be drawn to the initial questions of a study to ensure coherence. Research designs are plans that guide the conditions for the collection and analysis of data in ways that seek to give relevance to the search process (Cresswell, 2003). Therefore, the design of a study can be seen as a blueprint detailing what will be done and how it will be accomplished. Research design involves determining how a chosen method was applied to answer the chosen research question(s).

Henning, Van Rensburg and Smit (2007) argued that methodology is a collaborative stance to source data and findings that articulate the research questions that fulfil the purpose of the research. This suggests that the methodology draws on the choice and implementation of methods concurrent with the rationale of the study. This chapter embarks by strategically focusing on the research design and methodology that coincide with the MLE during ICT training.

This study is socially orientated. It seeks to understand how social interaction experiences of teachers who are being trained to integrate ICT into teaching and learning are created and given meaning. A qualitative approach was used to investigate how mediation in ICT teacher training influences effective ICT pedagogical integration in the classroom. The reason for adopting a qualitative approach is that it allows for in-depth descriptions and analysis of the social phenomena of the participants (Silverman, 2005). The qualitative approach helped the study to gain a deeper understanding of how mediation in ICT teacher training influences the development of teachers' ICT pedagogical skills. The advantage of using a qualitative approach is that it has the potential to produce findings that cannot be arrived at by a quantitative approach (McMillan & Schumacher, 2006). The study only had seven participants, which is a small sample, so it capitalised on the advantage of a qualitative approach, because this approach works better with smaller samples. Another reason for using a qualitative approach was that it allowed me to study mediation in ICT training in its natural setting.

Research Paradigm

A paradigm is understood as a set of basic beliefs that symbolise a worldview that explains for its holder the nature of the world and their place within it and considers their relationships to that world and its components (Guba & Lincoln, 1994). The research paradigm in this study reflects the multiple views, perceptions and assumptions about how mediation in ICT training was understood and later integrated in the classroom. Paradigms are different, diverse and unique to the specific contexts that shape reality for individuals. Consequently, there are divergent research paradigms to represent varying philosophical foundations and beliefs about reality. Mack (2010) identified the commonly used research paradigms as positivist, critical and interpretive. This study is framed within the interpretivist realm to draw meanings about ICT training from participants.

4.1.1 Interpretivism

The very nature of the interpretive paradigm is to articulate the value of subjective meanings and symbolic action in the process of how individuals construct and reconstruct their reality (Morgan, 1983). This tradition does not wish to pre-empt that social structure, culture or relations that are static or unproblematic but seeks to understand how and why human beings behave in particular ways through their interactions and socialisations. In trying to understand mediation in ICT training, how and why teachers integrate ICT was based on the meaning they attached to it. The study is interested in meaning, thus it is interpretive. The strength in deriving meanings is significant because it exposes the individual teacher's thoughts and sense making, which can be correlated with the end result. Meanings, assumptions and experiences are somewhat taken for granted in the positivist paradigm because science and experimentation support the claims thereof; however, in the interpretive realm, these actions are understood as historically and contextually situated (De Villiers, 2005). Therefore, the underlying feature of the interpretive paradigm dwells on the meanings created as a consequence of individual actions. These meanings are negotiated as they are modified through the interpretive journey.

Interpretive researchers build their constructs by conducting detailed explorations of individuals' experiences of the phenomenon of the research. Since knowledge and meaning are acts of interpretation, knowledge is seen as subjective rather than objective. Subjective findings indicate that inquiry is value-related as it allows for the study of complex human behaviour, shared meanings, documents and other artefacts. This correlates with the theoretical framework underpinning this study. In an attempt to understand the nature of the social realities of teachers who participated in ICT training, this study adopted an interpretivist approach because interpretivists believe there are multiple realities and that the social world is constructed by the human beings who live in it. As such, teachers who give meaning to their ICT professional development in the current study investigated how mediation (as social activity)

in ICT training helps them to develop their ICT pedagogical skills. Interpretivists use a systematic procedure to gain multiple socially constructed realities (McMillan & Schumacher, 2010). To gain social experience, the study relied on self-reported accounts of teachers who have attended ICT training to develop their ICT pedagogical skills, which enhances their instructional practice in the classroom. I inserted myself into a continual process of meaning construction in order to understand the phenomena under investigation by using a case study.

4.1.2 Strengths of interpretivism

Opposing the premise of the positivist paradigm, which predominantly accepts only one law-like formulation of the truth, the interpretive stance is far more inclusive to account for the social world with multiple perceptions from varied individuals (Thanh & Thanh, 2015). This was beneficial in achieving profound knowledge of how ICT training mediation helps in developing teachers' ICT pedagogical skills through the process of exploring participants' accounts of events. When multiple realities are understood within the plethora of in-depth reasoning, it can provide deep insight into the phenomenon. For instance, in the study by De Villiers (2005) regarding research in information systems, the interpretive paradigm was used to describe and interpret phenomena about domain processes, performances and innovations of information systems research. This contributed to deep insight into the management and development of information systems with reference to human thought and action in social or organisational contexts. This is what the study sought to do.

The relationships between human beings, organisations and technology are not static but are perpetually evolving. Interpretive research seeks to understand this interaction and iterate the meaning thereof (Klein & Meyers, 1999). Participants were envisaged as producers rather than products, which implies that they are not treated as instruments but as key stakeholders in the data generation process. Subsequent to this, the role of the researcher is influenced by the history of the context: The researcher becomes immersed and an

autonomous relationship with participants develops. Such an environment is critical to ensure that participants feel comfortable and open to express their points of view. When participants experience liberty in conveying their responses, it leads to a process of reflection (Pedro, 2005), which invokes the self-reflection, verbal reflection and written reflection crucial to critical thinkers. The societal factor was reinforced through this negotiation as I became part of the participants' community and vice versa in creating knowledge about ICT pedagogical skills. The study taps into participants' understanding of the mediation they got from the ICT training session. Engaging with participants allowed the study to establish varied meanings attached to ICT training and granted participants the opportunity to explain their myriad ways of integrating ICT into teaching and learning.

Methods of Data Generation

Cohen et al. (2011) emphasised that generating data involves a process of gathering or accumulating information from participants with the purpose of understanding, analysing and interpreting their behaviour and experiences in relation to the research questions of a study. Rajasekar, Philominathan and Chinnathambi (2013) distinguished between research methods and methodology by stating that the first comprises procedure and schemes of obtaining samples and data, and the latter permeates how researchers go about their tasks of describing, explaining and predicting phenomena according to the work plan of the research. Kaplan (1964) outlined the methods of data generation as tools, techniques, or procedures for acquiring responses from participants, while the methodology incorporates the body of knowledge or discipline that uses these methods. Methodologies indicate how inquiries move forward by singling out what problems are eligible for investigation; how to frame enquiries so that exploration is possible; how to create specific methods of data generation; and how to make inferences between the problem, data generation, analysis and conclusions (Jackson, Drummond, & Camara, 2007). Simply stated, Henning (2004) positioned the methodology within an epistemological base of inquiry that

regulates the research design to function. Henning et al. (2007) postulated the methodology as a collaborative stance to source data and findings that articulate the research questions to fulfil the purpose of the research. This suggests that the methodology draws on the choice and implementation of methods concurrent with the rationale of the study. Thus, research designs merge the data generation and analysis activities with the research questions and maintain that all research aspects are covered. It can therefore be established that data generation is a crucial part of the research, for without it the research is incomplete as the researcher has no evidence to impart significant claims.

Savenye and Robinson (2004) conveyed that in qualitative research, the researcher initially chooses the methods of data in relation to the research questions. These may be modified or changed, however, as the researcher's conceptions evolve throughout the study. This study is qualitative in nature and employed a case study methodology to understand mediation in ICT training and ICT integration in the classroom. A stark feature of case studies is the use of multiple sources of data; this strategy is used to increase the credibility and trustworthiness of the findings (Yin, 2003). Data sources may include document analysis, observation, interviews, artefacts, images, diagrams, reflections and online tasks (Baxter & Jack, 2008). Multiple sources invoke a holistic understanding of the phenomenon by obtaining detailed information from participants. The next section consequently discusses methodology and methods and how each of these methods has been used to obtain and underpin the data.

Case Study

Yin's (2003) definition is essential to cover the underlying ethos of a case study; he defined it as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 13). This suggests that the study is able to capture moments in the natural setting by exploring, in this instance, our understanding of mediation in ICT training and how it supports

effective ICT integration in the classroom. Although the phenomenon is predefined, it does not convey explicit control or manipulation of variables as the focus is on the phenomenon in its context. Fidel (1984) posited that when a case study is used as a research method, it seeks to discover findings beyond the individual cases.

A case study is further appropriate when there are no foundational laws to explain which factors and relationships are important. Consistent with this view, the case study design was considered more appropriate for this study for a number of reasons. Unlike quantitative analysis, which observes patterns in data at the macro level on the basis of the frequency of occurrence of the phenomenon being observed, case studies observe the data at the micro level (Rowley, 2002). Basically, a case study is an in-depth study of a particular situation rather than a sweeping statistical survey. It is a method used to narrow down a very broad field of research into an easily researchable topic. While it might not answer a question completely, a case study can give some indications and allow further elaboration and hypothesis creation on the subject. The case study research design is useful for testing whether scientific theories and models actually work in the real world. For psychologists, anthropologists and social scientists, case study designs have been regarded as a valid method of research for many years (Yin, 1994).

Case studies involve single or multiple cases. If two or more cases are shown to support the same theory, replication can be claimed. In analytical generalisation, each case is viewed as an experiment and not a case within an experiment. The greater the number of case studies that show replication, the greater the rigour with which a theory has been established. Multiple case designs are preferred on the basis of this replication logic and because multiple cases can be regarded as equivalent to multiple experiments. The more cases that can be marshalled to establish or refute a theory, the more robust the research outcomes are. A frequent question is how many cases should be included in a multiple case study. There is no simple answer to this question, but the literature cautions

that cases need to be carefully selected so that they either produce similar results (literal replication) or contrasting results, but for predictable reasons (theoretical replication) (Rowley, 2002).

The unit of analysis is the basis for the case. It may be an individual person, an event (such as a decision, a programme, an implementation process or organisational change), an organisation, a team, or a department within the organisation. It may sometimes be difficult to identify the boundaries of the unit of analysis. A key issue is that the case study should only ask questions about the unit of analysis and any subunits. Sources of evidence and the evidence gathered are determined by the boundaries that define the unit of analysis. In the next section, the multiple case research design is described in more detail and justification is provided as to why it was considered appropriate for this study.

This research constitutes a case study about mediated learning in ICT training (social interaction and participation) and how it influences ICT pedagogical integration in the classroom. A case study was used because it is an empirical enquiry that investigates a contemporary phenomenon within its real-life context. A case study was appropriate because the study sought to understand and interpret the social context realities of teachers who have attended ICT training to develop ICT pedagogical skills. McMillan and Schumacher (2010) maintained that in a case study, a single case is studied in depth, which could be an individual, a group, an institution, a programme or a concept. In this case, the study sought to use case study lenses to investigate in depth a group of ICT teachers in an institution to find out how mediation in the ICT teacher training influence effective ICT pedagogy in the classroom. The in-depth understanding of mediation include a comprehensive interpretation of the social interaction and participation of teachers with one another and with the ICT facilitator during ICT training. Bassey (1999, p. 58) explained that there are three types of case studies: A theory seeking and theory testing case study; a storytelling and picture-drawing case study; and an evaluative case study. This study was an

evaluative study that evaluated the mediational role of ICT training in influencing teachers' ICT pedagogical skills. Bassey (1999) further noted that the evaluative case study refers to an in-depth inquiry into educational programmes, systems projects or events to ascertain their value for the education system. The objects that were investigated in this case study were the ICT training (programme), ICT trainers and teachers as learners in the training programme.

In this research, a multiple case study was incorporated, not with the aim of comparing cases but to gain insight into issues around ICT training that is provided for teachers in different schools. Yin (2003) explained that multiple case studies permit the researcher to explore differences within and between cases. This study examined different cases to understand their similarities and differences in order to understand how ICT teacher training influences effective ICT pedagogical integration. According to Yin (1994), a case study addresses the how and the why of the questions very well. Therefore, the case study was appropriate to answer the research question of this study, which asks how mediation in ICT training influences effective ICT pedagogical integration in the classroom.

4.1.3 Strengths of the case study

Implementing the case study approach has several strengths. Firstly, using this method creates an opportunity for the researcher to acquire a deep holistic perspective on the problem, and this facilitates describing, understanding and analysing a research problem in its context (Denzin & Lincoln, 2011; Tellis, 1997). Qualitative researchers believe that social reality is constructed through human beings' experiences, opinions, beliefs and values, and these should be studied in the specific context from which they stem. When data is generated from such behaviour and actions, it allows the weaving together of interpretations and meaning, hence divulging intricate, rich details.

Another advantage of incorporating the case study approach is the analysis of data, which often occurs within the context in which it is ascertained (Yin, 1994).

The researcher can directly observe and document behaviour as it takes place, and this informs the phenomenon for this study. In approaches that rely on scientific or experimental studies, this is not possible, since the phenomenon is isolated from its surroundings and the focus is on a limited number of variables. This made the case study worthwhile as the study pursued qualitative data from a group of teachers in the specific ICT training context. A hallmark of case studies is the ability to access multiple sources of data that can advantageously increase the credibility of the study (Yin, 2003). Each data source represents one piece of the puzzle in the greater endeavour of imbuing the researcher with a holistic understanding as the pieces come together.

4.1.4 Model of the case studies

Multiple cases in the study were conceptualised as follows:

Case1 consists of ICT trainer Bheki, whom I observed in two training sessions and interviewed. Teacher Gumbi and teacher Dube, with whom the research did two classroom observations and one interview per teacher after observations.

Case 2 is made up of ICT trainer, Tumi, with two ICT training observations and an interview; and teacher Khulu, with two classroom observations and one interview.

Case 3 consists of ICT trainer, Sive, with two ICT training observations and an interview; and Teacher Chili, with two classroom observations and one interview.

Case 1 had three participants and case 2 and 3 only consisted of two participant each, as indicated in Figure 7.

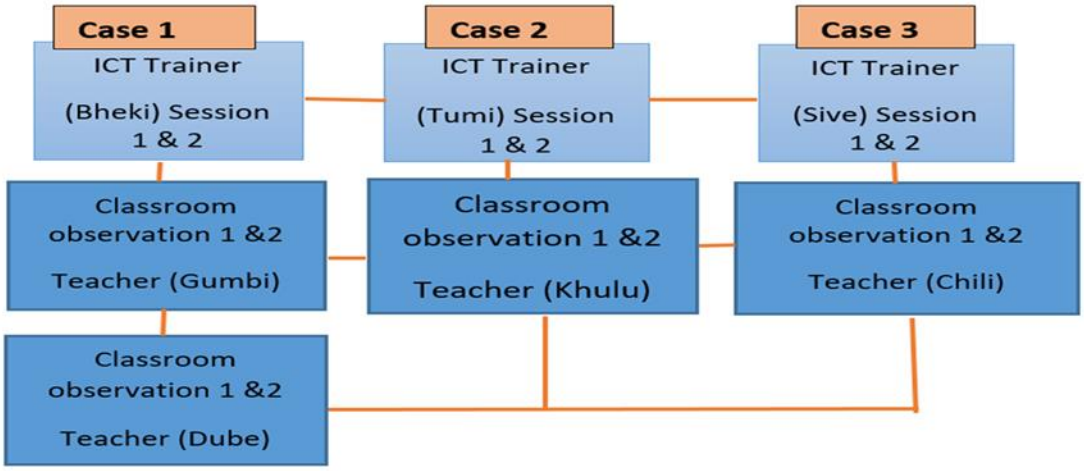


Figure 7 Multiple case study model for this study

Data Sampling

Latham (2007) explained that in any research, people, places, or things come under the microscope to be studied, explored, or understood. Frey, Botan and Kreps (2000) defined sampling in research simply as a subgroup of the population or a sampled unit representing the characteristics of a known number of units in the population. Qualifying research does not only depend on the appropriateness of the methodology and instrumentation but also assents to the sampling strategy that has been adopted (Cohen, Manion & Morrison, 2007).

Along these lines of thought, Lathan (2007) defined that all fields of study undertake research using sampling of the population as a method and agree on these universal assumptions of what constitutes sampling. Cohen et al. (2007) contended that the decision of sampling is taken during the initial stages of the research planning and recognised that the subgroup or subset chosen to represent the population is called the sample. Researchers approach possible groups that they believe will maximise the potential of acquiring data, which propels them to obtain further data once they have maintained the sample (Glaser, 1978).

Marshall (1996) saw sampling as preconceiving the optimum number of participants that is critical to establish the inferences to be made about the population. He further elaborated that the larger the sample size, the smaller the opportunity of a random sampling error. However, due to the sampling error being inversely proportional to the square root of the sample size, there is not much that can be achieved from studying large samples. The giltedge sample relies on the parameters of the phenomenon, the research questions, objectives of the study and the methods of data collection employed to expedite the receiving and processing of knowledge. Given these definitions, it is clear that sampling is all about describing who is going to form the particular group of people as a representative of the entire group. Simultaneously, these definitions also bring out the content factor. Onwuegbuzie and Collins (2007) argued that sampling is an important step in any research design since the trustworthiness of the findings revealed in a study is dependent on from whom the data was accessed.

The primary data generation methods employed by me for this multi-method study were ICT training observation; semi-structured interviews for both ICT trainers and teachers (ICT trainees); and classroom observations. Multiple sources of evidence clarify and validate the information given by different participants, especially where there may exist opposing views of events and actions (Darke, Shanks & Broadbent, 1998).

Purposive and Convenience Sampling

Maxwell (1997) defined purposive sampling as the "particular settings, persons, or events [that] are deliberately selected for the important information they can provide that cannot be gotten as well from other choices" (p. 87). This suggests that the researcher is in full view of the specific participants desired for the study. Morse (1991) condoned this perception by affirming that the researcher chooses to interview the participant with an expansive general knowledge of the phenomenon or those who have already undergone what is considered to be the

typical experience. As the study proceeds, the descriptions are amplified through the iterations of participants who provide rich insight into the phenomenon. This enables the researcher to have multiple iterations of the experiences to increase the breadth of the phenomenon to be understood.

In purposive sampling, it is already known who the participants are that possess the kind of knowledge envisaged by the phenomenon. Patton (1990) advocated that purposive sampling has the power to penetrate the core knowledge, histories, opinions and experiences of participants. This enabled me to learn significant information that are central and important to effective ICT integration in the classroom. Who and what are included in the sample is largely dependent on the core research problem and the methodological approach (Stake, 1995). This study sought to understand how mediated learning in ICT teacher training influences ICT pedagogical integration in the classroom. The 'how' question can be best answered by the participants, as Yin (1994) noted. This involved purposive sampling because the study focused on ICT trainers and teachers with specific profiles. Purposive sampling applies to studies that have theoretically informed decisions about who and what to include in the sample (Yin, 1994). Participants were thus commerce teachers who are integrating ICT into teaching and learning at the further education and training level and who have attended ICT training to develop their ICT pedagogical skills; and ICT trainers with 2–5 commerce teachers in their training group.

The participants were four teachers who are teaching commerce subjects at the further education and training phase. Choosing commerce teachers was an advantage for me, as I have been teaching commerce for the past seven years and understood commerce subjects better than other subjects. One teacher per school was chosen. The aim was not to compare them but to have representatives of different schools (in terms of location and quantiles) and to draw a deep understanding from these schools. Three ICT trainers were purposefully selected because they have 2–5 commerce teachers in their groups that could be observed during ICT training and in class when they were teaching.

Observation

Observation in research means that the researcher goes to a physical location and observes what is actually taking place (Christiansen et al., 2010). This enables the researcher to obtain first-hand information because they can report on things witnessed and recorded as opposed to on what other people said. From this perspective, I observed ICT training that took place in three different schools. Due to time constraints, it was difficult to appropriate participant observation, and therefore, I resorted to non-participant observation using a semi-structured observation schedule. Savenye and Robinson (2004) contended that non-participant observation is commonly used to focus on specific aspects of a context that can answer certain research questions of a study.

A semi-structured observation schedule suggests that the researcher does not ramble through a checklist but writes a free explanation of what are observed in the context of the study (Christiansen et al., 2010). Thus, the researcher may choose to focus on aspects pertaining to the research questions; however, if particular issues arise while collecting data, these can be worth pursuing in the study. I engaged in ICT training observations comprising of two hours and 30 minute per session and two sessions per trainer. Firstly, I observed two ICT training sessions where ICT training was taking place to understand what teachers are being trained on and how ICT pedagogical skills are mediated during ICT training. Secondly, I conducted classroom observations, to observe how teachers are integrating learned ICT pedagogical skills to influence teaching in their classrooms. I observed two sessions per teacher after ICT training to note how teachers are integrating ICT after attending ICT training. As this study is socially orientated, structured observations were used. Yin (1994) noted that structured observations are used to predetermine categories to be observed. Structured observation helped me to be more specific regarding what was to be observed. An observation guide was designed based on the theoretical framework and research questions for this study to predetermine what is to be observed. Observations were limited to what was taking place currently as well as to visible

social interaction. After classroom observation, I interacted with teachers and gained clarity on the observed occurrence to understand why they were doing what they are doing. This helped me understand that which was not clear to me and to minimise the limitations of this method.

The limitations of the case study approach noted by most scholars are that the presence of the observer in the classroom may result in reactive effects, where teachers and students are aware that they are being observed and may act differently (Merriam, 1998; Stake, 1995; Yin, 1994). This limits the observer from getting data from its natural occurrence. This was mitigated by visiting the ICT training sites and classrooms before the initial observations took place to allow participants to feel at greater ease in my presence. Even though there are limitations in doing observations, the advantages surpass them.

4.1.5 Advantages of observation

Observations seemed to be appropriate for this study because they allowed me to check for ICT teachers' non-verbal expressions that occur in the classroom; to determine during the ICT training who is interacting with whom; as well as how the mediation process is carried out during the ICT training. Observation allows the researcher to focus on specific aspects of context and to answer the research questions of the study (Savenye & Robinson, 2004). Consequently, it was possible to yield extensive, descriptive data. Again, I knew what to look for by focusing on particular issues like interaction and participation that was taking place during ICT training and ICT integration in the classroom. I used the data obtained from observation to verify the self-reported information from the one-on-one interviews (Savenye & Robinson, 2004). This enhanced triangulation of the data. Furthermore, observation led me to attain information about ICT pedagogical skills and how these skills are integrated in the classroom. Thus, the technique of conducting observations was appropriate for this study.

Semi-Structured Interviews

An interview is a form of communication in which the researcher seeks to gain an in-depth account of the participants' experience with regard to the phenomenon under study. This is done by addressing pre-established research goals and questions (Savenye & Robinson, 2004). Kajornboon (2005) added that interviews are a systematic manner of talking and listening to people and simultaneously collecting data while conversing. The researcher is typically regarded as the interviewer who spends time in the research context establishing when and where the interview will take place with participants, known as the interviewees. Wahyuni (2012) evinced the main feature of an interview as a facilitation of the participants to share their stories, experiences and points of view with reference to the phenomena being explored by the researcher. The participants, who are the practitioners in the field, divulge their assumptions through conversations during the interview.

Harrell and Bradley (2009) contended that researchers use interviews for a range of purposes such as data generation, gathering information from past and present behaviours, acquiring background knowledge or receiving expert knowledge from an individual on the basis of their experience. In this study, one-on-one semi-structured interviews were selected as an approach to obtain data from participants, who were training teachers (ICT trainers) and teachers (ICT trainees), to understand the mediation that takes place during ICT training.

Lincoln and Guba (1985) proposed a few stages in preparing for a semi-structured one-on-one interviews. Firstly, it must be decided who will participate in the interview. This is formalised by selecting participants that have knowledge of the phenomenon. The next step involves preparing for the interview by arranging a venue and time, and most importantly, preparing an interview schedule containing the research questions. Thereafter, it must be ascertained how to start the interview, which usually begins with general talk or an enquiry about the participant's background rather than rushing straight into the questions. Following this, the interviewer (researcher) should know how to pace

the interview and keep it productive. This means that the interviewer must be able to generate the desired responses to questions and that the interview should be sufficiently interesting to keep the participant alert enough to answer. They should not feel bored or distracted. The last stage incorporates finalising the interview in a reasonable way by acknowledging the interviewee's contribution and thanking them for their participation. Kajornboon (2005) asserted that researchers should have certain skills and abilities before embarking on the interview. These include having an ability to listen to participants' responses with an ear for pertinent details; an ability to be non-judgemental or uncritical to responses, especially if it appears extraordinary to the research; having a good memory to be able to reflect at a later stage on the interview; and possessing an ability to think off the cuff.

Interviews are the most commonly used method for collecting qualitative data because they allow the researcher to hear from the participants how they have made sense of their own experience (Yin, 1994). After purposively selecting the participants (teachers and ICT trainers), semi-structured face-to-face interviews were administered and audiotaped. The reason for audio-taping the interviews was to ensure that the exact words, ideas, comments and conceptions were clearly captured and to avoid misinterpretation or misquotation during data analysis. Semi-structured interviews allow the researcher to interact with the participants in the process of seeking in-depth understandings and meaning of participants' lived experience in their social context (Stake, 1995). This allowed me to engage with teachers who participated in ICT training to develop their ICT pedagogical skills in order to construct meaning from their ICT integration experience. The interviews unfolded in this order: After an ICT training session, ICT trainers were interviewed to gain clarity on some of the activities that occurred during ICT training; and teachers were also interviewed to gather their thoughts about the mediation in the ICT training which they attended. Teachers were followed to their classroom to observe how they integrate ICT into their instructional practice, and interviews took place after the observations to

understand why they did thing in a particular way. All interviews took place in a private space where the teachers and ICT trainers felt free and comfortable to speak.

According to Scott and Morrison (2005), semi-structured interviews encourage interviewees to respond open-endedly and to answer questions on their own terms. Research questions were designed in such a way as to propel the participants to respond openly. During interaction between me and teachers, we negotiated understandings of their ICT social context and their ICT training. I wanted to hear from them about their ICT training experiences and how it helped to develop their ICT pedagogical skills.

Field Notes

During interviews and observations, notes were taken to provide details of social interpretations and to describe all relevant incidents that occurred on the site. Stake (1995) argued that field notes are crucial in the search for patterns in data and that they provide building blocks, which are assembled and reassembled to provide a coherent and valid account. Therefore, this study used field notes as evidence that will give meaning and aid in the understanding of ICT training and its role in influencing ICT pedagogical integration in the classroom.

Figure 11 depicts the two data collection sites and the data collection instruments used for this study.

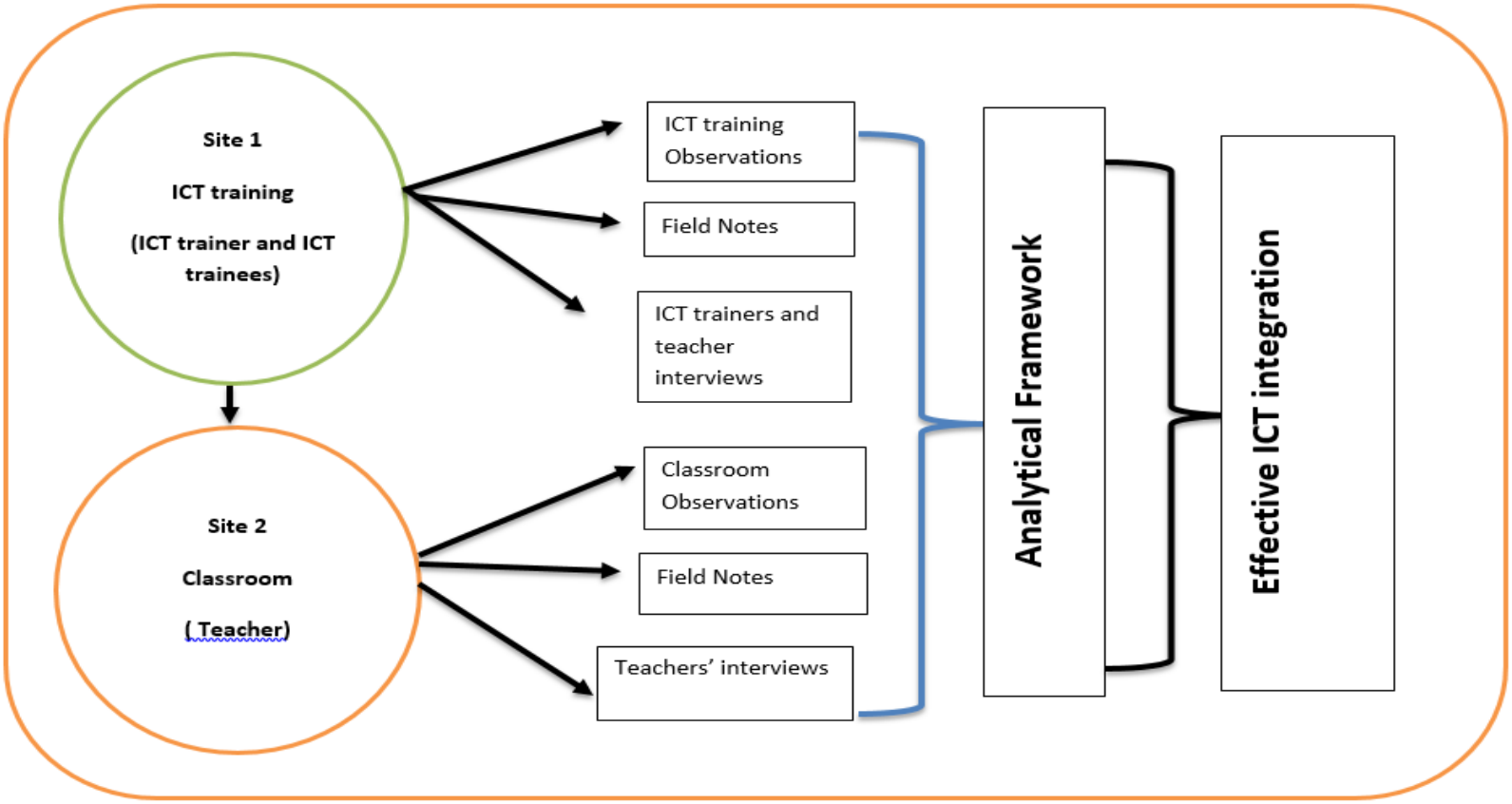


Figure *8* ICT training sites and data collection instruments used in the study

ICT Training

This study sought to investigate the influence of ICT teacher training on ICT pedagogical integration in the classroom. Figure 8 represents the two objects (ICT training and teachers) that were under the microscope for this study. These are multiple cases, and the case study explored four teachers who were attending the same ongoing ICT training. Various case study methods were used to collect data. As mentioned earlier, this study used a case study approach, which is based on the constructivist paradigm. Constructivists believe that the truth is relative and dependent on one's perspective. During data collection, there was collaboration between me and the participants (ICT trainers and teachers), where they explained their experiences of ICT training and ICT integration in the classroom. Through these explanations, participants described their ICT realities and this enabled me to better understand the role of ICT training in enhancing effective ICT pedagogical integration in the classroom.

Pilot

Piloting was carried out to pre-test or try out the interview questions for this research. Piloting was chosen because of its advantage to indicate beforehand whether the proposed methods are appropriate for the study. McMillan and Schumacher (2010) warned that pilot data is likely to contaminate the new data for the phenomena under study. To eliminate these limitations, participants who participated in the pilot study were not included in the actual study, where it was expected that they would respond differently because they were part of the pilot study.

Data Analysis

Qualitative research centres on the exploration of human behaviour and social life as it occurs in its natural settings (Miles & Hubberman, 1994). Its uniqueness and depth indicate that there are varied means of analysing social actions, intermingled with multiple perspectives and practices in the analysis of

qualitative data. Marshall and Rossman (1999) defined data analysis as "… bringing order, structure, and interpretation to the mass of collected data …. It is the search for general statements about relationships among categories of data … it is the search among data to identify content" (p. 150). Cohen et al. (2007) explained that qualitative data analysis involves organising, accounting for and making sense of the data in relation to how participants understood and explained the phenomenon, and observing patterns, themes, categories and regularities. Lacey and Luff (2009) saw data analysis as the mass of words captured through data methods that should be described and summarised, enabling the researcher to establish relationships between various themes that have emerged. They further added that implications for policy or practice may be warranted through the data generation and allow for the generation of theory, using advanced analytical techniques. These definitions divulge that data analysis is about making sense of the data using certain procedures that provide inductive or deductive reasoning regarding participants' assimilation with the phenomenon of a study. Moreover, the content factor arises through these perceptions of data analysis as they clearly define specific ways that need to be instituted in qualitative analysis, such as interpreting, summarising, describing, categorising, and organising. This suggests that qualitative data analysis does not align in a linear fashion but involves a different kind of logic to interpret and explain the findings. Ritchie and Spencer (1994) postulated that qualitative data analysis seeks to define concepts, map the phenomena, frame typologies, maintain associations within the data, provide in-depth explanations, and articulate strategies. During data analysis, I was cognizant of the area of focus that produced the themes and the research questions of the study.

According to Cresswell (2003), social researchers systematically collect and analyse empirical evidence to understand and explain social life. In this study, thematic analysis was incorporated to identify patterns of meanings across the data set that answered the research question: How does ICT training enhance effective ICT pedagogical integration in the classroom? Thematic analysis proved

to be appropriate for this study because of its theoretical flexibility: It can be used in different frameworks to address very different research questions. A thematic analysis is suitable for questions related to peoples' experiences, views and perceptions (Cresswell, 2003). Thus, it was used to analyse data for the phenomena under study. Thematic analysis were performed through the process of coding in six phases that is illustrated in Figure 9.

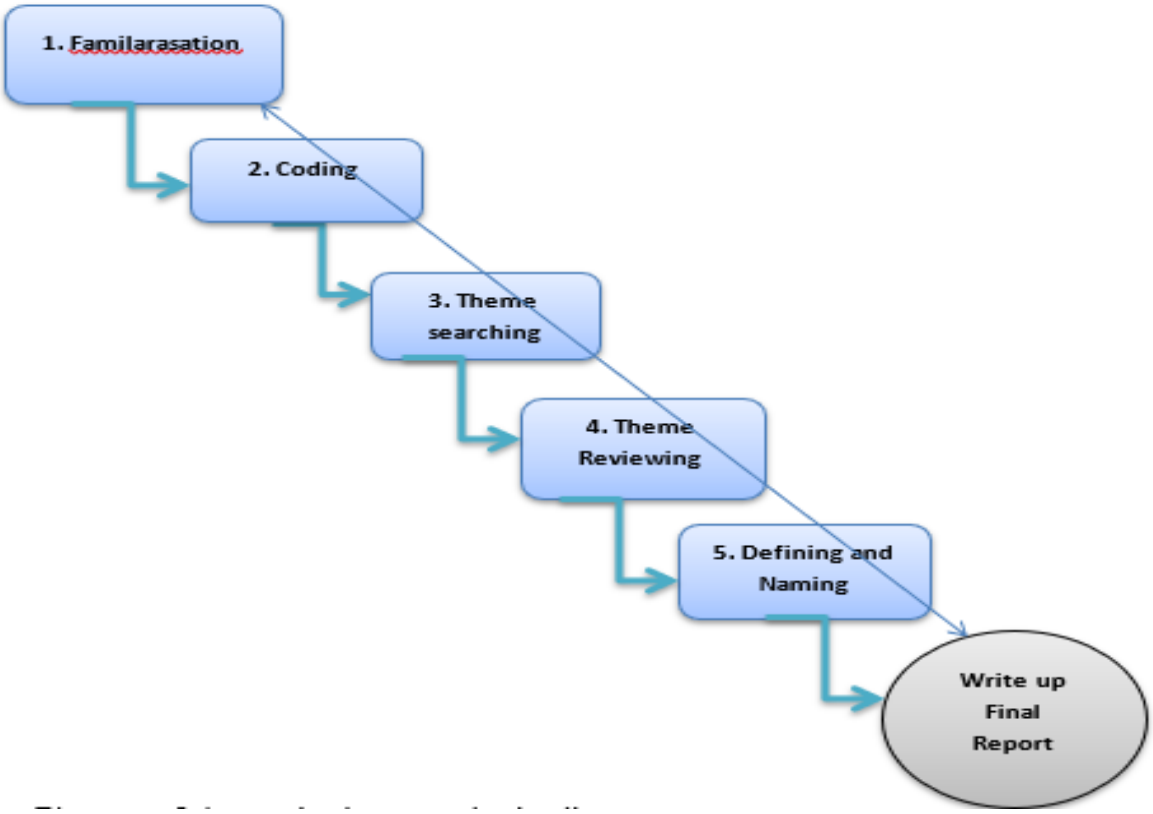


Figure 9 Phases of thematic analysis used in the current study

The thematic data analysis diagram in Figure 9 represents the sequential phases used in the data analysis; each phase builds on the previous one. Thematic analysis is a recursive process with back and forth movement between various stages. During thematic analysis, I took the following steps, as depicted in Figure 9:

- Read and re-read the data collected for the study to familiarise myself with the content.

- Generated succinct initial codes and pinpointed features of data that might be interesting and relevant in answering the research question.
- Examined codes to identify important patterns of meaning.
- Scrutinised participants' themes against the dataset to check whether they are relevant to the research question for the study.

I also:

- defined and named themes to include developing a detailed analysis of each theme.
- wrote up the final report by putting together the analytic narrative and data extracts and contextualising analysis in relation to the literature presented in Chapter 2.

Issues of Trustworthiness

Qualitative research seeks to produce valid knowledge of interpretations and understandings within a specific environment (Wahyuni, 2012). However, the concepts of validity and reliability, often used to increase the credibility of a study, have been critiqued for lacking value, quality and sustainability in the evidence of qualitative data (Ritchie & Lewis, 2003). Golafshani (2003) argued that these concepts are misleading since qualitative studies rely on achieving an understanding of the phenomenon, which is difficult to measure. Sinkovics and Alfoldi (2012) defined trustworthiness as a process of maintaining the soundness of the findings and the soundness of the arguments that result. The ideology behind soundness resonates with a perception of good judgement or competency that can be acquired when instrumenting particular steps. Lincoln and Guba (1985) proposed certain measures that must be taken to ensure a degree of trustworthiness in research. These include adopting the criteria of credibility, transferability, dependability and confirmability.

The use of multiple perspectives and different data collection methods are characteristics of a high quality case study and lend weight to the validity of the

findings. To validate the data that were collected for this study, various data collection methods were used to achieve triangulation. McMillan and Schumacher (2010) noted that triangulation aims for an accurate view of a situation under observation by combining different hermeneutic and analytical approaches. Methods that were chosen for this study complemented each other to help the study obtain valid data. Validity was strengthened by collecting the chain of evidence between interview questions, observations and field notes. To enhance trustworthiness in the study, teachers were given the opportunity to review the gathered information before and after the analysis took place. Teachers were supplied with a draft report to discuss the findings before the final write up.

Transferability or generalisability represents the degree to which the results of the findings can be transferred to other contexts with other participants (Wahyuni, 2012). In qualitative studies, the findings are applicable to a small number of people within a uniquely defined situation or environment. As such, the findings can be generalised to groups or contexts that possess similar characteristics (Shenton, 2004). Generalisation of findings in qualitative studies has often been criticised; however, transferability aims to counter this challenge by providing analytical generalisations. According to Bitsch (2005), maintaining transferability requires the use of thick description and purposive sampling. Thick description involves the researcher giving in-depth reasoning about the whole research process, from the research design and methodology to the final report of the study. Thick descriptions of detail allow the study to be replicated by other researchers in similar contexts (Anney, 2014). Purposive sampling underscores transferability by enabling the researcher to focus on selecting key participants who have knowledge of the phenomenon and can answer the research questions. In this study, transferability was sanctioned through incorporating thick descriptions of pertinent processes that elucidated deep meaning about the phenomenon of ICT mediation taking place during ICT training and ICT pedagogical integration taking place in the classroom. I went

into detail about the data generation processes, the research design and the final report of the findings. Moreover, purposive sampling has been used to choose the most suitable participants with key knowledge regarding the mediation in ICT training. These two measures were positioned in this study to gratify the step of transferability, in that, if similar settings could apply as the mechanisms coordinated here, a similar degree of results could be traced to the findings in this research.

Lincoln and Guba (1985) professed that another way of achieving trustworthiness is through a measure of dependability, which inclines to participants checking the findings, interpretations and recommendations to ensure they correlate with what was actually said and given to mean in accordance with the phenomenon of a study. This criteria cements dependability using an audit trail, triangulation and peer examination. The last two have already been discussed, with an audit trail given to mean the documents that should be kept, such as interview transcripts, raw documents, and field notes, for the purpose of an audit. I have ensured that these have been stored and secured and is available for auditing if necessary.

Ethical Considerations

Educational researchers have a responsibility to ensure that, in whatever research paradigm they work, their research should be conducted within an "ethic of respect" to those who participate (Clarke, 2004). This implies a number of responsibilities on the part of researchers that include ensuring trust, dignity, privacy, confidentiality and anonymity. Good research practice should therefore involve a partnership, and whenever possible, should be guided by the needs of the participants, who should be an important concern to the researcher. Therefore, the research is enacted within a rigorous framework that addresses the epistemological complexities of a study's methodological process and intellectual focus in an ethical manner that allows the recipients and participants of the research to have trust in its outcomes. So, an ethical

relationship in research is one that regards the other (participant) as an end and not as a means to an end.

According to Orb, Eisenhauer and Wynaden (2001), ethics is doing good and avoiding harm. Research in education, whether from a qualitative or quantitative platform, should seek to invigorate, build upon and cement the foundation for further developments in education. Ethics in research are of paramount importance, particularly when it involves humans and animals (Christiansen et al., 2010). The consequence of such research inadvertently has a profound effect on the manner in which it is applied and the implications thereof. The content factor arises through these postulations because higher education institutions have clearly defined policies articulating how ethics should be ascertained in any research undertaking. Researchers are expected to follow and abide by due protocol, ensuring ethics is maintained with the highest level of integrity. Given the nature of qualitative, interpretive studies, the fieldwork positions the researcher in close contact with the participants, and as such, ethics have to be fervently adhered to. Hence, I had to be particularly cautious and decisive regarding what to note and how best to deal with conflicting and confidential responses. In this sense, it is crucial that all research studies are guided by ethical principles (Orb et al., 2001).

A number of principles generally must be adhered to by researchers working with people as subjects. These principles were described by McMillan and Schumacher (2006) and include the following:

- Informing the subjects of all aspects of the research that might influence their willingness to participate.
- Being as open and honest with the subjects as possible.
- Protecting subjects from physical and mental discomfort, harm and danger, and informing them if any of these risks are possible.
- Securing informed consent from the subjects before they participate in the research.

- Keeping information obtained about the subjects confidential.

To uphold ethical practices in this study, I applied for ethical clearance at the Wits Schools of Education and the Department of Basic Education, and I also applied to the ICT training institution for ethical clearance. All the participants in this study were informed about the purpose of the study and the question that the study sought to answer. There was no potential physical harm to the participants, but participants experienced some discomfort during interviews. Because of this, I arranged interviews in the place that best suited the participants and where they felt more comfortable and freer to explain their ICT training and ICT integration. Cohen et al. (2007) argued that initiating an interview means interpersonal interaction between the researcher and participants. It was made clear to the participants that participation was voluntary. If they decided to participate, their names would not be used in any of the data collection methods or the final report, and pseudonyms would be introduced instead. Data collected in this study will be kept safe and confidential in a locked cupboard or drop box for the period stipulated by the university.

Limitations of the Study

In every study, despite how well constructed and presented, there are limitations in the research design and methods employed and in how they relate to the data generated (Wiersma, 2000). It is imperative to acknowledge the shortcomings by openly declaring them. Price and Murnan (2004) implied that limitations is the characteristics of the research design and methodology that may potentially affect the interpretation of the findings. Such constraints include issues of generalisability, applicability to practices and measures of achieving trustworthiness. In this study, the case study style of research was employed within the confines of the purposive and convenience sampling methods. This meant that only one training institution, three trainers and four participants were chosen. The findings do not represent all ICT training that is taking place in South Africa or Gauteng province. Therefore, generalisations are limited to

analytical assumptions. In addition, I may have exhibited possible biases as I was fully aware of who these participants were since purposive sampling involves hand-picking participants. To curb this concern, ethical principles were appropriated by ensuring participants' confidentiality and anonymity throughout the research process. Wiersma (2000) explained that the other related limitations of qualitative studies are the ability to achieve validity and reliability. I abided by the criteria of trustworthiness stipulated by Lincoln and Guba (1985). Incorporating issues such as credibility, transferability, confirmability and dependability helped enhance the trustworthiness of the research; however, I acknowledge that this can only be applied to a certain extent.

Conclusion

This chapter presented the research design and methodology. At the outset, the study commenced by providing a brief introduction to the value and prevalence of including various strategies pertaining to design and methods associated with enabling effective research. The next step involved identifying the interpretive paradigm with its potential to inform the perceptions of the study. The interpretive paradigm was incredibly estimable for allowing me to attain rich, detailed responses with regard to the phenomenon of ICT training. I was able to dig deep into the meanings behind participants' experiences, and consequently, understand MLE in ICT training. Exploring the principles of the interpretive paradigm led to the following section of discussing the qualitative research approach.

Synonymous with the interpretive perspective, qualitative strategies centre around producing in-depth accounts of participants' responses. This helped me theorise these into concepts. I immersed myself in the setting of the research in order to understand how its constituents interplay, thus enabling the interpretation of holistic experiences. A feature of qualitative studies is the use of the case studies and this informed the discussion thereafter. Case studies

usually involve a small number of people. Specifically, this study has seven participants (three ICT trainers and four trainees). The study selected a multiple case study to get to understand the participants in some depth. As a spinoff to this section, the study moved on to deliberate on the sampling methods adopted. Purposive and convenience sampling was implemented, since it enabled me to select participants who had knowledge of the use of e-resources and were most accessible to provide relevant data. The next chapter presents the crucial analysis of the actual data generated from participants.

Chapter 5:

Data Analysis, Interpretation and Presentation Of Findings

Introduction



Figure 4 ICT training sessions

The previous chapter outlined a comprehensive discussion on the research design and methodology used in this study. This chapter concentrates on presenting and analysing the data that was generated from the field (ICT training and classroom).

This chapter presents the data, interpretation and analysis of findings from the ICT training observations, semi-structured interviews and classroom observations. As mentioned in the previous chapter, data was collected from

three different ICT training centres in Gauteng province. Themes that emerged from ICT training and ICT integration in the classroom are presented and interpreted. The main research question and sub-research questions are re-stated and the themes that emerged are organised in relation to the research questions (presented in section 5.3 and 5.4).

ICT Training Context

Training sessions took place in three different schools in what the study refers to in Chapter 2 as onsite training. This means that ICT trainers were training teachers in their schools, which are government or public schools. Two schools are in Soweto and one in the east of Johannesburg (former white school). ICT training took place after school contact time in the classrooms with interactive Smartboards. Teachers brought their own laptops. The school are named School A, B and C for the purpose of this study. Each school had one ICT training facilitator and their pseudonyms are Bheki from School A, Tumi from School B and Sive from School C. Table 4 presents the training facilitators' personal details.

Facilitator's Name	Qualification	Training Experience	Training at School:
Bheki	Primary schools Teachers diploma	4 years	A
Tumi	Human Resource Management diploma	3 years	B
Sive	Certificate in public relations and Certificate for computer	4 years	C

Table 4 Training facilitators' qualifications and experience details

5.1.1 *Teachers' details*

Figure 15 presents the personal details of the teachers who participated in this study This data did not form part of the investigation, but it assisted in understanding issues that came up during the data analysis.

Name	Qualification	Age	Subject	Grade	Experience	School	Trainer
Gumbi	BED (Hons)	27	Economics	Grade 10	4	A	Bheki
Dube	MED	39	Accounting	Grade 11	15	A	Bheki
khulu	BED	32	Accounting	Grade 11	8	B	Tumi
Chili	ACE	51	Economics	Grade 11	22	C	Sive

Table 5 Teachers personal details

All teachers who participated in this study are further education and training teachers who teach commerce subjects. Three teachers are postgraduates and one has a BED. Two teachers are from School A; one from School B and one from School C.

5.1.2 *Bheki*

Bheki is an ICT trainer who was assigned to train teachers in School A. He has 8 years' experience in teaching primary school learners and 4 years' experience as a trainer. He explained that during his four years as a trainer, he has conducted different types of training, including anger management, financial management and end-user computing.

In the training sessions that I observed, Bheki was teaching teachers how to integrate ICT into teaching and learning. He arranged teachers according to departments: On Monday, he trained the science department; on Tuesday, the commerce department; on Wednesday, the maths department; and on Thursday,

the languages department. For the purpose of this study, ICT training observations were only done during commerce department training, which happened on the Tuesday.

5.1.3 Tumi

Tumi was responsible for training teachers at School B. He has specialised in training in the education space and outside of education. His training experience includes training in the corporate environment, where he taught English for communication purposes.

Tumi conducted his training sessions from Monday to Wednesday, and then kept Thursdays open for one-on-one consultations with teachers with specific problems. On Mondays, he would see Grade 10 teachers; on Tuesdays, Grade 11 teachers; and on Wednesdays, Grade 12 teachers. For the purpose of this study, I observed Grade 11 teachers on Tuesdays.

5.1.4 Sive

Sive was assigned to train teachers on how to integrate ICT into teaching and learning in School C. She is the youngest of the trainers who participated in the study. In her career, she has worked at a retailer and also as a trainer, training high school leavers in end-user computing.

She conducted training from Monday to Thursday. She trained all Grade 10 to 12 teachers, which meant that her groups were bigger than the groups of the other two trainers. I observed her training sessions on Wednesdays.

Research Question

How does mediation in ICT training influence effective ICT pedagogical integration in the classroom?

Research Sub-questions

1. What mediational role does the ICT trainer play in the development of teachers' ICT pedagogical skills?
2. How do teachers appropriate the ICT pedagogical skills that aid their instructional practice in the classroom?
3. What is the relationship between ICT pedagogical skills learned during ICT training and subsequent use of ICT in the classroom?

Table 1 shows the three themes and their subthemes that were generated based on the research questions.

Table 1 Three themes with subthemes generated in the study

1. Theme: Mediation of ICT Pedagogical Skills in ICT training

Subtheme: Modelling of ICT skills (approach and actual practice)

Subtheme: Discussion and interaction as learning strategy

Subtheme: Participation and collaboration

Subtheme: Subject specific pedagogy

2. Theme: Appropriation of ICT pedagogical skills in the classroom

Subtheme: Demonstrations

Subtheme: Discussions

3. Theme: Teachers' understanding of ICT pedagogy integration in relation to ICT training provided

Subtheme: Reflection of ICT training in teachers' teaching

Mediation

Teaching and learning that took place during ICT training was geared to equip teachers with relevant ICT skills that will develop their ICT pedagogical skills. This was mediated by the three trainers, who are mediators in this context.

Modelling of ICT Skills

Modelling is an instructional strategy in which the teacher demonstrates a new concept, skill or approach to learning and learners learn by observing and practising (Eggen & Kauchak, 2001). Every training session started with the trainer modelling basic ICT skills to the teachers (trainees). It was noted that two trainers started by describing how they were going to work together as a class.

Modelling Approach

The approaches of the three trainers were different: Bheki seemed to be more inclusive than the other two trainers. He indicated what he would do first, and afterwards, the teachers had to do as he showed them. For instance, he stated:

> *We will work like this 5 minutes [facilitator-led demonstration] 10 minutes [teacher self-exploration]. If you do not understand as I demonstrate, please stop me. I am here to reasonably assist you during the training contact, so if you struggle with something, feel free to ask for help.*

Bheki also allowed teachers to stop him during the lesson presentation, which showed that he wanted to move with everyone as they developed. On the other hand, Tumi went straight to his presentation and told teachers how he was he going to present his lesson. Teacher involvement would happen when they clicked where he asked them to. He started his lesson as follows:

> *Colleagues, this is how we are going to work: I will present this lesson using PowerPoint presentation, but we are not doing it yet. I am going to open steps on PowerPoint, then we will follow them. I mean in our computers.*

At this point, it is not clear if Tumi was going to project the slides with the steps on the screen, or if he was going to open both screens (slide with steps and the page that they will practise on).

Sive started slightly differently from the other trainers. She asked teachers to come and stand in front as she taught them how to use the Smartboard. All of them came to the front and formed a circle, so that they could all see the board. This approach indicated that Sive was considerate of the teachers, because when they sat at the tables, all of them could not see every tab on the Smartboard.

Sive first started by calming teachers' fears about the technology and saying, "*Smartboards are no different from any other technology (smartphone, tablets, even smart TV) that you have encountered with before*". This statement was supposed to make teachers feel at ease and indicated that their prior knowledge of technology would assist them as they navigated the Smartboard. Sive further assured teachers that learning to use a Smartboard was easy and it would make things easier in the classroom. She mentioned that:

> *Learning how to use a Smartboard is quick and easy. So even if you have never used one before, you will soon be able to get a good grasp on some essential skills and techniques that will make teaching your subject easy.*

From the beginning, Bheki encouraged the sharing of ideas and skills among teachers. He stated, "*Colleagues, please share information with one another. You know why? Because important and relevant information and skills are transferred by sharing!*"

The trainers' approaches to training had an effect on how teachers learn during training, and eventually, on how they would integrate ICT in the classroom.

Actual Mediation

In the teaching and learning environment, teachers use different strategies to make sure that learning takes place. In ICT training, trainers used a similar approach, where they demonstrate and give teachers the opportunity to do as

they have done. In this section, I explain how each trainer actually taught teachers ICT basic skills.

In both sessions, Bheki made sure everyone in class was able to see what he was demonstrating. Every time he explained something to the class, he stood in front. This helped the teachers because even if he was moving between the tables, when he moved to the front, teachers stopped what they were doing and listened/watched what he was saying/doing. This was not the case in Tumi and Sive's sessions. Tumi was always standing in front and letting teachers work on their computers, without going around checking how they were doing. This created a gap between what he was doing and what the teachers were doing on their computers. He could not tell how many teachers were following what he was doing in class. In Sive's first session about the Smartboard and teachers, she stood in front. In her second session, her movements were limited. She only went to assist the teachers who asked for help; other than that, she stayed in front.

At the beginning, Bheki gave teachers the history of the use of Microsoft Office by saying, "*Microsoft Word, Excel and PowerPoint were designed for businesses, but we have seen how they have benefited businesses and we want used them in education also to enhance teaching and learning in our classrooms*". At this stage, Bheki moved the teachers from what they knew about Microsoft Office and businesses to what they did not know about the integration of Microsoft Office into teaching and learning. It may have motivated the teachers to use ICT in teaching and learning when they discovered how technology has improved life today.

As mentioned earlier, Tumi went straight on to teach Excel. He did not give the teachers any introduction that would help them connect what they already knew with what was going to be learned. Tumi started by saying, *Can I start? I cannot start if some of you are still standing. Colleagues, I want us to get a better understanding to Microsoft Excel. So, here I have a, a presentation about Microsoft*

Excel". This indicated that Tumi wanted to get started and get over with the day's presentation. Even though he seemed to be in a rush, he showed some elements of inclusivity by saying, "*I want us to get better understanding of Excel*".

Sive, on the other hand, tried to show teachers the importance of learning basic Smartboard skills. She mentioned that *These are the some of the most important skills associated with using Smartboard effectively and are a great foundation for your everyday teaching, colleagues*". This statement was supposed to make teachers look forward to the skills that they were going to learn that would help them to integrate ICT into teaching and learning.

In both sessions, Bheki's demonstrations of ICT skills followed the same pattern. He would do something and allow teachers to observe and then give them time to try it out. For example, he would say,

> *You know different types of files store different types of information. I will show you this as now. Each file is given a file name and has a three-letter file name extension that identifies the file type. (The file name and file name extension are separated by a period.) For example, a document created using WordPad might have the file name letter to John.doc*

He projected the file on the screen so that teachers could see what it was. Bheki showed them step-by-step how to create a file. He kept saying "*click here*" and pointed where teachers were supposed to click, asking them if they were following ("*Are we still together?*"). At this point, everyone seemed to be following and doing exactly what Bheki was telling them. In this instance Bheki was doing what he promised at the beginning of the session: He demonstrated and gave the teachers time to do it themselves. As he was demonstrating, he was also trying to show them the bigger picture of what they were doing. He said:

> *Colleagues, at the end of the day we want to produce professional documents. So, you can make your document look professional and polished by utilising the header and footer sections. The header is a section of the*

document that appears in the top margin, while the footer is a section of the document that appears in the bottom margin.

This implies that as they were learning to insert the header and footer, they had an idea where they were going to use it, and this was not limited to what they did in class. Throughout the lesson, a similar pattern of 'I do, you do' was observed. He made sure that teachers practised what he was teaching in class. For example he would say, "*Colleagues, hands-on time. Open Word document and do the following: Convert text into a table; apply a table style of your choice; delete a row from the table; and insert a blank table with five rows and four columns*". Most teachers were able to follow the instructions; however, some were struggling and they got assistance from colleagues and from Bheki to complete the task.

Tumi's demonstration was slightly different from Bheki's, even though they presented the same content. He had assumptions about what the teachers knew. He said, "*Okay, here I have a blank spreadsheet of Microsoft Excel. Before I start with a blank, I opened it from my start menu. I guess all of you know how to, to open Microsoft Excel*". Tumi did not check if everyone indeed knew how to open a spreadsheet or where to find the start menu button. This was very important, because if someone got lost at the beginning, they were likely to be confused throughout the session. As mentioned earlier, Tumi prepared his lesson on a PowerPoint presentation. All the steps to be followed were listed in PowerPoint and teachers were expected to follow them. He said, "*To do the basic calculations that I just showed you, please look at the formulas presented in this slide, and do not forget to start your calculations with an equal sign*".

When teachers were doing calculations, Tumi was just standing in front and kept on asking teachers, "*How far are you, teachers?*". The teachers were at different levels of this activity. Those that were familiar with it were able to navigate the calculations, and the ones that were not were struggling and asking each other what to do. Some of the teachers that were struggling managed to get the

calculations right with the help of colleagues but others did not. Tumi did not notice that some of the teachers were left behind, because after some time, he moved to the next calculation, saying, "*I have given you enough time to do this calculation. Let us move on to the next one*". The teachers did not indicate to Tumi that they were struggling and they did not finish the first calculation. Maybe they were hoping that they would get the next one right. In both sessions, Tumi followed a similar pattern where he used a PowerPoint presentation to present the steps teachers needed to follow. He first showed them how to do it, and then when it was their turn to do it, he projected the steps on the screen. I do not think this was helping novice teachers, because they continued to struggle completing calculations. So, Tumi would do the step and allow teachers to do it on their own with the assistance of the steps presented on the screen. This was different from Bheki, because he was taking them step-by-step and offering assistance to those teachers who were struggling. The way Tumi demonstrated will influence the way teachers integrate ICT in the classroom. He was not showing them step-by-step and making sure that no one was left behind.

Sive's first session was different from the other two trainers'. In her first session, Sive taught the basic use of a Smartboard, but there was only one Smartboard, so she was the one who was doing the work most of the time. She would ask teachers here and there to demonstrate how they used certain functions on the smart board, saying, for instance, "*I will give two people a chance to calibrate a board so that I can see if you can*". She also asked teachers to show her how they used the smart pen when they were teaching by asking, "*How many of you are familiar with smart pen, and how are you using it in your class?*"

Having one Smartboard in the training limited opportunities for teachers to familiarise themselves with the Smartboard in the presence of their trainer where they could get assistance if they were struggling with something. The only chance that they had to explore more about Smartboards on their own was in classrooms. In the second session, Sive's demonstration was totally different from what she had done in the first session and also different from what Bheki

and Tumi did in their sessions. Sive was standing in front most of the time, demonstrating Microsoft Word. She would go to the teacher who was asking the question, and she would address the question with that teacher and not involve others in class. When a teacher raised their hand, Sive would go and talk to that individual very softly. This meant that if the teacher had a question, the answer would only benefit them. It was not clear why she was not asking the teacher to speak louder so that if someone was struggling with the same thing, they could also benefit or so that other teachers could contribute by answering. As time went by, not many teachers were asking questions from her, so Sive spent most of the time showing them where to click in different tabs. It was not clear if she was following the approach of 'I do, you observe and you do on your own', or if they were expected to do as she was doing, because the teachers were clicking while she was clicking.

ICT Pedagogical Skills in the Training

The main aim for ICT training is to teach teachers pedagogical skills that will help them integrate ICT into teaching and learning. During observation, trainers demonstrated different ICT skills to teachers; however, they seldom mentioned integrating those skills. It was only mentioned in passing or accidentally. This raises concerns because the training was supposed to be about ICT pedagogical integration to assist teachers with ICT pedagogical skills required for effective ICT integration in the classroom. Bheki, at the back of his mind, knew that he was supposed to teach ICT pedagogical skills, because he kept saying, "*Think how you can use this … in your subject. Better still, in different topics of your subject*". The teachers were not forthcoming about how they would integrate what they were learning in their subjects or in certain topics. This indicated that Bheki did not have the ICT pedagogical skills that these teachers were here to learn, but he had basic ICT skills, which are a prerequisite for ICT integration. These were, however, not enough for effective ICT pedagogical integration in the classroom.

Bheki at least was trying to bring the conversation around to ICT pedagogical integration in class; in contrast, the other two trainers taught ICT basic skills totally out of the relevant subjects taught. Tumi mentioned that "*I am here only to teach you Excel*". This means that he was teaching Excel in isolation of the subject the teachers taught, and he was not going to do anything beyond that. Teachers should learn Excel in the training, and then try to integrate it with the subject they teach.

The teachers did not ask who was going to teach them ICT pedagogical skills if he was going to teach them Excel only. When teachers asked questions around their subject, Tumi kept saying, "*You know I do not know your subjects*". This was sort of blocking teachers from asking questions pertaining their subjects.

At the beginning of her session, Sive promised teachers that the technological skills that she was going to teach them would help them when teaching in the classroom. In actual fact, she did not teach them how to integrate ICT skills with the subject they taught. She mentioned, "*So even if you have never used smart board before, you will soon be able to get a good grasp on some essential skills and techniques that will make teaching your subject easy*".

Tumi also had an idea about ICT pedagogical integration, but he did not know how to go about doing it. When one teacher asked a question that was subject-related, he answered, "*Colleagues, I am not familiar with your subjects. I see what you asking but I do not understand how it is supposed to be done. Maybe ask me certain formula you think it can work for these calculations*". Unfortunately, teachers did not take advantage of this. Maybe they were already discouraged or they were still thinking how to ask those formulas. Again, this shows that he was willing to assist, but he did not have the ability to do so. Here he was offering ICT skills and asking the teacher to come up with the method or to devise ways that could be used and he would provide the skills.

It was disappointing to see that the three trainers seemed not to have relevant ICT pedagogical knowledge to teach teachers, yet they came specifically to learn ICT pedagogical skills to help them integrate ICT into teaching and learning.

Discussion and Interaction as Learning Strategy

During ICT training, there was discussions that was facilitated by both trainers and teachers. Interventions that promote learning were also observed. Bheki's presentation about hyperlinking triggered the discussion and interaction presented below:

> *Teacher 1: I have been struggling with hyperlinking. I was wondering if it is possible to hyperlink the text inside the table that is pasted in the PowerPoint presentation?*
> *Bheki: Colleagues can you assist?*

By first asking the teachers to try and answer the question, Bheki indicated that he wanted to open this discussion to the class so that everyone could participate. In that moment, teachers just kept quiet and Bheki tried to understand the question again, but the way he asked questions seemed to confuse Teacher 1 because he asked two questions: "*Are you not confusing the hyperlinking with animation? You are trying to understand if it is possible to hyperlink the text inside the table that is imported from PowerPoint presentation right?*" Teacher 1 displayed confusion because he just said, "*Yes*". We do not know if 'yes' was for the first or second question. Teacher 2 tried to intervene, but his answer was not helping the situation, "*But we are not linking slides at the moment but hyper linking URLs. I am not sure hey!*" Teacher 1 wanted to make sure that while Bheki was still dealing with the hyperlink, he addressed his question, but it sounded as if Bheki was not getting the question correct. Teacher 3 tried to assist Teacher 1 and responded, "*Basically, you can hyper link anything as long as you are going to do it correctly*". He made a valid point, but Bheki did not say anything about his answer. Maybe he wanted to hear from other teachers because he did not comment but probed the teachers further: "*What could be the possible reason for*

the hyperlink not functioning properly, colleagues?" Teacher 3 tried to give a different answer: "*Maybe you did not save when you were done doing your preparations*". Immediately after Teacher 3, Teacher 2 responded: "*Usually it means that the display text of the hyperlink doesn't agree with the underlying link*". Even this answer was not clear and brought more confusion because after this Bheki gave an irrelevant answer, which had to do with hyperlinking to websites. Bheki's answer confused most teachers in the class:

> *Let me you give an example, sometimes changing from old server to a new server, site addresses can get loss or change. If you typed in the URL address manually rather than copying and pasting the address, you might have missed characters. Even copying and pasting the URL can cause problems if you did not highlight the complete address before using the copy command.*

Bheki was supposed to help teachers when they were confused, not to make things worse. Teacher 1 asked about hyperlinking documents in the slides, but he responded about URLs. Teacher 3 kept trying to solve the problem by saying,

> *Your explanation cuts above my head. Look colleagues from my understanding of my colleague's question the document that was hyperlinked during presentation was not saved on the very USB [memory stick] that he used in class. That is the reason why it did not work. Isn't my colleague? Remember colleagues, the hyperlink cannot fetch something from a different device if they are connected. So you were supposed to save that document in your USB and it was going to work perfectly.*

Teacher 3's intervention was very helpful because Bheki was able to unpack the question and came up with the possible reason why the hyperlink did not work. He further cautioned teachers about saving the documents. Eventually, the whole class seemed to understand his answer and they all said, "*Oh! I see*". This said something about the trainer's ability to facilitate discussion in the classroom, because if he did not give his fellow teachers a chance, the trainer

and the teachers would not understand each other. However, he acknowledged and valued Teacher 3's answer by saying, "*Thank you, colleague, for such clear explanation. I was carried away with hyperlinking the webs and I missed the real problem*".

Bheki also wanted to know if teachers were fine ("*Are you following?*"; "*Are we still together?*") and made sure that even the ones who did not participate during the discussion were following.

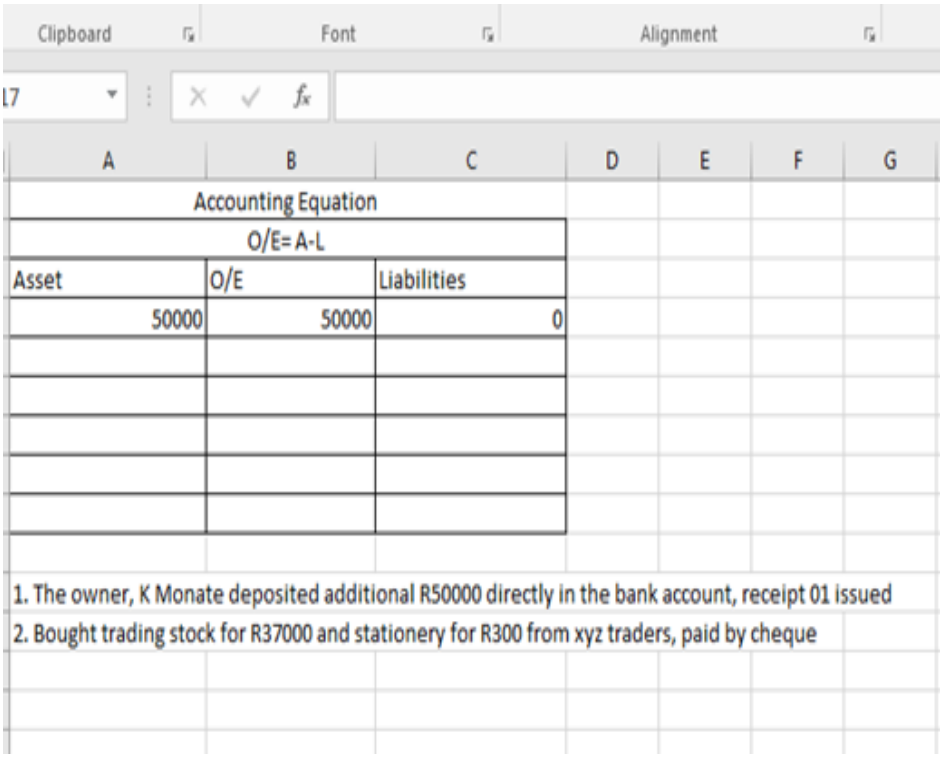
At the beginning of this excerpt, Teacher 1 had a concern directed to Bheki. It continued as a dialogue between the two of them while Bheki was trying to understand the teacher's question. Bheki was lost because he redirected the question and probed further to understand. He eventually rephrased the question. Teacher 2 came in and tried to move the discussion between Teacher 1 and Bheki. He tried to involve everyone by using the inclusive term 'we', which indicated that this was a dialogic phase and that everyone can participate, even though he was not in agreement with the question that was asked by Teacher 1. Immediately after Teacher 2, Teacher 3 tried to give the answer, but Bheki did not approve of the answer, and instead, he rephrased the question and tried to involve everyone. This implied that the trainer and trainees would engage as equals in this phase of the talk and that multiple perspectives would be explored. This is evident in Teacher 2 and 3 participating in the discussion. Bheki allowed teachers to give possible answers and it looked like he wanted them to come up with all possible reasons that could be used to develop a correct answer. For example, after Teacher 2's response, he repeated and then paraphrased the response. Then he provided a number of reasons that could cause the hyperlink not to function as anticipated. His response was very one-sided because no one was responding or questioning, and he did not use examples that teachers could link with. It was largely a monologue and scientific. Bheki was funnelling ideas towards consensus on hyperlinking the web. Teacher 3 brought back interactive dialogue when he gave his answer. It sounded as if Bheki's answer was confusing from the trainees' side, because after he gave his answer, everyone was quiet.

However, after Teacher 3's answer, everyone seemed to have understood him. All of them said, "*Oh, I see*". Bheki's mediation in this excerpt provided trainees with the opportunity to talk and participate and to think individually or as whole class. They replied differently, taking responsibility for using the new meanings. During reciprocity, Bheki found it difficult to change incidental learning to the intended learning experience given that he misunderstood Teacher 1's question. Teacher 3's response was clear and he mediated in this excerpt. At the same time, he allowed the students to advance their own thinking about the problem and thus maintained some of the dialogic mode of the talk.

Discussion also took place in Tumi's sessions. Similar to Bheki's session, a teacher started a discussion by asking the following question from Tumi:

> *As I mentioned at the beginning of this training that I am anticipating to walk away with the ICT integration skill from this training. Tumi, I want your assistance in this one. We have been doing Excel formulas, so I was wondering how can I use formulas to teach accounting equation to my learners? I want to incorporate accounting formulas with Excel formulas.*

The teacher started by stating his expectations of the training. He asked questions that were subject specific. For Tumi to be able to provide an accurate answer, he needed to have knowledge of both technology and the subject. This was quite different from what was asked by Teacher 1 in Bheki's session. The teacher wanted to know something generic about hyperlinking, but this question is particular. Tumi was a bit puzzled. He looked at the teacher, showing that he was confused. The teacher decided to show him what he wanted on his laptop, saying, "*I want to do something like this but using formula because what you see here I have done it manual*".



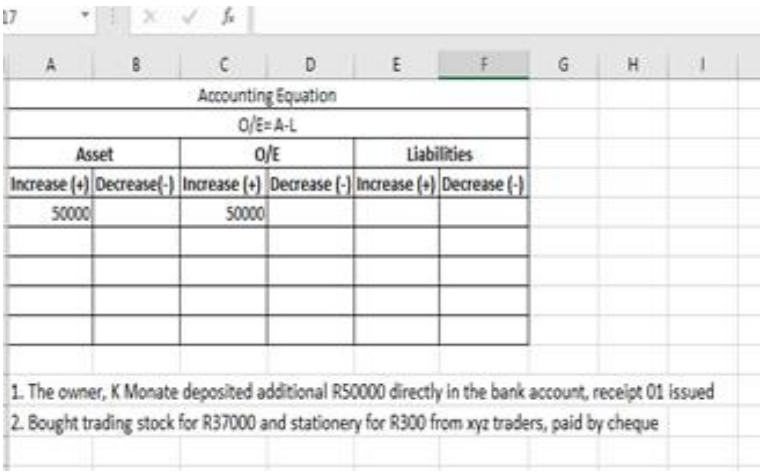
	A	B	C	D	E	F	G
	Accounting Equation						
	O/E= A-L						
	Asset	O/E	Liabilities				
	50000	50000	0				
	1. The owner, K Monate deposited additional R50000 directly in the bank account, receipt 01 issued						
	2. Bought trading stock for R37000 and stationery for R300 from xyz traders, paid by cheque						

Figure 5 Manual formula that teacher asked Tumi about

Figure 16 shows that the teacher was trying to integrate what he was learning in the classroom with what he does when teaching Accounting. He was not sure if what he wanted exists as he asked: "*Is it possible?*" Tumi looked at laptop and tried to understand the teacher's question. The teacher elaborated further by saying, "*Initially, I wanted to put plus (+) before R50 000 to show learners that there is an increase in assets and in owners' equity*". Tumi could not help because he was not sure how to do it and he speculated as follows: "*I think you need accounting software that are strictly designed to perform accounting calculations. If you want to use Excel, it will require a lot of work to automate cells*". This statement was likely to discourage teachers from trying to incorporate Excel in their classrooms because Tumi indicated that it requires a lot of time and teachers are usually overworked. He tried to explain why Excel is not appropriate for the activity the teacher was asking about by saying, "*For example, you cannot type + in cell as you would do in Word. The moment you move to the next cell + will disappear*".

Tumi said this but did not demonstrate it to the teacher. If you know Excel, what he said makes sense. However, the teacher who asked the question was a novice with Excel, and so to picture what the trainer was saying might have been problematic. Trying to justify his answer, Tumi said, "*Colleagues, I am not familiar with your subjects. I see what you asking, but I do not understand how it is supposed to be done. Maybe ask me certain formula you think it can work for these calculations*". Tumi showed some willingness to help, but the way he put it was that the teacher was required to bring what he knows in relation to the problem and they would join it with Tumi's technological knowledge to solve the problem. He realised that the conversation was between the two of them and he asked the other teachers to intervene: "*Can you assist?*"

The way teachers were helping each other in class showed that they had been using technology in their own way to solve everyday problems they came across as they teach. Teacher 2 shared how he used Excel to teach an accounting equation, but he was clear that he does not use formulas and presented a different way of doing it: "*I am not sure of the formulas, but alternatively you can use a different format for your accounting equation. Where you show increase and decrease per account. Like this* [shown in Figure 12]".



Accounting Equation					
O/E=A-L					
Asset		O/E		Liabilities	
Increase (+)	Decrease(-)	Increase (+)	Decrease (-)	Increase (+)	Decrease (-)
50000		50000			

1. The owner, K Monate deposited additional R50000 directly in the bank account, receipt 01 issued
2. Bought trading stock for R37000 and stationery for R300 from xyz traders, paid by cheque

Figure 6 Teacher 2's alternative way to solve the question

What the teacher presented as a solution to Teacher 1's question was manual. He had just decided on do it in Excel. It could also be done in either PowerPoint or Word. It is worth noting that Teacher 2 understood what Teacher 1 was looking for, and he sounded like someone who had the same problem when teaching accounting equations. He continued by saying,

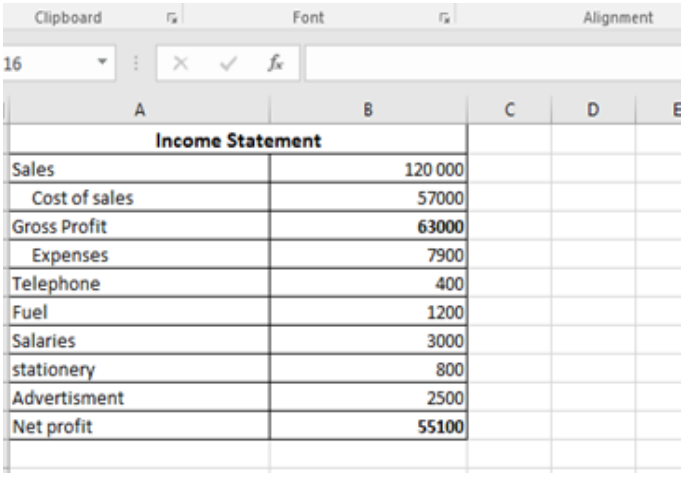
> *As an Accounting teacher, I understand what you want to do. You want to put formulas in these cells. So that when learners entering amount in the cell, it will be calculated automatically. Unfortunately, I do not know much about Excel. I wish I can help.*

Teacher 2 seemed to understand the importance of using Excel or Excel formulas to teach accounting equations, because he said the following: "*If this can be done in Excel, most of our problems will be solved, because learners do not understand accounting equation well*". It was shocking to hear Tumi praising the table presented by Teacher 2 and saying, "*I think the table makes more sense …*". Yet, the table was a representation of other teaching and learning material. This table could be done on a chart, chalkboard or in Microsoft Word. Nevertheless, Tumi saw this as a problem that they needed to tackle as a team, saying, "*It will be much better if we can figure out how to use formulas to automate the whole spreadsheet*". This encouraged teachers to come up with solution for this problem. Tumi further stated, "*I will advise sir to learn all the formulas, so that he will know exactly what formula should be used where*". It was noted that Tumi was unable to assist the teacher with the problem that seemed common with every teacher who teaches Accounting.

Teacher 1 outlined his expectations of the training and asked the question from Tumi. From the way he outlined the question, it was clear that he has content knowledge and he was looking forward to learning ICT pedagogical skills from the training. Tumi speculated that the teacher needed to get accounting software to be able to do whatever he wanted to do. His answer suggested that he lacked understanding of the content (accounting), and therefore, it was difficult for him

to comprehend what the teacher wanted to do. He then asked the other teachers to intervene to try and help Teacher 1. Teacher 2, who teaches Accounting, understood very well what Teacher 1 was asking, and he tried to assist. In his answer he kept saying, "*I am not good with Excel*", but gave his advice on how the accounting equation can be done in Excel. Again, Tumi displayed a lack of content knowledge. He instructed teachers to familiarise themselves with Excel formulas so that they would be able to apply them when necessary.

Excel formulas were noted as an important skill to have if you are teaching Accounting, because in Bheki's class, a similar question was asked about formulas. Teacher 2 asked: "*I want to show you this, and my questions will be based on this spreadsheet*" [income statement in Figure 13].

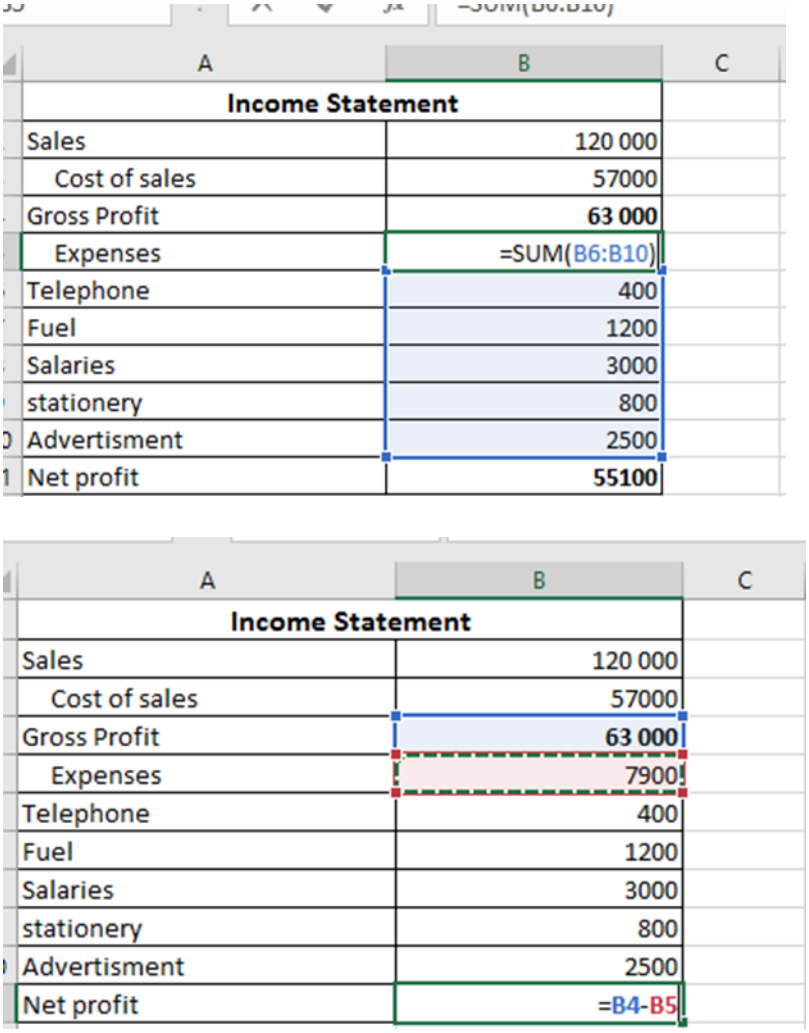


Income Statement	
Sales	120 000
Cost of sales	57000
Gross Profit	**63000**
Expenses	7900
Telephone	400
Fuel	1200
Salaries	3000
stationery	800
Advertisment	2500
Net profit	**55100**

Figure 7 Income statement that Teacher 2 asked Bheki about

After he showed Bheki the income statement presented in Figure 13, he continued: "*This is a very basic income statement. In fact, it is straightforward. Please show me how can I use formulas instead of calculating manual?*" The issue here is that the teachers have been using Excel to type different accounting exercises. However, now they realised that calculations can be done in Excel to make their work much easier. Hence, the teachers in different sessions asked about these formulas. Bheki understood that he did not understand Accounting as a subject, so he opened the question to the floor so that teachers who teach

the subject could help: "*Is there anyone who wants to assist in this regard?*" Even in this instance, Teacher 3, like other teachers, demonstrated how he uses Excel to teach income statements. He showed his income statement, presented in Figure 14, and stated, "*I normally do formula for gross profit, expenses and net profit/loss*".



	A	B	C
	Income Statement		
	Sales	120 000	
	Cost of sales	57000	
	Gross Profit	**63 000**	
	Expenses	=SUM(B6:B10)	
	Telephone	400	
	Fuel	1200	
	Salaries	3000	
	stationery	800	
10	Advertisment	2500	
11	Net profit	**55100**	

	A	B	C
	Income Statement		
	Sales	120 000	
	Cost of sales	57000	
	Gross Profit	**63 000**	
	Expenses	7900	
	Telephone	400	
	Fuel	1200	
	Salaries	3000	
	stationery	800	
	Advertisment	2500	
	Net profit	=B4-B5	

Figure 14 The income statements that Teacher 3 used to answer Teacher 1's question about formulas in income statements.

In Figure 14, Teacher 3 has identified arrears in the income statement, which can easily be done using Excel formulas, but he has not mastered automating the whole income statement, especially expenses transactions. However, the way he was doing it was much better than Teacher 1 in Tumi's class.

The teachers' level of understanding of basic ICT skills was exposed when they asked questions. One would expect teachers to know default Microsoft templates. Teacher 1 also asked Bheki the following question about templates in Excel: "*Is there a readily available workbook for cash flow statement for Grade 11 maybe?*" This question again seemed confusing to Bheki because the following dialogue took place:

> *Bheki: You mean blank workbook that you can customised for your class?*
> *Teacher 1: Open a blank spreadsheet again. I mean something similar to the third template.*

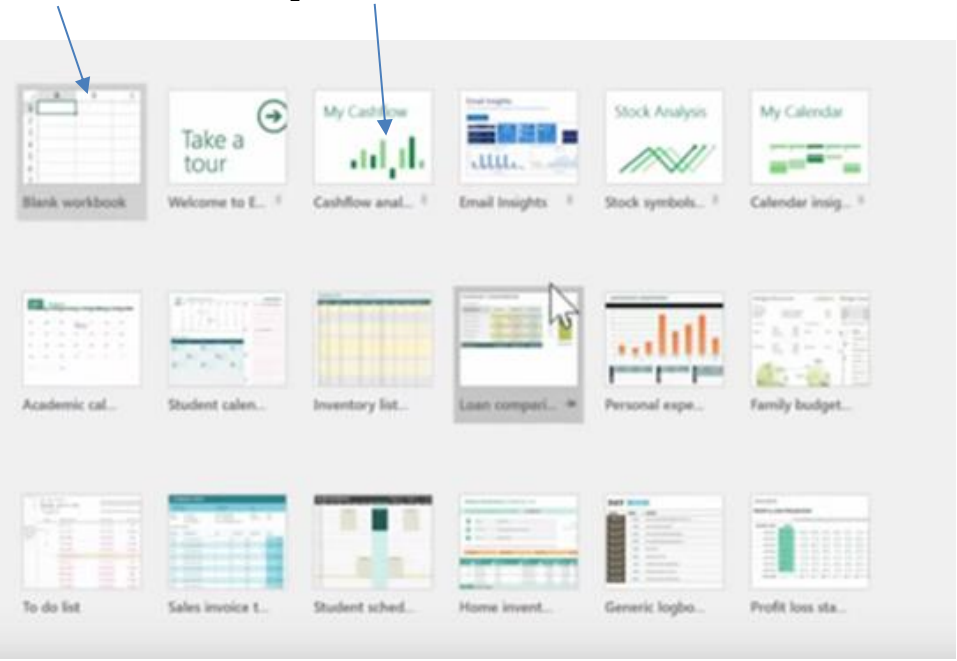


Figure 15 Template option in Excel that Teacher 1 was asking Bheki about

The teachers asked questions related to the subjects they teach that the trainers were unable to answer. However, they allowed the teachers to help. Even in this instance, Bheki asked the teachers to intervene and Teacher 3 responded by saying, "*There is no template that can be used to teach cash flow statement*". This is not different from what was asked in Tumi's Excel session, though it was on a different subject (Economics). Teacher 3 asked if there is a readily available demand-and-supply graph on Excel when Tumi was showing them how to

convert data into graphs. It was clear that the trainers did not understand anything subject-related because, as shown in Figure 15, Tumi followed up to understand whether the teacher was asking about the graph presented in picture 1. This highlights Tumi's lack of understating of the content the teacher is asking about. The teacher picked up that Tumi did not understand his question and decided to draw on the chalk board (picture 2 and 3) what it was he wanted to know (demand-and-supply graph). When Tumi asked, "*You mean this one?*", referring to the graph in picture 4, it confirmed that did not understand the question.

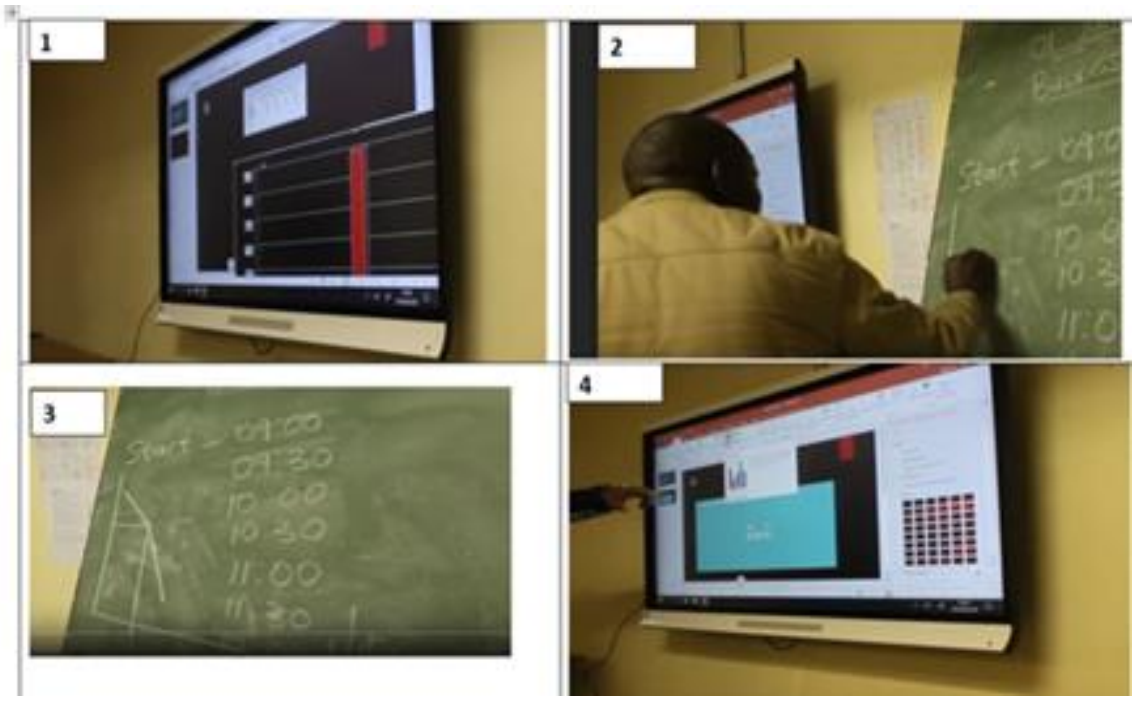


Figure 8 Pictures 1–4 showing the back and forth between Tumi and Teacher 3.

This indicates that the teachers knew the ICT pedagogical skills they wanted for their subject, but they were not offered these in the training because the answers were limited to what colleagues could provide. Anything beyond that was still not available in the training or the trainers' answers, which only led to more confusion for the teachers. Tumi's confusion also confused the teacher, because he tried to redirect the teacher and explain how the chart happens: "*This is the only charts we have, but remember it will be according to your data. I have not*

seen a demand graph in Microsoft suites". This led the teacher to believe that there was no graph readily available, but he continued by asking, "*If you say it is according to the data provided, does that mean if I provide demand table, will it give me a demand graph?*"

Even though Tumi was not sure how to go about drawing a demand-and-supply graph, he confirmed that "*there is no demand-and-supply graph on Microsoft suit*". It is worrisome that Tumi as a trainer could not give an alternative way of doing it.

In Sive's session, she told teachers that they could convert hand-drawn shapes (Figure 17) to objects because the shape recognition pen converts hand-drawn shapes and lines into objects.

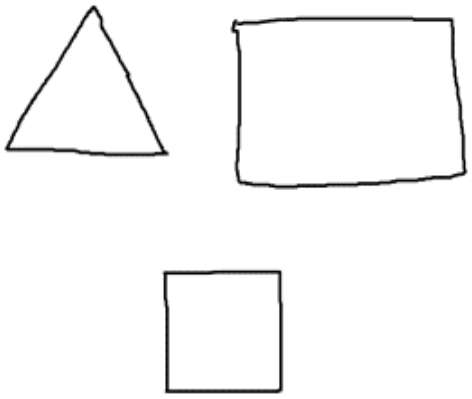


Figure 17 Hand-drawn shapes that can be converted to objects

This provoked Teacher 1's thinking and started the following dialogue about what was possible in her subject:

> *Teacher 1: This is what I want for my subject [Economics]. You know this board is small and if you handwrite on it at times learners do not see. Is it possible to convert the whole graph [supply and demand] after drawing it?*
> *Sive: I do not know the graphs you are talking about [supply and demand] but shapes like this can be converted [Figure 23].*

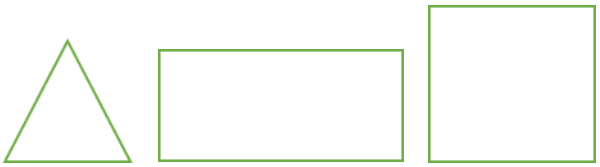


Figure 18 Hand-drawn shapes converted to objects.

Tumi's and Sive's presentations provoked questions for the teachers.

Teacher 1 asked a question and Tumi did not understand it and was confused by the question. Teacher 3 even drew on the chalkboard to clarify his question, but Tumi was still confused. He opened a chart on Excel to check if Teacher 1 was asking about that. This suggests that Tumi had technological knowledge but lacked content knowledge. The dialogue continued between Teacher 1 and Tumi because Teacher 1 was trying his best to explain to Tumi what he wanted. Teacher 2 came to Tumi's rescue and took the teachers step-by-step showing them how to draw a demand-and-supply graph. It was clear that Teacher 2 was familiar with both content and the technology that he used to draw the graph.

Teacher 1 also asked a pertinent question regarding her subject (Economics) about converting a handwritten graph (demand and supply) to a standard or proper graph, like converting handwritten shapes. Sive did not know if that was possible and advised the teacher to try it by saying, "*I am sure that any recognised shape it will recognise*". Her answer was not helpful, because the teacher needed to go and work out if it was possible.

Mediation was, however, observed when the teachers were driving the conversations. Their questions were technological questions about the Smartboard. Only Teacher 1 asked a specific question regarding her subject. Unfortunately, the trainer was not able to assist her.

Subject Knowledge and ICT Basic Skills

Teachers' understanding of the content of the subject they teach was observed during ICT training. Teacher 2, in Tumi's class, and Teacher 3, in Bheki's class,

provided alternatives as the teachers were asking questions about Excel that could be used. These teachers presented step-by-step what they normally do in their classes with Excel, but it was worrying to see that misunderstandings were evident and that misconceptions expressed by the teachers went unchallenged, because they seemed to be the ones that possessed the knowledge needed by other teachers. On the other hand, it was interesting to see what they do without formal ICT training, like Teacher 2 in Tumi's class. The graphs in Figure 19 show how Teacher 2 drew demand-and-supply curves when he was showing the class how to do it. It is worth noting that these graphs were drawn using shapes in Microsoft Word.



Figure 19 Demand-and-supply graphs used as example by Teacher 2 in Tumi's class

During this presentation, Teacher 2 was the only one talking and everybody else was looking at him. It was more like showing teachers what to do and without their contribution. During Bheki's session, Teacher 4 involved the teacher at the start of his demonstration and assigned them to read the transactions to him as he was putting them on the Excel spreadsheet. Figure 19 shows Teacher 4's example of his general journal and ledger accounts while he was showing the class how to do it.

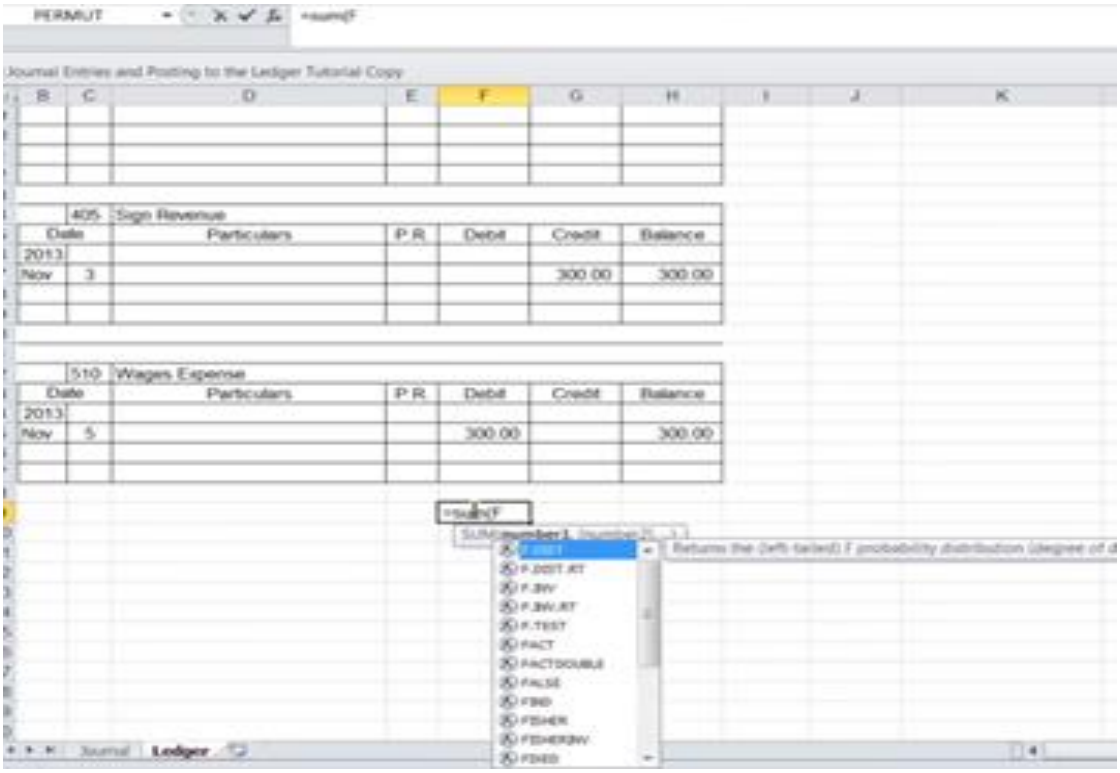


Figure 9 Teacher 4's example of his general journal and ledger, in Bheki's class

It was interesting to see Bheki learning from Teacher 4 and redirecting the teachers during the teacher demonstration. He said, "*Colleagues, are you following? If you notice Teacher 4 here is using mostly sum function to add these entire column?*"

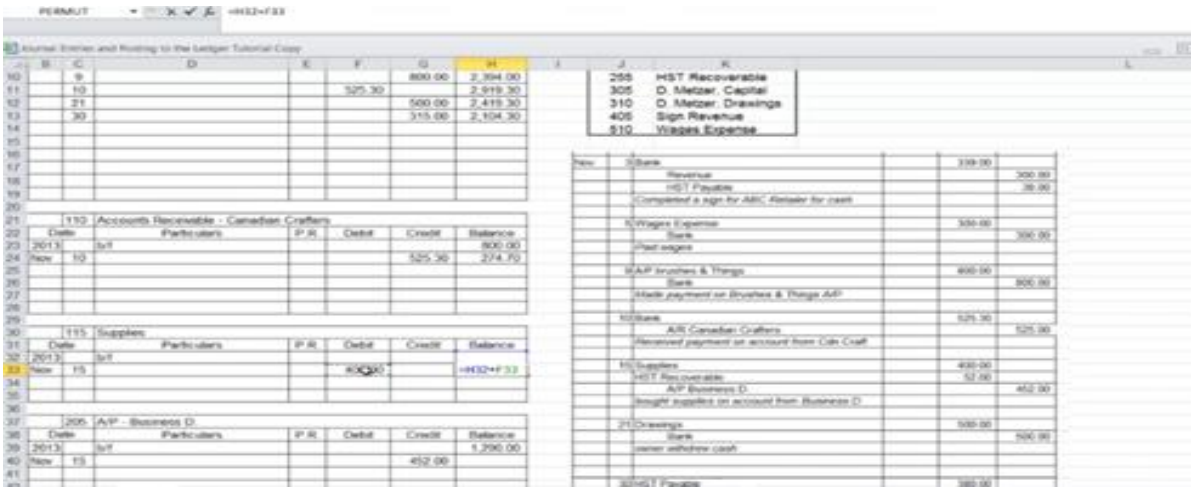


Figure 10 General Ledger

In Bheki's second session, the conversation started between Teacher 2 and Bheki. He included other teachers and asked them to assist. Teacher 3 went to Teacher 2's table to show him the calculation for gross profit and expenses. Bheki seemed not to understand the question and let the teachers help each other. In the end, Bheki said, "*I think it is clear to everyone this spreadsheet uses only basic Excel formulas. It should not be a problem. Unless you want something else*". This statement was a bit confusing because Teacher 2 and 3 were working on the laptop and the other teachers did not see what was happening, so they did not ask any questions. Bheki's intervention in this regard was minimal and only benefited Teacher 2, who asked the question. He was not able to guide teachers in relation to what was asked or even to ask Teacher 3 to show the calculations on the board to open up the discussion to the rest of the class.

Triggered by Bheki's presentation, when he was showing the teachers how to open the Excel spreadsheet, Teacher 1 directed a question to Bheki. He did not understand the question from Teacher 1, and he opened the question to the floor. As usual, Teacher 3 came to Bheki's rescue, but wanted to be sure that he understood the question. There was a dialogue between Teacher 1 and 3. The rest of the class was not part of this conversation and even Bheki seemed to be lost. Teacher 3 gave the answer. Later on, Bheki confirmed that he was not familiar with Accounting as a subject, thus his mediation was minimal. He encouraged the teachers to share how they integrated Excel into their teaching and learning. This opened a discussion that is presented in excerpt 3.

ICT Technological Knowledge

Tumi's and Sive's technological knowledge was evident. While the teachers were asking how best they could improve the way they use technology in class, Teacher 3 asked Tumi:

> *I have this challenge when I present my lesson using PowerPoint. My learners become too excited and others just laugh uncontrollable, that*

disrupt my lesson and I start to believe it is not for the type of the learners that I teach. Please advise, colleagues.

Tumi answered based on her technological knowledge and also warned the teachers about the dangers of using animations untimely. Tumi said,

Too many animations in a presentation will excite/irritate your learners, especially if the animations you selected involve many movements; for example, one slide has each bullet point spiral in and the next slide has each bullet point fly in from a different side of the screen. You are only two slides into your presentation and half of your class is already entertained, you are not going to win in that case. Use animation sparingly and stick with one or two moderate animations in your lesson presentation and learners will behave differently.

It was surprising to hear Teacher 2, who had been quiet during Tumi's whole class, giving guidance about how Teacher 3 could mitigate the issue of multimedia and avoid standing in front and controlling slides. He mentioned that

Alternatively, automate your presentation; you must not let use of multimedia take over your lesson presentation. Keep things simple, create fully automated lesson presentation with each point entering at a timed interval and slides advancing automatically. You also have master timing. For example, I panic if something happen to interrupt my lesson flow and I do not think is the calibre of learners you teach. I strongly believe the problem is how you use multimedia in your presentation.

It was clear that Tumi understood the technological part of the training, because he also said the following very important thing about images and videos with poor quality:

Another mistake is the use of bad quality images. In order to save time, educators search through the internet for images relevant to the

subject/topic, they download and paste them on the slide, caring little for the final outcome.

A typical example is when a teacher just adds the image next to the text, that is considered as a nice combination of image and text of which is not true. You must spend enough time searching for the most appropriate image and you can gradually develop your own collection of graphics. Bright colours and clear graphics attract the learners' attention whereas low quality images, that sometimes contain even a logo, have the exact opposite result.

The same applies to the videos added. You must take into consideration the language of your learners and whether the video includes subtitles or not, so it can be easily understood. In addition, the audio must be clear enough without distracting noise.

It is worth noting that Tumi's answers to Teacher 3's question were surprising, because he had not been able to answer the questions the teachers asked during the Excel session. Most questions were answered by teachers and limited to their understanding. However, it could be that Tumi was confused because the teachers were asking questions that were based on the subject they teach, whereas this one is more general, yet it touched important ICT pedagogical issues.

This was no different from Sive's session in which she was teaching the basic use of the Smartboard. The following dialogue took place:

Teacher 4: I find using smart pen on a PDF document so useful and I normal use it with my eBooks, however I am wondering how can I send the notes I make during my presentation to my learners? For example, during class I highlight with different colour pens to emphasise some points.

Sive: You can save your notes like you normal save other documents and share them using different medium, e.g. email or save on a memory stick.

Another question that was asked by Teacher 1 was based on technological knowledge, and Sive answered it in a very coherent manner by providing step-by-step instructions to follow to convert handwritten text to text. The following dialogue took place:

> *Teacher: As indicated earlier, I am not familiar with technology. I use free hand a lot because I am still learning how to use other tools. I do not know how to convert it to text afterwards.*
> *Sive: This how you do it after writing your notes direct on the screen. To convert notes to text, click on the select button on the toolbar, select the text to be converted and a dropdown box will appear, choose recognise "your word" and your handwritten notes will be converted to text.*

Teacher 1 started a conversation wanting to understand how calibration works on the smart board or when calibration should be done. The trainer provided an answer, but it was not straightforward and left the teacher hanging: "*It depends*". Teacher 3 wanted to know about troubleshooting technical problems for a Smartboard. However, he was turned down by the instruction from Sive's seniors that if they come across any technical problems, they should call technicians. Other teachers asked basic things like file management and use of devices, like a mouse, on the Smartboard. The teachers and the trainer addressed these questions.

ICT integration has been understood as the usage of technology seamlessly for educational processes, like transacting curricular content and learners working on technology to do authentic tasks. The way teachers were integrating ICT into teaching and learning after attending ICT training is explained in the following section.

ICT Pedagogical Integration in the Classroom

Effective ICT integration into teaching and learning requires teachers to possess a set of ICT competencies that include ICT pedagogical skills, which can be acquired through formal or informal training. Classroom observations showed

that ICT pedagogical integration in class depends on the teacher and the subject they teach. The ways teachers were integrating ICT into their lessons is presented in this section.

Mr Gumbi, an Economics teacher from Bheki's class, used a variety of ICT tools in different parts of the lesson he was teaching. He incorporated videos, illustrations and PowerPoint presentations in one lesson. One might think that using a variety of ICT tools to teach one lesson will create havoc in the class and confuse both the teacher and the learner. However, this was not the case in Mr Gumbi's class because he managed them well. For example: Mr Gumbi would pause a video at certain points and draw learners' attention to certain important or symbolic parts of the video, while moving around the class and making sure they were taking notes. Mr Gumbi seemed to have everything under control, because even during the second classroom observation, he used multiple ICT tools to grab learners' attention from the beginning of the lesson. Before starting a lesson, Mr Gumbi projected pictures in a slideshow depicting the composition of the South African population and labour. At this point, learners were concentrating and engaged as he introduced the topic.

It was evident that Mr Gumbi invested time preparing the lesson, because he used simulation games that require thorough planning from both parties (learner and teacher). Using simulations as a teaching strategy has the potential to engage learners in deep learning that empowers understanding of the content. It was thought provoking to see how he integrated simulation, music and the explanation at the same time. This was a highlight, because, while learners were performing, he played very soft music that supported different roles that learners portrayed. It is worth noting that the song was divided into segments. It would play and pause, which is when Mr Gumbi provided the learners with an explanation.

Mr Gumbi's ICT pedagogical integration was seamless and advanced. The way he included ICT indicated that he is not a novice when it comes to ICT

integration. However, Mr Dube, the Accounting teacher who attended the same ICT training with Mr Gumbi, integrated ICT differently. In his lesson, Mr Dube taught using the Smartboard with smart notes to assist him with calculations. He first modelled the calculation steps to the learners on the board, and he also referred the learners to textbooks, especially to pages where there were examples of calculations. He took learners through variable cost, fixed cost, unit cost and break-even point.

Even though he was using different ICT tools and the textbook, he did not lose his learners in the process of integration. He called learners to the board to come and do some calculations and the learners did them correctly. To ensure a clear view, he opened a new blank document and allowed learners to use free-hand writing, so that everyone in the classroom could see what was on the board. This indicated that he knew where to find what in the Smartboard, because he projected the calculator on the side, used smart notes and allowed learners to use free-hand writing.

Mr Dube used a video in his class like Mr Gumbi, and it was interesting to note that Mr Dube used the same strategy with the video as Mr Gumbi had. Mr Dube did preparation of ledger accounts for a manufacturing business during the lesson. He used video clips to show some of the calculations taken from YouTube. As the video clips were playing, he paused them to emphasise the calculations for the learners. This strategy kept the learners alert, because he would pause and ask them questions and then elaborate further. The way he linked what was portrayed on the video with the learners' everyday knowledge and at the same time asked learners questions that probed their understanding was thought provoking.

Mr Dube's integration also included the use of social media and this was only evident in his class. Fifteen minutes before the end of the period, he gave learners 10 minutes for group work and timed it on the board where every learner could see as they were busy doing the task. The use of the timer on the board helped

learners to try to finish within the given time. After 10 minutes, he asked them to take pictures of their work and post it to their chat group. It was not clear how Mr Dube was going to mark the work on a WhatsApp group chat.

Even though there were similarities in ICT integration between Mr Gumbi and Mr Dube, it was creativity that set them apart. On another hand, Mr Khulu, an Accounting teacher who attended Tumi's ICT training sessions, integrated differently from the two teachers. He prepared a PowerPoint presentation for this lesson, with close to 50 slides for one period. It was worrying to see so many slides for one period. However, as he was going through them, the reason for so many slides became clear. He said that "*I left some space on my slides so that we can use it for calculations*". He wanted to put calculations on the slide, not to open a blank document to work on, like Mr Dube had. Learners were using the calculator on the Smartboard to calculate and write answers on the slides. He taught learners how to prepare ledger accounts for a manufacturing business, focusing on the balance sheet section accounts as well as nominal accounts.

Mr Khulu also used videos in his lesson like Mr Gumbi and Mr Dube. In one of the slides he hyperlinked audio, but unfortunately it did not play during the presentation. He tried to troubleshoot, but he was not lucky and learners also gave him tips on how to retrieve or to get it to play, but none of the tips worked. This incidence really disturbed Mr Khulu, because he started to panic and learner engagement was very limited. Mr Khulu dominated throughout the lesson. The reason for less participation could be the disjuncture between what was supposed to play and what was already presented. It is worth noting that Mr Khulu's slides were clear and not clustered with information.

Technical problems were the main challenge for Mr Khulu, because even during the second session when he used Excel and PowerPoint, the presentation inventory system on the Smartboard froze and he was disturbed. When this happened, he was not as worried as he was in the first session. Mr Gumbi and

Mr Dube also experienced some technical problems, but it did not even worry them and it was easy for them to troubleshoot.

Mr Khulu seemed to have mastered Excel formulas, because he had prepared spreadsheets with formulas to assist with totals and some basic calculations for this topic. He was navigating from sheet one and two, but looked relaxed, because there were no challenges experienced. Learner participation was better and the learners were following what was presented in the classroom. They kept asking him how to create formulas and he showed them. It looked like PowerPoint was not his strong point, because most of the time he was focusing on Excel and he did well with it.

As mentioned earlier, teachers integrate ICT differently. Ms Chili, an Economics teacher who was in Sive's training, also did it her own way. Even though she used the Smartboard like the previous teachers, she used it to project/open the e-book so that learners could see what she was talking about. She used a smart pen to highlight important points on the board. She would read a sentence or a paragraph and explain to the learners. Ms Chili's integration was disordered, because where pictures were used, she would zoom them so that learners could see them. At some stage, she left the board and moved around in the classroom talking to learners. In fact, she forgot about it and carried on with her teaching, without paging through the e-book that was projected on the board. When she returned to the board, she lost track of the pages of what she had already explained to learners and used a pen to write on the top of the book. This showed that she was a novice when it came to the use of technology in teaching her subject. In some instances, she would lose track of what she wanted to explain and focus on getting the technology right. Having difficulties with technology use in class did not make learners judge Ms Chili. Instead, learners displayed understanding of her level of ICT skills, because they took turns to come to the board to help her, without disrupting the classroom. Her learners were helpful like the learners in Mr Khulu's class, because they also tried to assist him with the technology when it was failing him. It is important to note that Ms Chili,

when she was not focusing on the technology, narrated poverty in a way that learners could visualise. That demonstrated a sound understanding of the content.

Technology continued to be a bit of a challenge in Ms Chili's lesson. In the second lesson, she prepared a PowerPoint presentation that was too basic for the topic that she was teaching. Moreover, Ms Chili forgot to put the presentation on slide show mode. Again, one of the learners assisted her with it. She took time to move to the next slides, but eventually lost track of her slides. She was proactive and tried to outsmart the situation because she had notes by the side of the table that she used as a point of reference for the use of technology. Unfortunately, using the technology was not as straightforward as she anticipated. Preparing notes for technology reference implied that Ms Chili is used to deal with technical problems in class, hence she came prepared.

ICT Pedagogical Integration Learned During ICT Training

ICT training for educators is designed to equip teachers with relevant ICT pedagogical skills. However, what teachers learn during the training and what they do in class depend on them. During training, the teachers were exposed to different kinds/forms of ICT training content aimed at developing their pedagogical ICT skills in the classroom. The expectation was that when they went back to class, they would integrate ICT into teaching and learning. Nonetheless, the skills learned during ICT training should reflect in the teachers' teaching. After training, the teachers decided to integrate ICT in their own way.

Mr Gumbi and Mr Dube were in Bheki's Class and they integrated ICT in more-or-less the same way, but not like their trainer. Mr Dube copied teaching strategies that were used by Bheki. For example, Bheki demonstrated ICT to them and gave them time to do it. I observed Dube doing the same thing in class, where he demonstrated calculations and then let learners do it. One might say that Mr Dube's demonstrations had nothing to do with ICT integration, because it is a common teaching strategy. The way Mr Dube and Mr Gumbi integrated

ICT in their teaching is more advanced than what they did in the training: They used simulation games, videos, WhatsApp and advanced uses of the Smartboard. When they were asked during the interviews about ICT training and their ICT integration, Mr Gumbi said, "*I have learned a lot, but I have a computer prior knowledge*". This means Mr Gumbi was a step ahead of his colleagues, because some of them were doing training for the first time. It may be that Mr Gumbi's ICT knowledge helped him integrate it seamlessly.

In Mr Khulu's presentation, there was bit of what they learned in Tumi's training, because there were so many questions asked around Excel formulas that ended up being answered by the teachers. Tumi encouraged the teachers to go and learn more about Excel formulas so that they will be able to use them in their teaching. However, in the interviews he mentioned that, "*I have learned a lot because it was my first time to learn how to operate the Smartboard, Microsoft packages, but I am familiar with them*". Mr Khulu and Mr Gumbi attended training, but they already had the basics.

It is confusing when Mr Khulu says he attended but is familiar with the Microsoft packages. His PowerPoint was not up to scratch, not like someone who had used a computer before. The animation used in his presentation was a bit chaotic. It was surprising, because Tumi indicated during training that they need to be careful when applying animation in their presentation. Though he struggled with the audio that was hyperlinked in his presentation, Excel was well prepared with formulas. As a result, he ended up focusing on Excel and left the PowerPoint presentation. Comparing what Mr Khulu did in class, it was advanced compared to what they all did in class, especially with Excel.

Ms Chili was a different case because she stated that "*I learned everything in the training. It was my first time to learn ICT skills*". In her first lesson, she used the Smartboard, and Sive had taught them the basic use of Smartboards. She succeeded, because the learners assisted her. I would not say what she is doing in her classroom mirrors the ICT training attended for the following reasons:.

Conclusion

This chapter presented a background to the study and that of the participants. It further elaborated on how the themes were generated and analysed to make sense of how mediation took place during the ICT training that should support effective ICT integration in the classroom. The next chapter discusses the themes generated in this chapter.

Chapter 6:
Thematic Discussion and Synthesis of Findings

Introduction

This chapter discusses the analysis of the findings presented in the previous chapter. The main aim of the study was to examine the concept of mediated learning in ICT training and how it influences ICT pedagogical integration in the classroom. As mentioned in Chapter 4 on research design, this study used multiple case studies. This method was used to examine the processes and outcomes across three cases and identify how individual ICT trainers mediate ICT pedagogical skill to teachers. Three bounded cases were selected to develop a more in-depth understanding of the phenomena. Cases were analysed separately and then patterns of similarity or difference were explored to determine the coherence between mediation in ICT training and pedagogical integration in the classroom. The findings about mediated learning in ICT training are reported in this chapter, following the same pattern in Chapter 5.

Mediation of ICT Pedagogical Skills in ICT Training

Mediation by human beings is one of Vygotsky's core tenets that was advanced by Reuven Feuerstein as MLE. In most professional development activities, trainers lead the training and are taken as more knowledgeable than the trainees. This study describes ICT pedagogical skills as sets of ICT skills or abilities that are intertwined with teaching methodologies to facilitate effective ICT integration that may be applied online and in hybrid and face-to-face learning environments. The teaching and learning that took place during the ICT training were geared to equip teachers with relevant ICT skills that would develop their ICT pedagogical skills. Therefore, the core duty of trainers was to mediate ICT pedagogical skills for teachers. However, teachers in ICT training do not learn in isolation but through guidance from the trainer and from other colleagues. Hence, the mediation of ICT pedagogical skills took place in different forms.

ICT Trainers' Intervention During ICT Training

Effective ICT pedagogical integration in the classroom is largely influenced by meaning making and skills learned during ICT training. Meaning making during teaching and learning is made possible by teachers' intervention. They learn how to be more interactive during ICT training and how to use the technology to create a more stimulating learning environment, while realising that their pedagogic knowledge rather than their technical knowledge is what makes them teachers (Harrison, 2010).

Mortimer and Morris (2003) posited that intervention is central to teaching and learning, regardless of content area. Thus, the concept of intervention is deployed in this study to understand ICT trainers' intervention during training. This study holds that ICT trainers, as the knowledgeable people in the training with appropriate ICT knowledge and skills, are expected to intervene and incorporate different intervention strategies during ICT training to develop teachers' ICT pedagogical skills. Trainers should intervene by shaping ideas, selecting ideas, marking key ideas, checking understanding and reviewing (Mortimer & Morris, 2003). During ICT training, it was evident that the trainers' intervention was not enough to help the teachers develop ICT pedagogical skills to enhance teaching and learning in the classroom. This was apparent in the incidents presented next.

In Bheki's observations, it was highlighted that he can only share ideas and check the understanding of the teachers during training. The sharing of ideas was based on the technological aspects of training. The following quote of Bheki illustrates this point: "*Colleagues, if you want to present a professional looking document in Microsoft Office, you should understand word processing very well*". This statement suggests that he understands the importance of producing a professional document, but that does not help much in developing ICT pedagogical skills because he did not explain how they should use word processing skills in their teaching. However, there was an element in his presentation that showed that he understands that he lacks ICT pedagogical

skills, as he kept redirecting teachers' questions to their colleagues by saying, "*Colleagues, can you assist on this one?*"

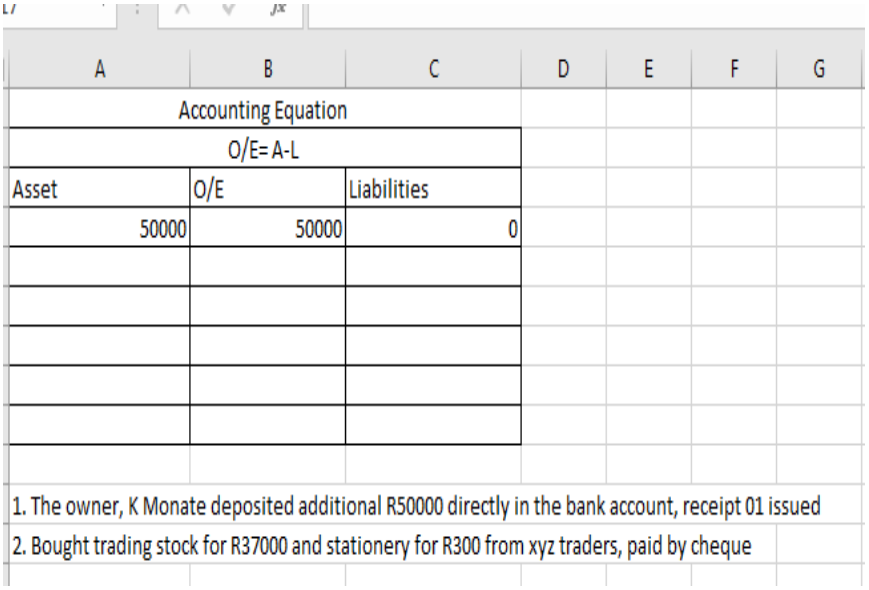
For me, that was Bheki's sharing of knowledge, which is technological knowledge and letting the teachers address what he assumed they know. Drawing from Koehler and Mishra (2009), technological knowledge is a part of the body of knowledge important for teachers to have for the effective integration of ICT into teaching and learning. However, only having technological knowledge is not enough. This means that if Bheki only shared technological knowledge with the teachers, it will not allow them to effectively integrate ICT when they are in their classroom.

Bheki's teaching background came in handy in this context, because even though he lacks ICT pedagogical skills, he was able to check teachers' understanding after every explanation and also acknowledge his mistakes; for example, he said, "*Colleagues, I hope that is clear, and my apologies on my explanation, I got carried away*".

Checking understanding is one of the elements of meaning making stipulated by Mortimer and Morris (2003); but they cautioned that these elements need not operate in isolation to appropriate meaning making in the classroom. However, in Bheki's sessions, other elements of intervention were done by the trainees to help each other learn ICT pedagogical skills. It is not a bad thing when teachers learn from each other, but when they dominate the training, it defeats the purpose of having someone who is assigned to train them. One can argue that when these teachers are coming from the same school, they might as well train one another, rather than have a trainer who is less knowledgeable than them. This raises the notion of communities of practice within the school. These act as a catalyst for any professionals to internalise new knowledge, which eventually allows them "to reach different interpretations of the same knowledge" (Kapucu, 2012). Communities of practice provide an interactive mode for professionals on how they engage with each other about their practice and how they co-construct

knowledge. Teachers indicated their level best in shaping and selecting ideas and marking key ideas. Teacher 2 was noted to pay full attention to the question that was posed in the class and helped by redirecting Bheki to the question and also keeping an eye on the key idea of the question. This instance revealed that teachers have a good understanding of each other as well as the subject they teach, and this makes it easy for them to share how they integrate ICT in the classroom.

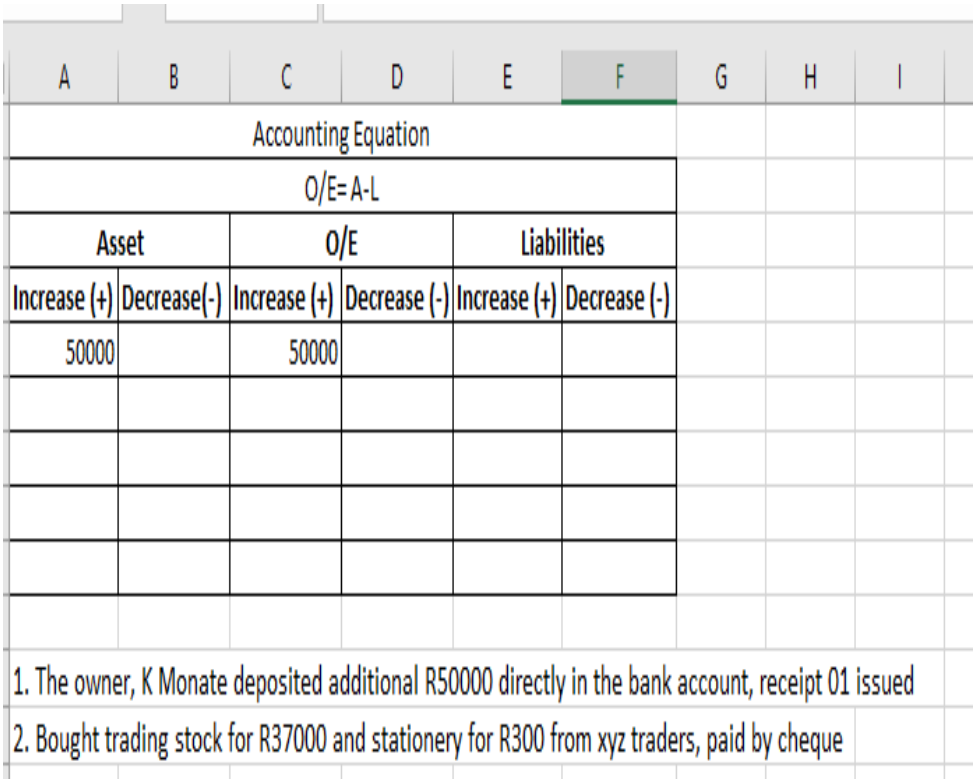
Tumi's intervention was limited to the checking of the ideas because he kept asking if they understood and he was not elaborating on what was forwarded. "*Teachers do you understand?*", he kept asking and then would move along. Given that Tumi does not have a teaching background, perhaps he does not understand the importance of clarifying the feedback to the benefit of everyone. Similar to Bheki's class, there was a lot of peer intervention in Tumi's class when the teachers were advising each other about how to do accounting equations using Excel. A teacher asked if it was possible to automate the extract in Figure 22 in Excel.



A	B	C	D	E	F	G
Accounting Equation						
O/E= A-L						
Asset	O/E	Liabilities				
50000	50000	0				
1. The owner, K Monate deposited additional R50000 directly in the bank account, receipt 01 issued						
2. Bought trading stock for R37000 and stationery for R300 from xyz traders, paid by cheque						

Figure 11 Table that a teacher in Tumi's class wanted to automate

Tumi indicated that he did not know because he is not familiar with Accounting as a subject. Figure 23 shows an alternative way of doing the accounting equation without automating it that was presented by another teacher.



A	B	C	D	E	F	G	H	I
Accounting Equation								
O/E= A-L								
Asset		O/E		Liabilities				
Increase (+)	Decrease(-)	Increase (+)	Decrease (-)	Increase (+)	Decrease (-)			
50000		50000						
1. The owner, K Monate deposited additional R50000 directly in the bank account, receipt 01 issued								
2. Bought trading stock for R37000 and stationery for R300 from xyz traders, paid by cheque								

Figure 12 Alternative offered by another teacher to a question in Tumi's class

Even though the teacher did not know what the other teacher asked, he showed an alternative way. This indicates that the teachers came to training with an established worldview about their content, formed by years of experience in education. Furthermore, the trainer's answers revealed that he had learned his ICT skills in isolation of the content. If his ICT skills were intertwined with content and pedagogy, he would have been able to show how to automate accounting equation calculations in the spreadsheet rather than doing it manually. However, the solution in Figure 23 showed a certain level of understanding of the accounting content and pedagogy but also a lack of strong technological skills. Had Tumi as a trainer had ICT pedagogical skills, his intervention would be of help to the teachers making ICT pedagogical skills

meaning. I also noted that when teachers asked questions, it created confusion in class as Tumi would get totally lost in the content knowledge and end up not knowing how to advise the teachers from the technological aspect, which he was good at. Tumi's intervention was very flat, as he was only checking understanding and leaving the rest to the teachers.

It is important to note that the teachers in Tumi's classes were shaping ideas through probing and were able to help each other during training. An example is in Figure 24 where an Economics teacher's question about drawing a demand-and-supply graph led to another teacher stepping in to help.

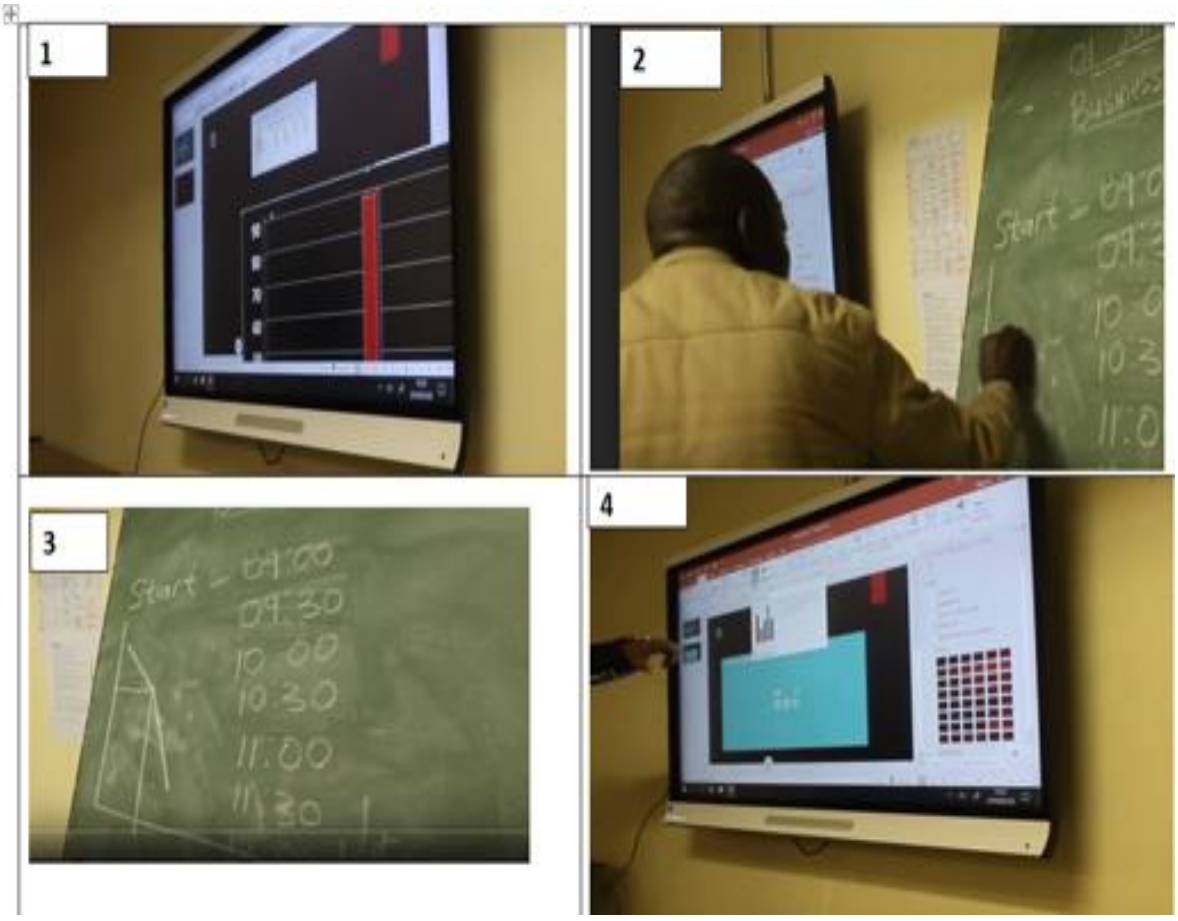


Figure 13 A teacher explaining to another teacher how to draw a demand-and-supply graph in Excel

Figure 24, as explained in section 5.10, shows that the teacher is seeking understanding of how to draw a demand-and-supply graph on Excel. His question created confusion for Tumi and the teachers resorted to drawing it on the chalk board with the hope that Tumi would understand what he was asking. After he drew it, Tumi's confusion mounted and he asked, "*You mean this one?*" (pointing to an ordinary graph in Excel [picture 4]). To an accounting question, he said, "*I do not know*". Teaching Excel in isolation of what subject teachers teach was a challenge. The challenge constantly arose when teachers wanted clarity on questions related to the subject. Teachers helping each other was evident in Figure 25, when one teacher intervened to assist another on how to draw a demand-and-supply graph manually in Excel. This was very disappointing as this was the second time Tumi was asked and was unable to answer the question. Seeing that the trainer was not able to answer, one of the teachers presented the demand-and-supply graph in Figure 25. However, it should be noted that this teacher also did the graph manually and took a long time to finish it.

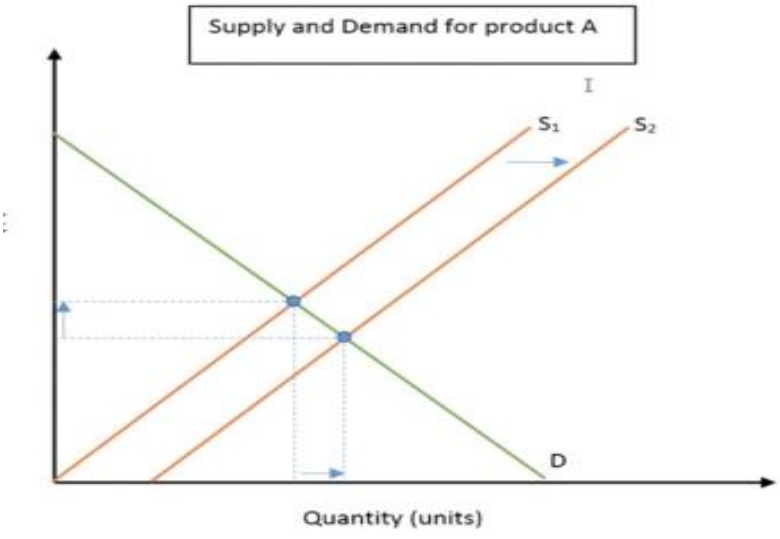


Figure 25 Demand-and-supply graph manually drawn by a teacher in Tumi's class

What can be deduced from this scenario, is that the teacher had invested time to learn how to draw a demand-and-supply graph manually and was willing to share his skill with the rest of the class. In his presentation, he covered more intervention elements, which included the shaping of ideas, checking understanding and the sharing of ideas. This was much better than Tumi's intervention. It must be emphasised from this that Tumi's lack of subject knowledge made it difficult for him to connect with the teachers. Tumi, being the trainer, was well versed in technology and would presumably know better about how to go about doing the graph automatically, such as the example in Figure 26. Figure 26 is an automated graph done from Excel and it does not take much time to do. One can argue that if teachers cannot learn these skills from ICT training, where are they supposed to learn them?

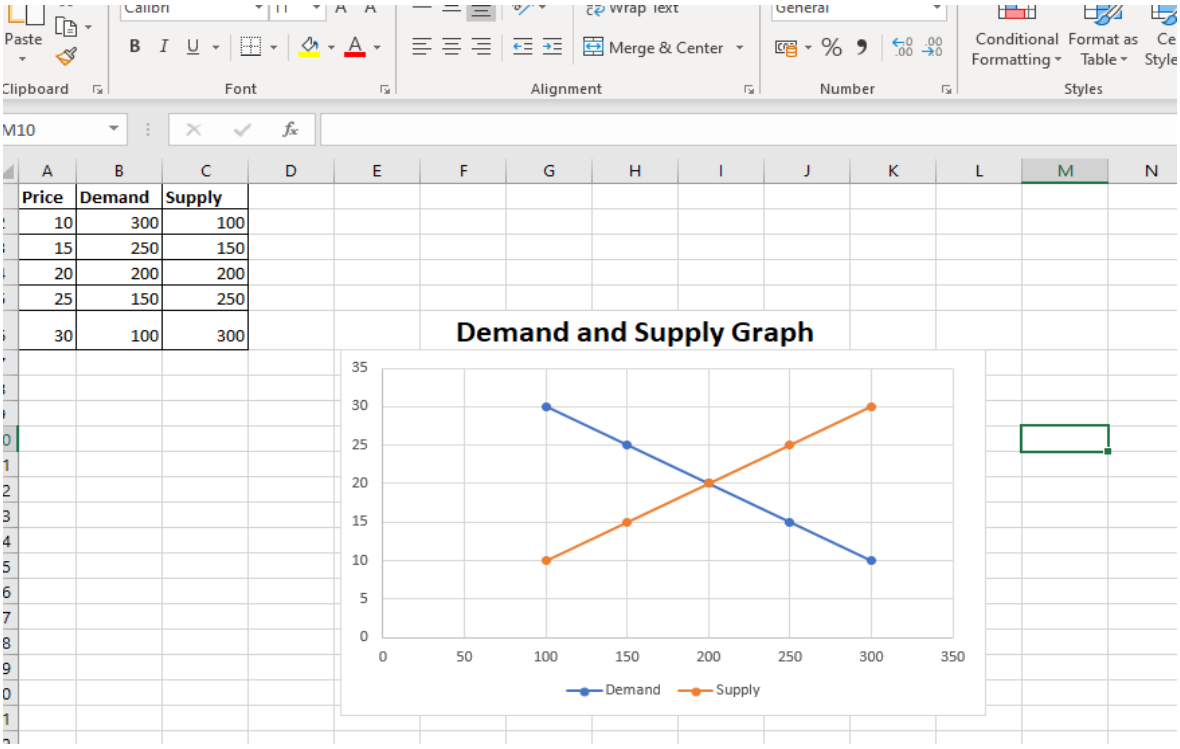


Figure 26 Automated Excel demand-and-supply graph

Tumi's intervention was very limited and he could not even assist teachers with follow-up questions as the presentation was unfolding. His intervention was second to that of Bheki.

Sive's training sessions, like Tumi's, showed limited elements of intervention. When teachers were asking for certain functions on the Smartboard, she showed them and proceeded. For example, Teacher 1 from her class asked the following question:

> *This is what I want for my subject [Economics]. You know, this board is small and if you hand write on it at times learners do not see. Is it possible to convert the whole graph (supply and demand) after drawing it?*

Based on this question, the teacher wanted to know if the Smartboard has the capability to convert hand-drawn demand-and-supply graphs so that they can be visible for the learners. Sive understood that part of the question. However, it was difficult to give a correct answer, because she did not understand the graphs the teachers was talking about. Hence, she answered, "*I do not know the graphs you are talking about (supply and demand) but a basic graph like this can be converted*".

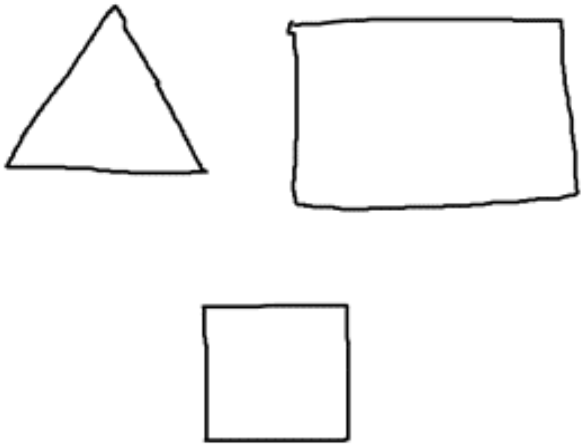


Figure 27 Hand-drawn shapes Sive drew as examples to convert to objects

Sive's answer indicates her technological knowledge but also that she lacks ICT pedagogical skills, because she left it to the teacher to find out if the Smartboard could do what he was asking. Most of the time, she kept saying, "*I do not know your subject*" and confused some teachers. In this case, her intervention was as

good as absent. According to Mortimer and Morris (2003), shaping ideas, selecting ideas, marking key ideas, checking understanding and reviewing are intervention elements that promote meaning making in a teaching and learning environment. Therefore, the trainer should not be using them in isolation.

All trainers' interventions were weak, and it was not surprising because they were limited to shaping ideas and checking understanding here and there. This was also noted by all the teachers. During the interviews, they indicated that the ICT trainers' intervention did not help them much to learn what they learned during ICT training and that it was each other's help that did so. However, Teacher 2 from Bheki's class acknowledged that his facilitator was key in learning what he learned, because in instances where he lacked knowledge, he asked for assistance from other teachers and stirred up a discussion that resulted in them learning from each other. From this end, it is important to emphasise that in as much as ICT trainers' interventions were minimal in all training sessions, teachers in Bheki's and Tumi's class mediated their own learning, especially their pedagogical skills. In Sive's sessions, however, teachers were unable to help each other as much, because they were using one Smartboard. From this, it can be deduced that meaningful intervention was affected by two things: Lack of subject knowledge on the part of the trainers and lack of teaching material. Teaching material was only an issue in Sive's class, because she was teaching how to use the Smartboard and there was only one Smartboard.

Looking at how these trainers intervened during ICT training from the theoretical framework perspective of this study, the intervention only had shaping of ideas and checking of understanding. This was done through the mere presentation of an idea or asking teachers if they understood. These were created by a gap that existed in their body of knowledge, because all three displayed a sound understanding of ICT skills (technology), but had no content and pedagogy knowledge. In Tumi's and Sive's sessions, teachers gave answers in the only way they knew: They simply presented answers, which were accepted as correct.

According to Mortimer and Morris (2003), meaning making requires understanding wholes as well as parts and which parts must be understood in the context of wholes. Therefore, the learning process focuses on primary concepts, not isolated facts. Drawing from this context, in all training sessions, meaning was only developed in parts and never got to a stage where it was consolidated as a whole because of a lack of subject knowledge from the ICT trainers. An essential concept in the constructivist view is that learning always takes place in a context and that the context forms an unavoidable link with the knowledge embedded in it (Ertmer & Newby, 2013).

For effective meaning making, answers need to be refined for efficient learning, but refining can only take place if there is relevant knowledge. In this case, there was a knowledge gap. Thus, answers were not refined, because in all instances one teacher would answer questions and there was no one to refine them. Learning is a search for meaning, and therefore it must start by participants actively trying to construct meaning with the ICT trainer, mediating what needs to be learned. According to Kärki et al. (2018), trainers provide teachers with opportunities to construct knowledge collaboratively, and learning becomes a joint and social activity. Therefore, in teaching and learning environments, there is a sense of shared expertise and ongoing conversation on the content. It is very important to note that other intervention elements, such as mark key ideas, share ideas, and review ideas, were not visible because the ICT trainers did not have content and pedagogical knowledge.

These findings show that the participants learned ICT pedagogical skills from each other, even though they were unaware that they possessed some ICT pedagogical skills, even prior to ICT training, that could help each other. The ICT trainers' lack of ICT pedagogical skills disadvantaged the whole process of teaching and learning because the trainers could not mediate beyond mediation of intentionality and reciprocity. This means the classes were unable to have a deep engagement with ICT pedagogical skills as the 'skill' that was targeted for

this training. As a result, trainers could not transcend something they did not know. This also applied to meaning making.

It was surprising to look through the analytical framework lens of the study and witness that the ICT trainers lacked the ICT pedagogical skills that are supposed to help them intervene as teachers help their learners learn better. The teachers' input in the discussion was not only encouraged but also valued. Trainers should act as a discourse guide (Hakkarainen et al., 2007). Conversely, teachers who claimed in their interviews that they do not have ICT pedagogical skills, noted that pedagogy and content knowledge were able to assist with the little that they have when it came to ICT integration in the classroom. The question now is how best can teachers, who can teach each other, be upskilled to perfect the skills that they already have. ICT trainers were recorded during the observations doing more modelling of technological skills than intervening with ICT pedagogical skills. How the trainers modelled their technological skills is presented in the following section.

Modelling of ICT Skills (Approach and Actual Practice)

Pratt and Johnson (2009) noted modelling as an instructional strategy in which the teacher demonstrates a new concept or approach to learning that the learners learn by observing and are then expected to perform later in the classroom. It is more than just giving a visual representation of content; rather, it is a process where learners can imitate developing their own skills and understanding. I was not anticipating to see modelling during training and it was not part of the initial theoretical framework, but this study takes the stand point that the modelling approach will help teachers develop their ICT pedagogical skill in the classroom with the ICT trainer as mediator of learning. The trainer should model exact ICT pedagogical skills that teachers are expected to have at the end of the training.

Modelling was observed from all three trainers, but they differed in how they were doing it. The way teachers were introduced into the lesson was an indication

of how the lesson was going to unfold. Among the three trainers, Bheki's modelling approach was well orchestrated and gave the teachers an overview of the whole lesson. This helped because the teachers knew what was expected of them during the session. Bheki indicated what he would do first and then gave them a chance to try it out. Tumi's approach, on the other hand, was confusing because he explained the technology that he was going to use, which was PowerPoint, yet he mentioned that they were not doing it as yet. Clear instruction is paramount in the teaching and learning environment as it determines whether the lesson will succeed or fail. If teachers get confusing instructions at the beginning of the training, they are likely to be confused throughout the session. Research by Levy (2007) indicated that giving clear instructions or an ability to explain things well is noted by most training participants as an important quality of a good trainer. In this aspect, Bheki's teaching background worked to his advantage, because he was able to give clear instructions to the teachers. It is also important to note that Sive's modelling approach was different because she was teaching the basic use of the Smartboard but only had one Smartboard in the class to demonstrate with. Sive was considerate of her teachers, because she envisaged that they might not see well if they were sitting at their tables and organised them to come forward. In this set up, Sive was the only one who dominated the lesson with teachers were at the receiving end.

Observations indicated that the approach to modelling was different for each trainer and actual modelling was different too. As a result, ICT pedagogical integration followed suit in the classroom. Actual modelling of ICT skills contained different levels of interactivity; however, there was limited opportunities available for the teachers to engage with the presentation to try and apply the skills on their own. This is incongruent with modelling as a teaching strategy, because modelling is supposed to help learners see what it is that they are to produce as the end product and also to give them the chance to try it on their own. In Bheki's training sessions, he demonstrated and also gave teachers the opportunity to do it on their own and then followed up to see if they

were coping with the task. According to Pratt and Johnson (2009), educators can abstractly explain to learners how to perform a certain task, but when they give them an actual activity to do, learners can literally "see for themselves" what was presented to them and make their own connections that result in meaning making. This indicates that when we combine the general explanation of a task with a concrete model of what their process should look like, we give learners a direct image of their targeted outcome. This means that in ICT training, trainers should demonstrate ICT pedagogical skills to teachers and also give them an opportunity to practise them while they are still in the training. Pratt and Johnson (2009) further argued that demonstrating and allowing teachers time to try the skill out will make it easy to give guidance and do comparisons as they can orchestrate their work to emulate the model and ask themselves 'Does mine match the example or do I need to make improvements?'. This is consistent with constructivists who believe that the mind filters input from the world to produce its own unique reality (Jonassen, 1991). By so doing, it will assist teachers to perfect the ICT skills learned and to improve their confidence to subsequently promote ICT pedagogical interaction in the classroom. As Gadelshina, Vemury, and Attar (2018) pointed out, a clear demonstration of what the outcome looks like will help students see how the individual tasks they are performing contribute to their growing set of skills and knowledge.

It is the 'how' and 'what' of modelling that produce effective results. If trainers decide to stand in front of the class and show teachers where to click without deep engagement with teachers on how to integrate the learned skills into their teaching and learning, it will be limited to what is modelled in class. Bheki and Sive tried to connect what was already known to teachers to what was unknown to them. Sive explained to teachers, "*A Smartboard is not different from the smart technology you use every day*". According to Vygotsky (1987), there should be a connection between spontaneous knowledge (everyday knowledge) and scientific knowledge, because spontaneous knowledge provides foundations for scientific knowledge. He believed that everyday concepts do not add much to student

cognitive development, because they are based on already existing cognitive mechanisms. The connection of what is already known with the unknown is noted as pivotal in training sessions to draw teachers' interest and open channels for engagement. Modelling was incorporated as a means to help trainers to mediate their ICT skills to teachers. However, it was noted that teachers from Bheki's and Sive's classes had an advantage over teachers that attended Tumi's class, because they were able to link what they were familiar with to scientific knowledge.

Modelling is a teaching strategy that is widely used in the teaching and learning environment, especially teaching content that requires demonstrations or teaching skills. During ICT training, all trainers demonstrated the skill that they wanted teachers to learn, however, only Bheki granted teachers an opportunity to try it out. This was impossible for Sive because there was only one Smartboard. This meant that teachers needed to memorise everything that she was doing and try it out when they were back in their classrooms. There is a huge possibility that these teachers will have forgotten by the time they try this out. As for Tumi, he was moving too fast and never bothered to check if the teachers were trying out what he was presenting. It was evident in his modelling that he assumed teachers know what they are supposed to do as he presented. Only Bheki's modelling, to a certain extent, carried the true sense of modelling, whereas the other two's main focus was on modelling not in knowing what happens there after. Modelling variations observed do not support what is known in modelling literature: 'as I do, you do'. This is the key construct of modelling theory, as theorists believe that learning occurs as a result of emulating what was presented to them. If the trainer only applies 'I do' and leaves out 'you do', learning cannot be guaranteed. From the theoretical framework perspective, the way Sive and Tumi modelled ICT skills for teachers does not support mediated learning and it only covers one level of teacher intervention, which is the sharing of ideas. Mortimer and Morris (2003) established that using intervention levels in isolation does not promote meaning making. Therefore, if ideas are presented

to teachers without letting them try them out in the presence of the trainer and colleagues, the onus lies with them in their own time. In this situation, learning of ICT skills is not mediated and there is no interactive dialogue. It is just the presentation of skills. As a result of this, one would argue that there is no, or limited, learning that takes place in this situation. Gadelshina et al. (2018) argued that if modelling strategies are followed appropriately, there is a fair chance that learning will take place. For example, at the beginning of a lesson, or when new material is being introduced, the teacher has a prominent role in the delivery of the content through the 'I do and you do' strategy. When this strategy is followed, mediated learning is likely to take place at all levels. The 'I do, you do' strategy is sometimes referred to as 'I do it, we do it, you do it'. This is the 'I do' phase. Trainers seem to have done well in this phase of modelling, because all of them were showing/demonstrating skills first. Trainers, as mediators in the training, were expected to lead the training with demonstrations of what teachers are supposed to learn.

The significant difference was noted in the 'you do' phase. In both sessions, Bheki gave teachers support as they were trying out learned skills to ensure that the navigation is not too complex to them. Pratt and Johnson (2009) further explained that in the 'you do' phase, learners acquire new information and skills and the responsibility of learning shifts from teacher-directed instruction to learner processing activities. The 'you do' phase in Tumi's sessions was characterised by fear of being left out and confusion. Teachers were given the opportunity to apply skills on their own; however, there was no support from Tumi as the mediator and support was limited to support coming from colleagues. As Tumi remained standing in the front, even when the teachers were confused, he could not help. This was worrisome, because if the teachers cannot try skills learned in class during the training, the chances are they will lose interest and develop a negative attitude to ICT integration. Consequently, training will be regarded as useless. Sive's case was a mixture of limited support and no support. In the first session, she was able to assist teachers as they were

navigating the basic use of the Smartboard. Her support was limited to what the teacher could do at a given time because she was using one Smartboard. This was a disadvantage because teachers were only subjected to do what Sive asked them to do. There was no time to try out something new with the Smartboard. In session two, support was noted, but the way it was done benefited only the teachers in question because Sive kept the question between her and the teacher who asked. The study inferred from the ICT training that teachers did not get enough support from trainers as mediators to evaluate their level of understanding and give them feedback on their work. This is a crucial time when teachers are trying it out themselves, because this is when the trainer will notice the red flags for the ones that really need support.

Based on modelling literature, there are three phases for effective modelling: 'I do' phase, 'you do' phase and 'we do' phase. This model proposes a plan of instruction that includes demonstration, prompt and practice. In this study, the 'I do' and 'you do' phases were evident, especially in Bheki's sessions. However, the 'we do' phase was not part of the training. According to Eggen and Kauchak (2001), in the 'we do' phase of learning, the teacher continues to model, question, prompt and cue learners, but as learners move into the 'you do' phase, they rely more on themselves and less on the teacher to complete the learning task. It is clear that during this phase, learners begin to perfect the skills and develop confidence with applying the ICT skills learned. If this phase is skipped during ICT training, the teachers are deprived of the opportunity to polish the skills learned during training. This stage is where the ICT trainer provides interactive instructions and where mediation of intentionality and reciprocity come in to play as the learners work together and the teacher checks prompt and cues.

The ICT training provided does not give teachers enough time to learn the ICT skills they need to infuse with pedagogy with ICT when they teach. This is due to a number of reasons, like limited resources available in the training centres, like the Smartboard. If trainers only give them the chance for 'you do', some are

supported and others not. There is a lack of clear direction on how to go about learning ICT pedagogical skills that will eventually play out in the classroom.

Modelling as teaching strategy that is adopted by the trainers has the potential to develop teachers' ICT pedagogical skills. The incorporation of an ICT trainer's intervention where they shape, share, and mark key ideas, check understanding and MLE has room for deep engagement with ICT pedagogical skills. During modelling or demonstrations, the ICT trainers can probe learners to check their understanding. In this way, ICT trainers and teachers can explore new means of ICT pedagogical skills that are central to effective ICT integration in the classroom. Shaping ICT pedagogical skills and ideas assists teachers to arrive at different viewpoints about ICT integration. Through sharing ideas, teachers will get an opportunity to show how they integrate ICT into teaching and learning in their classroom, which will benefit everyone in the classroom. This might also help the ICT trainer to mark key ideas around ICT pedagogical integration and improve ICT integration in the classroom.

Intertwining modelling and MLE in teaching teachers ICT pedagogical skills allows both trainers and trainees to talk/participate and think individually in groups or as a whole class. It makes more sense because the trainer can deliberately guide the interaction between trainees through mediation of intentionality and reciprocity, where the mediator makes sure that the learner in some manner goes beyond the immediate needs of the ICT training, which would not occur without the mediator's/trainer's presence. Changing an incidental ICT pedagogical skills learning experience to an intended one that is required in the classroom.

Imparting ICT pedagogical skills meaning provides teachers with the will power to keep them involved in the interaction that is taking place during modelling. The trainer makes meaning available to the social plane of the classroom. Integrating modelling and MLE grants the opportunity for dialogue that is aimed at developing deep engagement with ICT pedagogical integration during ICT

training. The main objective is to achieve a stage of ICT pedagogical transcendence. This is where the ICT trainer spikes debate and discussion about ICT pedagogical skills that connect present and future; elicits thinking among teachers; and provides an explicit explanation about how teachers are supposed to integrate ICT into teaching and learning. This involves moving beyond the immediate ICT pedagogical skills needed and onto developing the potential to apply it elsewhere in slightly different ways. This is the heart of mediation.

6.1.1 ICT Pedagogical skills in the training

The effective integration of ICT into the curriculum is associated with new pedagogies that enhance the role of the teachers and increases learners' control of their learning, self-regulation and collaboration. ICT training holds promise to provide teachers with opportunities to explore and develop deeper understandings of professional ICT knowledge, professional ICT practice and professional ICT values for effectively integrating ICT to enhance learning and teaching. This corroborates with the constructivist approach that considers learners active participants in making meaning, instead of passive recipients of information given to them by the teacher. In ICT training, teachers are immersed in the experience and then the trainer provides encouragement and questions the teacher to guide them to reflect upon their ICT pedagogical practices and construct and display their own explanations.

The literature shows that technology can effectively improve pedagogical abilities, and hence, learners' performances (Louw, Muller & Tredoux, 2008). In spite of teachers often being constrained by the ICT resources available to them, there are examples in the literature of educators appreciating the technology when it is integrated into pedagogy. Cox, Preston and Cox (1999) showed that many educators perceive ICT as a tool for improving the presentation of material, for making lessons more fun for the learners and for making administration more efficient. In addition, ICT provides fast and accurate feedback to learners (Becta, 2003). When teachers were asked during the interviews what they learned during

ICT training, their answers were limited to ICT tools. For example, both participants in Bheki's training, Mr Gumbi and Mr Dube, mentioned that they learned Microsoft packages, though Mr Gumbi was more specific and said that he learned tables, which is Word, and formulas, which is Excel. This means that the trainers' modelling was limited to ICT basic skills, and this also indicates that there was an ICT pedagogical skills gap in ICT training.

ICT basic skills are noted in literature as a prerequisite for effective ICT integration. However, teaching only basic skills during ICT training does not move teachers beyond understanding ICT tools in isolation of the subject they teach. According to Koehler and Mishra (2009), teachers must have the TPACK for them to maximise the potentials of technology. I agree with them, because teachers, especially in Gauteng, for the longest time have been trained on computers skills. Post training, teachers fail to integrate ICT skills in teaching and learning.

At the beginning of training, the trainers explained to the teachers how they were going to work, "*We will work like this for five minutes (facilitator-led demonstration) 10 minutes (teacher self-exploration). If you do not understand as I demonstrate, please stop me*". Bheki even said, "*I am here to reasonably assist you during the training contact, so if you struggle with something feel free to ask for help*". Here, Bheki was trying to make teachers feel at ease. But what does this mean? Should teachers ask what is being demonstrated to them or should they ask questions related to ICT integration intended for the classroom?

Modelling as a teaching strategy has the advantage of making abstract concepts easily accessible to the learners (Pratt & Johnson, 2009). The challenge with Bheki's modelling is that it lacks ICT pedagogical skills. Novice teachers find it difficult to engage at a TPACK level and they are limited to questions about ICT tools. The classical example of the aforementioned is Mr Dube, who asked: "*Is it possible to do perform calculations in Microsoft Word?*" From ICT training observations, we can infer that modelling as a teaching strategy limits teachers'

thinking. If teachers imitate the ICT trainer straight after the trainer has just modelled steps, there is a risk that they are doing little more than copying. However, this limitation could be avoided by building in a gap between the example modelled by the trainer and the one that teachers have to do, so they do not have to produce exactly the same product as the trainer. This means that the trainer needs to model ICT skills at a high level, in order to challenge their thinking. This will assist in fostering an independent culture that teachers need when integrating ICT in their classrooms.

It was clear from ICT trainers' presentation that they have high knowledge of basic computing but lack ICT pedagogical skill. Trainers were hoping that teachers will bring their pedagogical knowledge and they (the trainers) will bring ICT skills, so the two will complement one another and the class will experience ICT pedagogical integration. During observation, Bheki kept saying to teachers "*Think how you are going to use this … in your subject*". This observation displays a gap between teachers' ICT pedagogical expectations of ICT training and ICT pedagogical skills that ICT trainers can offer. Literature seem to agree that ICT training that is offered to teachers does not help them develop ICT pedagogical skills needed for effective ICT integration in the classroom. Based on the theoretical framework for this study, the ICT trainer is supposed to model ICT pedagogical skills for teachers clearly as more knowledgeable than someone in the training. They should not expect teachers to learn these skills simply by virtue of being in the ICT training. For deeper understanding of ICT pedagogical skills, they need to take the shape of an apprenticeship. According Dennen (2012), an apprenticeship is a trade where learning occurs as an experienced person and novices interact socially while focusing on completing a task. Pratt and Johnson (2009) proposed five stages for cognitive and intellectual modelling (p. 99):

1. Modelling by the master and development of a mental model/schema by the learner.

2. Learner approximates replication of the model with the master providing support and feedback (scaffolding/coaching).
3. Learner widens the range of application of the model with less support from the master.
4. Self-directed learning within the specified limits acceptable to the profession.
5. Generalising: Learner and master discuss how well the model might work or would have to be adapted in a range of other possible contexts.

Through these stages, teachers will learn appropriate ICT pedagogical skills and will also gain confidence. In addition, Liu (2005 p. 3) explained that apprenticeship learners observe how experts deal with problems in an authentic context and learn to solve the same or similar problems by "learning through guided-experience" in authentic activities.

These findings are consistent with those of other studies that suggest that most ICT teacher training is poorly structured and emphasis is directed to gadgets (technology) and learning technological skills. Technological skills are a prerequisite for ICT integration, however for effective ICT integration, ICT pedagogical skills are also needed. Therefore, ICT training should also contain ICT pedagogical skills that are relevant for the classroom. Guskey (2009) noted that teachers are the ones chiefly responsible for implementing what was learned in the training, therefore professional development, regardless of its form, must be relevant and directly address classroom needs. I agree with Guskey, because modelling as teaching strategy (that was used by Bheki in ICT training) should deeply embed ICT pedagogical skills that will allow teachers rapid adaptation in the classroom's real world conditions. This will assist in acculturating teachers with ICT skills needed for effective ICT integration in the classroom. Zepeda (2011) asserted that it is difficult enough for practitioners to learn features of one innovation, let alone figure out how it can be integrated into or combined with others. Each year programmes are introduced in schools without any effort to show how they relate to those that already exist. Guskey (2009) maintained

that professional developments need to be sufficient in scope to challenge professionals and kindle interest (and have an impact on teacher's classroom practice).

6.1.2 Subject specific pedagogy

It is important that teachers have an in-depth understanding of the subjects that they teach, but knowledge of subject matter alone is not sufficient to ensure that they will be effective and that students will be successful in their learning. To be effective, teachers must also have an understanding of their students' interests and styles of learning. According to Aldermann (2004, p.15), "the knowledge base of motivation is so extensive that the crucial factor is making the best choice for a particular problem. If we have not learned the extensive motivational knowledge base, then our choices are limited".

It is believed that ICT–supported learning environments could be beneficial to a constructivist teaching approach (Newhouse, 2002). One of the most important components of the constructivism theory of learning is the concept of proximal learning, which asserts that learner construct their own knowledge, for which scaffolding is initially required. The scaffolding could be provided by a tutor or computer. Thus, the technology can be used to help create the types of learning environments and the types of support for learning that are known to be ideal. These are argued, in this paper, to have been ignored or have been failed to be widely implemented in the past (Newhouse, 2002, p. 10).

Appropriation of ICT Pedagogical Skills in the Classroom

During classroom observations, it was noted that teachers' ICT integration was varied. This was owing to a number of facts, including the training that they have received. The importance of developing ICT skills from a pedagogical perspective is that the teachers' reflective use of those skills presupposes or mirrors what was modelled to them during ICT training. Fischer (2009) and Fischer and Bidell (2006) maintained that around the variability of development and learning does

not rule out progress in the adoption of technology in education settings. However, progress will be a dynamic and uneven process that ultimately results from the interaction between student, teacher, subarea of knowledge involved, and the technology itself. It depends on the teacher's adoption of ICTs when integrating them into the system of symbols present in any education setting.

Teachers' appropriation level reveals a certain level of understanding of ICT. Mr Khulu, who was in Tumi's training session, seemed to be in control of everything that was happening in class. When he moved to the subtopic recording transactions using the periodic system in the journals and ledger, he switched to Excel and he had prepared a spreadsheet with formulas to assist with totals and some basic calculations of this topic. The Smartboard now and then froze but Mr Khulu had mastered all the formulas and looked so relaxed. He was navigating between sheet 1 and 2 and experienced no challenges. You could see that the learners were following what was presented in the classroom. They kept asking the teacher how to create formulas and he showed them.

Appropriation and adoption refer to how teachers incorporate ICT into their daily classroom activities. Adoption is linked to the knowledge that teachers develop of ICT, the instrumental use they make of it and the changes they make to adapt it to their educational practices (Fischer, 2009). Various levels of ICT adoption, from the simplest to the most complex, was observed from the teachers. These levels range from using ICT to streamline operational processes in the classroom (by conveying content more efficiently to learners, which require the teachers to be aware of ICT potential) to advanced levels, where teachers deliberately integrate technology to generate educational experiences that would be difficult to implement without the use of ICT.

Despite the fact that the levels have some hierarchical characteristics (or the ability to move up from basic to advanced levels), they are not mutually exclusive and may not involve a linear and gradual progress. The same teachers may have practices that could be classified at different levels of adoption. Such variability

can be understood by seeing adoption as a complex phenomenon based on multiple factors. As with many other knowledge construction processes, this depends on factors such as prior knowledge, the implicit and explicit learning theories of the teachers, their representations of ICTs, the ICTs available, the number of students, the teachers' intentions, and the students' intentions. In terms of the ideas of these, variation in ICT integration was evident in Mr Dube's integration during his lesson. These are the notes I took during his lesson:

> *Mr Dube is teaching using Smartboard, smart note to assist him with calculations. He first modelled calculation steps to the learners on the board and he also referred learners to textbooks especially to pages where there are examples of calculations. He took learners through: variable cost, fixed cost, unit cost, and break-even point.*
> *Then he calls learners on the board to come and do some calculations. In this stage he opens a new black document and allows learners to use free-hand writing so that everyone in the classroom can see what is on the board ….*

Advances in levels of adoption involve the reflective use of ICT. This is deliberate and arises from experiences and ongoing practice as part of a process of reflection that enables teachers to review their practice and propose better suited and more effective ways of incorporating ICT into teaching and learning. In other words, the coherence and relevance of content, learning objectives, teaching strategies and the use of ICT increases in direct proportion to the level of reflective integration of technology within teaching.

Mr Khulu, in one of the slides he hyperlinked audio, unfortunately it did not play during the presentation. He tried to troubleshoot but he was not lucky and learners were also giving him tips on how to retrieve or to get it to play but none of the tips worked.

Yes why? Yes he did however, he still makes some mistakes that take time from his lesson and I have noted that in his presentation he is limited to what was

done during ICT training. He did not try to advance or to look for better tools to bring life to his lesson.

Teachers must be well prepared if they are to use ICT efficiently within their teaching practice. Although some progress may be intuitive, teachers need to deliberately create meaning around the use of ICT in education and to move towards a model of learning with technology, using it to promote meaningful learning (Caicedo, Montes & Ochoa Angrino, 2013; Jonassen, Carr & Yueh, 1998; Martí, 2003; Montes, 2007).

Understanding Teachers' ICT Integration in Light of ICT Pedagogical Skills Learned

The purpose of learning is for an individual to construct their own meaning, not just to memorise the 'right' answers and regurgitate someone else's meaning. Teachers were expected to make their own meaning during ICT training. This study showed unprecedented findings. Mr Gumbi, who was a trainee in Bheki's session, had ICT integration that was on a higher level than what they were trained on. For example, I made the following notes during his class observation:

> *He taught using videos, illustrations, PowerPoint presentations all in one lesson, he was able to use these various ICT for different parts of the lesson he was teaching. With regards to the videos, he downloaded the videos onto his memory stick and used it during his lesson. He would pause a video at certain points and draw learners to certain important or symbolic parts of the video, while moving around in class and making sure learners were taking down notes.*

It was noted that what he was doing was not part of the ICT training he attended, however, during training he was not that active in correcting ICT trainers and assisting other teachers. This indicates that Mr Gumbi attended training already having ICT pedagogical skills that he learned somewhere else. At first, I could not work out why he was not showing other teachers what he did in class during training, because Bheki kept on asking them how they integrate ICT in their

teaching and he kept quiet. When he was asked during interviews, he indicated that he already had ICT skills, but he needed motivation to start integrating ICT into his teaching. He emphasised that he drew his strength to start from the ICT training environment. He said,

> *When I saw how teachers with little ICT knowledge are trying their best to integrate ICT into their teaching and over and above try to assist during ICT training, I said I can do better than them. It all started there.*

It can be argued that Mr Gumbi's qualification and experience in teaching the subject is an added advantage over other teachers. Simply because when one does postgraduate studies, one is likely to use technology for the studies. His ICT, content and pedagogical knowledge put him in a different position from the rest of the teachers. Gadelshina et al. (2018) emphasised that effective ICT integration requires interdisciplinary knowledge. The only valuable way to measure learning is to make assessment part of the learning process, ensuring it provides learners with information on the quality of their learning. It is also important to make connections between facts and fostering new understanding in learners.

Mr Gumbi's integration was the total opposite of that of Ms Chili. She really struggled to integrate ICT into teaching and learning. This was noted during her classroom observation:

> *At some stage she leaves the board and moves around in the classroom talking to learners. In fact she forgets about it (Technology) and carries on with her teaching without paging e-book that is projected on the board. When she returns on the board she loses track of the pages of what she already explained to learners and she will use a pen to writes on top of the book. For a moment she will forget learners and focus on getting technology right.*

Using technology to teach brought confusion and panic to Ms Chili because she is a novice when it comes to ICT integration, unlike Mr Gumbi. During the

interviews, she mentioned that ICT disturbs her teaching rhythm. Drawing from this, you can tell that ICT training did not help Ms Chili much when it came to classroom integration. Teachers need to develop knowledge of pedagogy of ICT use to make the most of ICT to support teaching and learning (Harris & Hofer, 2011; Ertmer & Ottenbreit-Leftwich, 2013). Ms Chili's knowledge of ICT is still developing, hence she felt disturbed by using technology in her teaching. Effective ICT integration from a constructivist perspective lens includes teaching in contexts that may be personally meaningful to learners; negotiating taken-as-shared meanings with learners; class discussions and small-group collaboration; and valuing meaningful activity over correct answers (Wood et al., 1995). This was not possible in Ms Chili's class, given the frustration brought by integrating ICT into her teaching.

In contrary to what happened to Ms Chili's lessons, during Mr Dube's lesson, the smartboard was freezing too but he was not moved by that. Instead, he told learners that they must not worry about the video that did not play during the lesson he will post it on their WhatsApp group. It can be deduced that Mr Dube's calmness emanate from knowing that he has an alternative way of sharing the video with learners even if the smartboard freezes unlike Ms Chili. However, Capdeferro and Romero (2012) mentioned that teachers become stressed if there is a sudden discrepancy during ICT integration regardless whether they are experienced or not.

This section sought to establish if there was ICT knowledge transfer from ICT training to ICT integration in the classroom. It is not easy to tell if transfer took place because the teachers' levels of integrating differs, with Mr Gumbi excelling at integration and Ms Chili struggling. Thus, owing to a number of reasons, such as the lack of ICT pedagogical skills from the trainers and not having enough training equipment, as was evident in Sive's training sessions, making meaning-making and dialogical processes was impossible.

Conclusion

This chapter presented the themes and subthemes that were generated from the data collected for this study. The following conclusions were drawn from these themes: ICT trainer intervention is minimal, and in some cases invisible, because trainers lack ICT pedagogical skills. As a result, teachers do not benefit much from them. Modelling, a new phenomenon that was not part of the analytical framework, came strongly to the fore from the observations. All three trainers used it as a training strategy, but they were not reaching all the stages of modelling as prescribed in the literature. Trainers were identified modelling technological skills instead of pedagogical skills because they lacked ICT pedagogical skills. The was also the challenge of limited or no understanding of subject content. An interesting point emerged from the teachers, which was their ability to help each other by demonstrating how they integrate ICT in their everyday teaching and learning, which seemed to overpower trainers' knowledge of ICT. It is suggested that modelling be interwoven into the analytical framework for this study, thereby developing an effective mediated ICT training model that will give ICT trainers guidance on how to train teachers on ICT pedagogical skills. The model will be explained in full in the next chapter.

Chapter 7:
The Contribution of the Study and Conclusion

Introduction

The preceding chapter intensely discussed the findings of the entire study. Three themes and their subthemes (mediation of ICT pedagogical skills in ICT training; appropriation of ICT pedagogical skills in the classroom; and understanding teachers' ICT pedagogical integration in relation to ICT training offered to equip teachers with ICT pedagogical skills) were discussed. While discussing the findings, the study used the framework presented in Figure 28 to understand how mediation takes place during ICT training and its subsequent integration in the classroom.

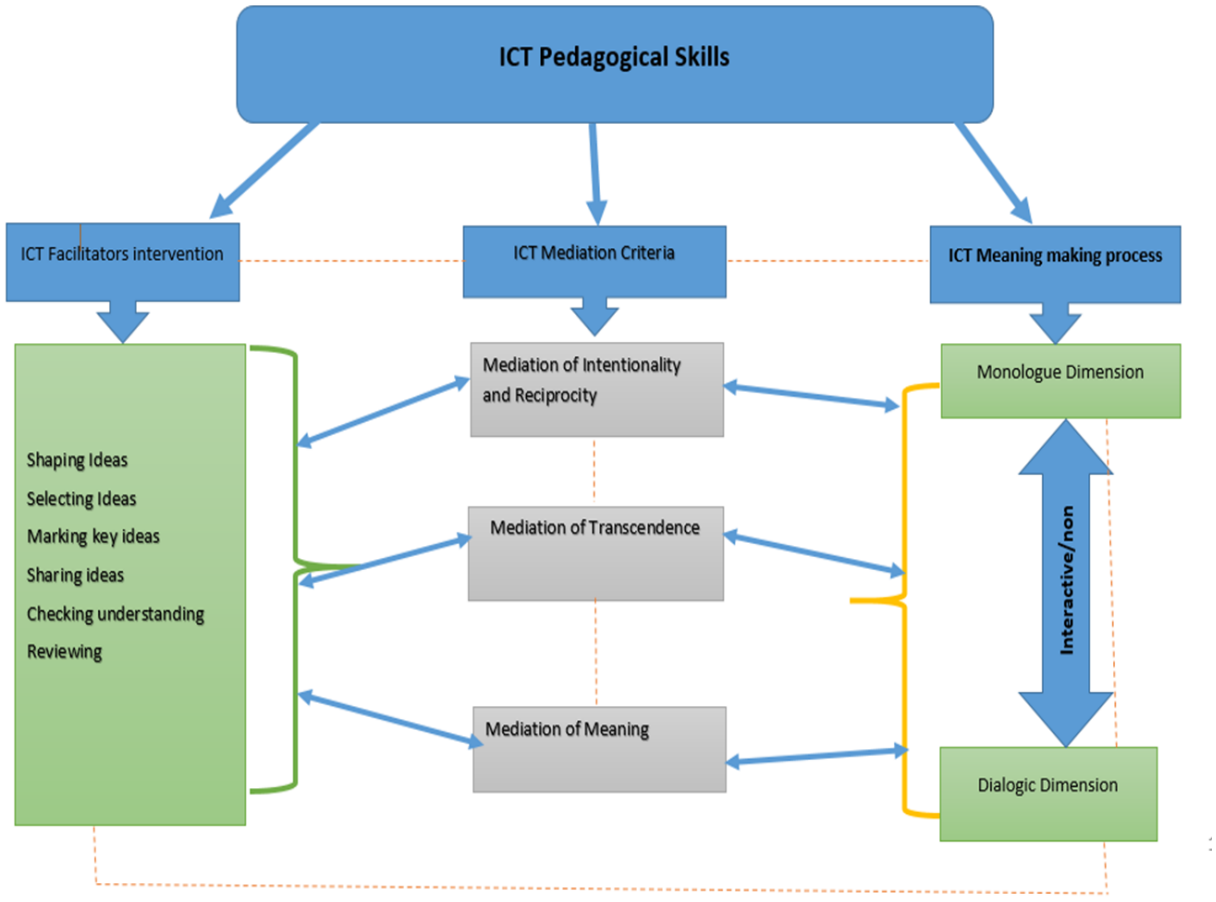


Figure 14 Analytical framework

Using the above analytical framework helped me to understand how teachers were trained and how they integrate ICT after they attended ICT training. Despite that, teachers' integration differed from one another. Data showed that concepts developed (modelling) that were not covered in the initial framework. These concepts mushroomed from the data and were very strong. It was important that they are incorporated in the proposed effective mediated ICT training model presented in Figure 28.

The Contribution of the Study

Despite the narrow scope and limitations of the study, it is interesting to note that it has made significant contributions to the existing body of knowledge in the field of educational technology, and more particularly, in the area where ICT is trusted to bring about change in education that is needed for 21st-century skills. An effective mediated ICT training model is needed to guide ICT teacher training because ICT teacher training is at the heart of effective ICT integration in the classroom. Teachers who receive appropriate ICT professional development learn how to manage their classrooms more effectively and use the technology to create a more stimulating learning environment, while realising that their pedagogic knowledge and technical knowledge are what fuel their effective ICT integration in the classroom (Harrison, 2010, p. 83).

To achieve effective ICT training that which will result in effective ICT integration in the classroom, a guideline is needed. In 2007, the Department of Education designed Guidelines for Teacher Training and Professional Development in ICT to be incorporated in ICT training. This document sets out the ICT knowledge, skills, values and attitudes needed by teachers to effectively integrate ICT into teaching and learning. It also acknowledges that the development of ICT skills and knowledge for teachers should be an integral part of initial and continuing teacher development programmes, as reflected in the National Policy Framework for Teacher Education and Development in South Africa. However, this guideline provides a generic guide on what ICT training should include and does not pay

attention to details about how ICT training should be structured. This study designed an effective mediated ICT training model and provides detailed guidelines on how teachers should learn through ICT training. This is not to overlook the importance of this guideline but to close the gap. This model draws from the theoretical and conceptual frameworks used for this study. The effective mediated ICT training model that reflects a holistic approach to teacher development in ICT is presented in Figure 29.

Figure 34 presents an effective mediated ICT training model that I propose for effective ICT training that will result in effective ICT pedagogical integration in the classroom. This model integrates the concepts of modelling and a MLE. This study is based on the sociocultural learning theory, which describes learning as a social process and the origination of human intelligence in society or culture. According to Vygotsky's theory, social interaction plays a fundamental role in the development of cognition. Therefore, it is important that ICT trainers engage trainees during the training, take into account how trainees learn during the training, and provide a clear demonstration and instructions that are in line with modelling concepts (I do it, we do it and you do it independently). This needs to be interwoven into the concept of MLE (mediation of intentionality and reciprocity, mediation of transcendence, and mediation of meaning). These concepts blended together provide teachers with the necessary scaffolding for ICT pedagogical skills, thereby developing teachers' ICT pedagogical skills and building teachers' confidence that they need for effective ICT integration in the classroom. In the process, teachers learn to work with one another and realise how their peers influence their ability to acquire ICT knowledge and impact their professional development.

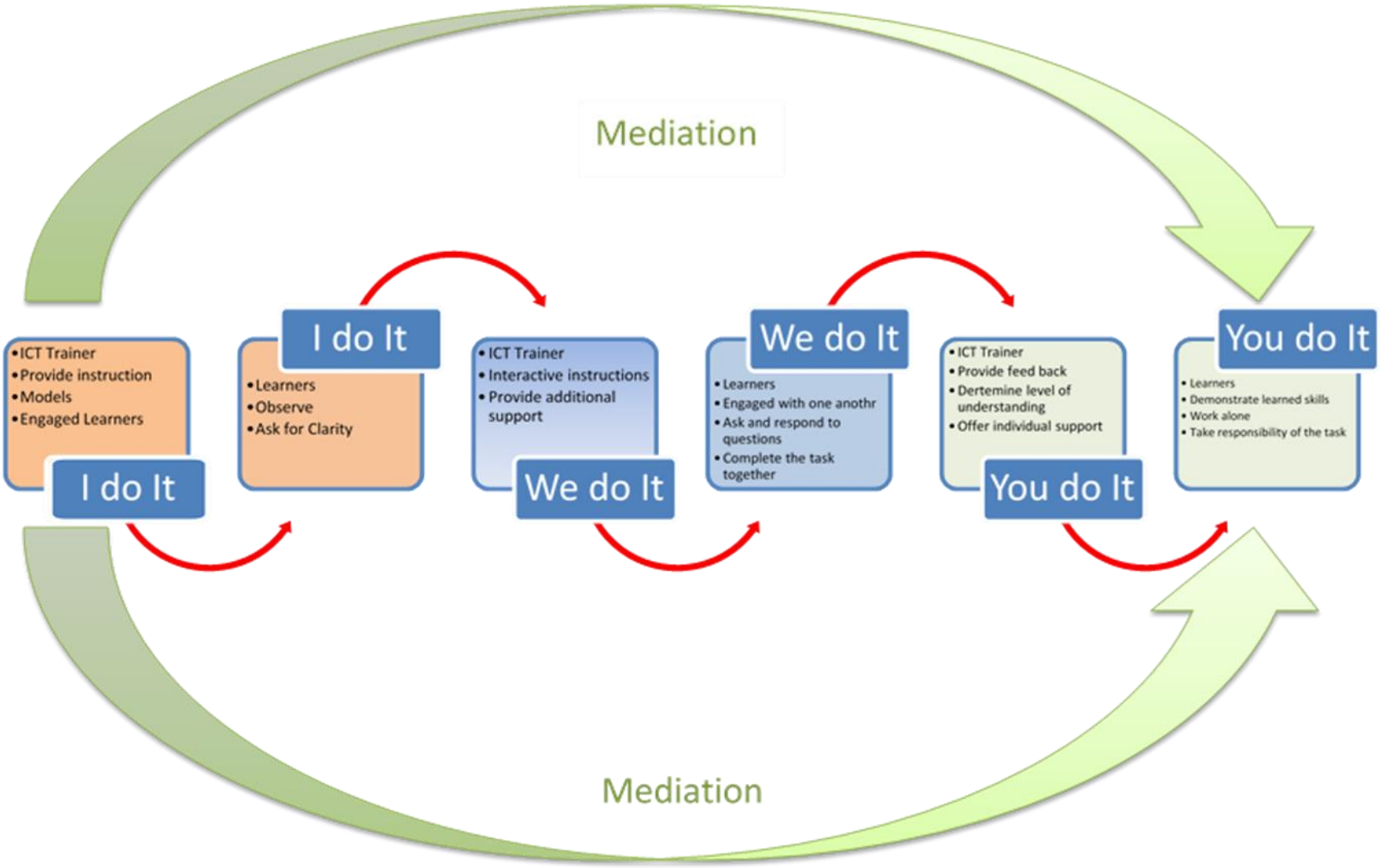


Figure 29 Effective mediated ICT training model

Summary

The previous section presents a model (Figure 29) that is this study's contribution that can be used in ICT training to promote effective ICT integration. It concludes the study, which was particularly concerned with how teachers learn ICT pedagogical skills in the training that is normally conducted in South African schools to support effective ICT integration in the classroom. The study was based on the assumption that there is an ICT framework/model that is used during ICT training to promote deep understanding of ICT pedagogical skills during training that are important for effective ICT integration in the classroom. Having a framework or model also help guide private ICT training service providers and government officials when conducting ICT training and help to avoid a 'willy-nilly' type of training.

The study investigated ICT training to try and understand how ICT pedagogical skills are mediated during ICT training to promote effective ICT integration in the classroom. The study was ignited by the concerns about ICT training that is taking place, especially in South Africa. The training is aimed at equipping teachers with ICT pedagogical skills, but upon completing the training, teachers are reported not to be integrating ICT into their practice. The literature reports that professional development, such as ICT training, is capital intensive yet yields limited results.

This was a qualitative study that was framed within the interpretivist paradigm. The intention was to gain insight into to how ICT skills are mediated during ICT training to promote effective integration in the classroom. Three trainers and four teachers participated in this study. All participants were purposefully selected to suit the needs of the study. Given that the study was qualitative in nature, observations and semi-structured interviews were incorporated to understand the realities for both teachers and ICT trainers.

To gain a deep understanding of the phenomenon at hand, sociocultural theory was used as the theoretical framework as the lens to zoom into the study. The

study did not use the whole concept of sociocultural theory, but only focused on the construct of MLE. MLE was used to understand how mediation advances ICT training to promote meaning making and also to gain clarity on how participation and interaction with ICT trainers and among teachers help promote effective ICT integration in the classroom. Literature was reviewed to understand what has been done locally and internationally in understanding teachers' learning during ICT training and also to identify the gap that exists in mediated learning during ICT training. From the literature that was reviewed, a conceptual framework was designed.

Reflection on the Findings

The study looked at the studies that have been done internationally and locally, trying to understand how teachers learn during ICT training. The following were the findings based on the research questions for the study.

1. What mediational role does the ICT trainer play in the development of teachers' ICT pedagogical skills?

It was noted in the observations and interviews that ICT trainers' mediation is very limited and does not assist in getting teachers to effectively integrate ICT into teaching and learning. The reason noted was that no ICT trainers have ICT pedagogical skills, however they are experts in basic computer skills.

2. How do teachers appropriate the ICT pedagogical skills that aid their instructional practice in the classroom?

Classroom observations revealed that teachers are at different levels of ICT integration. Teachers from the same ICT training group integrate ICT differently. Teachers who were in the ICT training, where a certain level of mediation and support was evident, integrated better than those who did not have the same input from the trainers. It is worth noting that the mediation and support came more strongly from colleagues than from the trainers.

3. What is the relationship between ICT pedagogical skills learned during ICT training and subsequent use of ICT in the classroom?

ICT integration in the classroom presented a skewed picture, because teachers were doing much more advanced things in the classroom. Some of these were not even part of the training. When they were asked during their interviews, they mentioned that they already had basic ICT skills prior to ICT training. This was not a surprise because both these teachers have postgraduate degrees. That means that all they needed to do was to start integrating ICT into teaching and learning. Maybe ICT training helped them to see that the skills they possess are even better than those of a trainer and they gained confidence from that. One teacher was really struggling to integrate ICT into her teaching. She was surviving with her learners' assistance and the notes that she usually keep to help her with technology. ICT training helped her to get started.

After understanding the nature of ICT training in Gauteng province, an effective mediated ICT training model was presented in Figure 29. It is designed to provide guidance for ICT trainers on how to effectively train teachers for effective ICT pedagogical integration in the classroom.

Limitations of the Study

I would have loved to investigate all ICT training that is taking place in Gauteng province; however, there was time constrains for the study and there was very limited available ICT training during the time of data collection. One major limitation that was perceived in the study was that the sample was small and was based in one province of South Africa. Therefore, the results/findings that are provided do not guarantee generalisations as they do not represent the whole country. Three ICT trainers from one organisation form the cases presented in this study. Generalisability of the findings is limited to the nature of their ICT training settings and contextual factors.

The other limitation was that the study did not include learners as participants in the study to see if effective ICT pedagogical integration improve learners' attainment of knowledge.

Recommendations

Drawing from the findings that emanated from this study as well as from engagement with the literature, pertinent recommendations are consequently warranted. These recommendations have been developed to inform the Department of Education, especially policy makers, ICT training organisations and the academic community. It is strikingly clear that ICT adoption and appropriation in the classroom is still lagging behind, despite huge financial investments made by the various tiers of government in infrastructural provisioning and ICT training for teachers. In view of this, the study makes the following recommendations to improve the process of ICT training and enhancing effective ICT integration.

7.1.1 Develop ICT champion teachers

The findings show that there are gaps in the sets of knowledge possessed by both ICT trainers and teachers. This study suggests that ICT training should be done by teachers. Notwithstanding the fact that most teachers do not have technological knowledge, in developing ICT champion teachers, teachers need to undergo comprehensive ICT training to develop relevant ICT skills that will empower ICT integration in the classroom. Upon finishing training, these champions must train other teachers.

7.1.2 Training model

The literature indicates that the ICT training space is open in that ICT trainers, train teachers the way they see fit, because there is no clear guideline on how they should go about training. As a result, after training teachers find it difficult to integrate ICT into teaching and learning. This study emphasises the

importance of having an ICT training model that will provide guidelines on how ICT training should be carried to ensure it promotes meaning making during ICT training and consequently promote effective ICT integration in the classroom. Dlamini and Mbatha (2018 p. 18) suggested that "… to change education and improve core activities in the educational setting through ICT, the implementation must be accompanied by meaningful and effective ICT teacher development activities". Thus, this study argues in favour of the effective mediated ICT training model (Figure 34) that will promote effective ICT integration in the classroom.

7.1.3 Subject specific ICT training

Subject based learning opportunities were identified during ICT training, but most of the time these were missed because the trainers were unable to identify them and did not have knowledge of the specific subjects. It was interesting to see that teachers were able to connect the dots on their own because they always came through when ICT trainers came short. This study echoes the call for subject specific ICT training that is advocated for in the literature.

7.1.4 Qualified trainers

The findings of this study revealed that all three ICT trainers were not qualified ICT trainers. However, one of them has a diploma in primary school education. The study advocates for qualified ICT trainers who will be able to handle ICT pedagogical issues and be able to show teachers the pedagogical value of ICT in education. The use of ICT will encourage teachers to use their creativity to enhance teaching and learning. Having qualified ICT trainers will help eliminate confusion, such as that which was evident during ICT training, because of a lack of ICT pedagogical knowledge.

Conclusion

This chapter presented the study's contribution to the field of educational technology. It highlighted the importance of the existing *Guidelines for Teacher Training and Professional Development in ICT (2007)* and also pointed out gaps that exist in the document. In closing those gaps, it introduced a model that can be used during ICT training. The chapter further provided a summary of the study, a reflection on the findings, and recommendations.

References

Abuhmaid, A. (2011). ICT training courses for teacher professional development in Jordan. *Turkish Online Journal of Educational Technology-TOJET*, *10*(4), 195–210.

Aldermann, MH, Cohen, H., Roque, R., Madhavan, S., Braun, S., Boyko, V., ... & Neaton, JD (2004). Principles of education in oncology. Dtsch Med Wochenschr , 129 , 768-770.

Anney, V. N. (2014). Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria. *Journal of Emerging Trends in Educational Research and Policy Studies, 5*(2), 272–281.

Balanskat, A., Blamire, R., & Kefala, S. (2006). *A review of studies of ICT impact on schools in Europe*. European Schoolnet.

Ball, D. L. (1993). With an eye on the mathematical horizon: Dilemmas of teaching elementary school mathematics. *The Elementary School Journal, 93*(4), 373–397.

Bassey, M. (1999). *Case study research in educational settings*. UK: McGraw-Hill Education.

Baylor, A. L., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms?. *Computers & Education*, *39*(4), 395–414.

Beastall, L. (2006). Enchanting a disenchanted child: revolutionising the means of education using Information and Communication Technology and e-learning. British journal of sociology of education, 27(1), 97-110.

Beastall, L., & Walker, R. (2007). Effecting institutional change through e-learning: An implementation model for VLE deployment at the University of

York. *Journal of Organisational Transformation & Social Change, 3*(3), 285–299.

Becta (2003) What research says about interactive whiteboards. Coventry: Becta. Available at: http:// www.becta.org.uk/page_documents/research/ wtrs_whiteboards.pdf

Belawati, T. (2003). Malaysia: ICT use in education. In *The UNESCO Meta-Survey on the Use of Technologies in Education in Asia and the Pacific (2003–2004)* (pp. 107–110).

Berk, L. E., & Spuhl, S. T. (1995). Maternal interaction, private speech, and task performance in preschool children. *Early Childhood Research Quarterly, 10*(2), 145–169.

Bernstein, B. (1996). *Pedagogy, symbolic control, and identity: Theory, research, critique*. London: Taylor & Francis

Bernstein, B. (2000). *Pedagogy, symbolic control and identity: Theory, research, critique* (Revised ed.). Oxford: Rowman & Littlefield Publishers.

Bertau, M. C. (2011). Dialogue: Where language meets activity-An essay review of 'Language as dialogue. From rules to principles of probability'by Edda Weigand [2009]. International Journal for Dialogical Science, 5(1), 17-36.

Binglimas, K. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science & Technology Education, 5*(3), 235–245.

Birman, B. F., Desimone, L., Porter, A. C., & Garet, M. S. (2000). Designing professional development that works. *Educational Leadership*, *57*(8), 28–33.

Bitsch, V. (2005). Qualitative research: A grounded theory example and evaluation criteria. *Journal of Agribusiness, 23*(345-2016-15096), 75–91.

Bliss, T., & Bliss, L. (2003). Attitudinal responses to teacher professional development for effective integration of educational technology. *Journal of In-service Education, 29*(1), 81–99.

Boote, D. N., & Beile, P. (2005). Scholars before researchers: On the centrality of the dissertation literature review in research preparation. *Educational Researcher, 34*(6), 3–15.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. Educational Researcher, 33(8), 3–15.

Bradley, R. H., & Caldwell, B. M. (1984). 174 children: A study of the relationship between home environment and cognitive development during the first 5 years. In A. W. Gottfried (Ed.), *Home environment and early cognitive development* (pp. 5–56). Academic Press.

Brandt, B. L., Farmer, J. A., & Buckmaster, A. (1993). Cognitive apprenticeship approach to helping adults learn. *New Directions for Adult and Continuing Education, 59*, 69–78

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32–42

Bruner, J. (1962). The new educational technology.

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

Caicedo, AM, Montes, J., & Ochoa-Angrino, S. (2013). Learning from and with technology: some research results on the integration of ICT in higher education. Letter from AUSJAL , 38 , 28-35.

Capdeferro, N., & Romero, M. (2012). Are online learners frustrated with collaborative learning experiences?. International Review of Research in Open and Distributed Learning, 13(2), 26-44.

Carlson, S., & Gadio, C. T. (2002). Teacher professional development in the use of technology. In W. D. Haddad & A. Draxler (Eds.), *Technologies for education: Potential, parameters, and prospects,* Paris: UNESCO and AED

Cartwright, V., & Hammond, M. (2003). The integration and embedding of ICT into the school curriculum: More questions than answers. In *ITTE 2003 Annual Conference of the Association of Information Technology for Teacher Education, Trinity and All Saints College, Leeds*.

Christensen, R. (2002). Effects of technology integration education on the attitudes of teachers and students. Journal of Research on technology in Education, 34(4), 411-433.

Cohen, J. (1992). Things I have learned (so far). In *Annual Convention of the American Psychological Association, 98th, Aug, 1990, Boston, MA, US*. American Psychological Association.

Cohen, L., Manion, L., & Morrison, K. (2007). Observation. *Research Methods in Education, 6*, 396–412.

Collis, B., & Jung, I. S. (2003). Uses of information and communication technologies in teacher education. In B. Robinson & C. Latchem (Eds.), *Teacher education through open and distance learning* (pp. 171–192). London: Routledge Falmer.

Cresswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). California: Sage.

Croft, A., Coggshall, J. G., Dolan, M., & Powers, E. (2010). *Job-embedded professional development: What it is, who is responsible, and how to get it done well. Issue Brief*. National Comprehensive Center for Teacher Quality.

Cushion, C. J., Armour, K. M., & Jones, R. L. (2003). Coach education and continuing professional development: Experience and learning to coach. *Quest*, *55*(3), 215–230.

Danneels, E. (2004). Disruptive technology reconsidered: A critique and research agenda. *Journal of Product Innovation Management, 21*(4), 246–258.

Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: Combining rigour, relevance and pragmatism. *Information Systems Journal, 8*(4), 273–289.

Darling-Hammond, L. (2003). Keeping good teachers: Why it matters, what leaders can do. *Educational Leadership*, *60*(8), 6–13.

De Clercq, F., & Shalem, Y. (2014). Teacher knowledge and employer-driven professional development: A critical analysis of the Gauteng Department of Education programmes. *Southern African Review of Education with Education with Production*, *20*(1), 129–147.

Dennen, V. P. (Ed.). (2012). *Virtual professional development and informal learning via social networks*. IGI Global.

Denzin, N. K., & Lincoln, Y. S. (Eds.). (2011). *The Sage handbook of qualitative research*. Sage.

Dlamini, R., & Mbatha, K. (2018). The discourse on ICT teacher professional development needs: The case of a South African teachers' union. *International Journal of Education and Development using ICT, 14*(2).

Donald, D., Lazarus, S., & Lolwana, P. (2002). *Educational psychology in social conte*xt (2nd ed.). Cape Town: Oxford University Press.

Donato, R., & McCormick, D. (1994). A sociocultural perspective on language learning strategies: The role of mediation. *The Modern Language Journal*, *78*(4), 453–464.

Doughty, C., & Williams, J. (Eds.). (1998). Pedagogical choices in focus on form. In *Focus on form in classroom second language acquisition* (pp. 197–262). Cambridge: Cambridge University Press.

Dron, J. (2012). The pedagogical-technological divide and the elephant in the room. *International Journal on E-Learning*, *11*(1), 23–38.

Du Plessis, A., & Webb, P. (2012). Teachers' perceptions about their own and their schools' readiness for computer implementation: A South African case study. *TOJET: The Turkish Online Journal of Educational Technology*, *11*(3).

Duncan-Howell, J. (2010). Teachers making connections: Online communities as a source of professional learning. British journal of educational technology, 41(2), 324-340.

Earle, R. S. (2002). The integration of instructional technology into public education: Promises and challenges. *Educational Technology*, *42*(1), 5–13.

Eggen, P., & Kauchak, D. (2001). *Educational psychology: Windows on classrooms* (8th ed.).

Elmore, R. F. (2002). *Bridging the gap between standards and achievement* (3rd ed.). Thousand Oaks: Sage.

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61.

Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 26*(2), 43–71.

Ertmer, P. A., & Ottenbreit-Leftwich, A. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers & Education, 64*, 175–182.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255–284.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education, 59*(2), 423–435.

Feuerstein, R., Klein, P. S., & Tannenbaum, A. J. (Eds.). (1991). Mediated learning experience (MLE): Theoretical, psychosocial and learning implications. Freund Publishing House Ltd..

Feuerstein, R., Klein, P. S., & Tannenbaum, A. J. (Eds.). (1991). Mediated learning experience (MLE): Theoretical, psychosocial and learning implications. Freund Publishing House Ltd..

Feuerstein, R., Klein, P. S., & Tannenbaum, A. J. (Eds.). (1991). *Mediated learning experience (MLE): Theoretical, psychosocial and learning implications*. Freund Publishing House.

Fidel, R. (1984). The case study method: A case study. *Library and Information Science Research, 6*(3), 273–288.

Fischer, K. W., & Daley, S. G. (2007). Connecting cognitive science and neuroscience to education. In L. Meltzer (Ed.), *Executive function in education: From theory to practice* (pp. 237–160). The Guilford Press.

Franssila, H., & Pehkonen, M. (2005, May). Why do ICT-strategy implementation in schools fail and ICT-practices do not develop. *In Media Skills and Competence Conference Proceedings* (pp. 9–16).

Frey, L., Botan, C. H., & Kreps, G. (2000). *Investigating communication*. NY: Allyn & Bacon.

Fullan, M., & Hargreaves, A. (2002). *Teacher development and educational change.* New York: Routledge.

Gadelshina, G., Vemury, C., & Attar, A. (2018). Meaningful learning and the integration of responsible management education in the business school courses. *International Journal of Modern Education Studies, 2*(1), 23–34.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, *38*(4), 915–945.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597–607.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of Qualitative Research, 2*(163–194), 105.

Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher, 15*(5), 5–12.

Guskey, T. R. (1994). Professional development in education: in search of the optimal mix.

Guskey, T. R. (1999). *Evaluating professional development*. Corwin Press.

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice, 8*(3), 381–391.

Guskey, T. R. (2003). What makes professional development effective?. *Phi delta kappan, 84*(10), 748.

Guskey, T. R. (2007). Using assessments to improve teaching and learning. Ahead of the curve: The power of assessment to transform teaching and learning, 15-29.

Guskey, T. R., & Sparks, D. (1991). What to consider when evaluating staff development. Educational Leadership, 49(3), 73.

Guskey, T. R., & Yoon, K. S. (2009). What works in professional development. *Phi delta kappan, 90*(7), 495–500.

Hafiz, K. (2008). Case study ecmple. The qualitative report, 13(4), 544-559.

Hargreaves, A., & Fullan, M. (2012). *Professional capital: Transforming teaching in every school*. Teachers College Press.

Harrell, M. C., & Bradley, M. A. (2009). *Data collection methods. Semi-structured interviews and focus groups*. Santa Monica: Rand Corporation.

Harris, J. B., & Hofer, M. J. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education, 43*(3), 211–229.

Haslaman, T., Mumcu, F. K., & Usluel, Y. K. (2007). The integration of information and communication technologies in learning and teaching process: A lesson plan example. *Egitim ve Bilim*, *32*(146), 54.

Hennessy, S., Harrison, D., & Wamakote, L. (2010). Teacher factors influencing classroom use of ICT in Sub-Saharan Africa. *Itupale Online Journal of African Studies*, *2*(1), 39–54.

Henning, E. (2004). Finding your way in qualitative research. van Schaik.

Henning, E., Van Rensburg, W., & Smit, B. (2004). *Finding your way in qualitative research*. Van Schaik Publishers.

Hoadley, U., & Jansen, J. D. (2009). *Curriculum: Organizing knowledge for the classroom*. Oxford University Press Southern Africa.

Holland, D. C., & Valsiner, J. (1988). Cognition, symbols, and Vygotsky's developmental psychology. Ethos, 16(3), 247-272.

Holloway, J. H. (2000). The promise and pitfalls of site-based management. *Educational Leadership, 57*, 81–82.

Honey, M., Culp, K. M., & Carrigg, F. (2000). Perspectives on technology and education research: Lessons from the past and present. *Journal of Educational Computing Research, 23*(1), 5–14.

http://unesdoc.unesco.org/images/0014/001405/140577e.pdf

http://www.schoolnetafrica.net/fileadmin/resources/Teacher_Professional_Development_In_the_use_of_Technology.pdf.

Inan, F. A., & Lowther, D. L. (2010). Factors affecting technology integration in K-12 classrooms: A path model. *Educational Technology Research and Development, 58*(2), 137–154.

Jackson, R. L., Drummond, D. K., & Camara, S. (2007). What is qualitative research?. *Qualitative Research Reports in Communication, 8*(1), 21–28.

Jonassen, D. H. (1991). Evaluating constructivistic learning. *Educational Technology, 31*(9), 28–33.

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational Technology Research and Development*, *48*(4), 63–85.

Jonassen, D. H., Carr, C., & Yueh, H. P. (1998). Computers as mindtools for engaging learners in critical thinking. TechTrends, 43(2), 24-32.

Kajornboon, A. B. (2005). Using interviews as research instruments. *E-journal for Research Teachers, 2*(1), 1–9.

Kaplan, A. (1964). The Conduct of Inquiry: Methodology for Behavirol Science. Chandler Publishing Company.

Kapucu, N. (2012). Classrooms as communities of practice: Designing and facilitating learning in a networked environment. *Journal of Public Affairs Education, 18*(3), 585–610.

Kärki, T., Keinänen, H., Tuominen, A., Hoikkala, M., Matikainen, E., & Maijala, H. (2018). Meaningful learning with mobile devices: Pre-service class

teachers' experiences of mobile learning in the outdoors. *Technology, Pedagogy and Education, 27*(2), 251–263.

Karsenti, T. (2009). *PanAfrican Research Agenda on the pedagogical integration of ICTs: Phase II*. OECD

Kirschner, P., & Davis, N. (2003). Pedagogic benchmarks for information and communications technology in teacher education. *Technology, Pedagogy and Education, 12*(1), 125–147.

Klein, J. T. (1996). *Crossing boundaries: Knowledge, disciplinarities, and interdisciplinarities*. University of Virginia Press.

Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers & Education*, *49*(3), 740–762.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. Contemporary issues in technology and teacher education, 9(1), 60-70.

Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. Computers & Education, 59(4), 1109-1121.

Kozulin, A. (2002). Sociocultural theory and the mediated learning experience. *School Psychology International, 23*(1), 7–35.

Kozulin, A. (2003). Psychological tools and mediated learning. In A. Kozulin, B. Gindis, V. S. Ageyev, & S. M. Miller (Eds.), *Vygotsky's educational theory in cultural context* (pp. 15–38). Cambridge University Press.

Kozulin, A. (Ed.). (1996). Vygotsky in context. In *Thought and language* (pp. xi-lvi). Cambridge: MIT Press.

Kozulin, A., & Presseisen, B. Z. (1995). Mediated learning experience and psychological tools: Vygotsky's and Feuerstein's perspectives in a study of student learning. *Educational Psychologist, 30*(2), 67–75.

Kukla, A. (2000). Social constructivism and the philosophy of science. Routledge.

Lacey, A., & Luff, D. (2009). *Qualitative data analysis*. NHS & NIHR.

Lantolf, J. P. (Ed.). (2000). Introducing sociocultural theory. In *Sociocultural theory and second language learning*. Oxford University Press.

Latham, B. (2007). Sampling: What is it. Quantitative research methods, 5377.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, *77*(4), 575–614.

Leedy, P. D., & Ormrod, J. E. (2005). Practical research (Vol. 108). Saddle River, NJ: Pearson Custom.

Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: Planning and design*. Upper Saddle

Lim, C. P., & Chai, C. S. (2008). Teachers' pedagogical beliefs and their planning and conduct of computer-mediated classroom lessons. *British Journal of Educational Technology, 39*(5), 807–828.

Lim, C. P., & Khine, M. S. (2006). Managing teachers' barriers to ICT integration in Singapore schools. *Journal of Technology and Teacher Education*, *14*(1), 97.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury.

Liu, Z. (2005). Reading behaviour in the digital environment: Changes in reading behavior over the past ten years. *Journal of Documentation, 61*(6), 700–712.

Lloyd, M. (2005*).* Towards a definition of the integration of ICT in the classroom. In *AARE 2005, AARE, Eds. Proceedings AARE 05Education Research Creative Dissent: Constructive Solutions, Parramatta, New South Wales*

Louw, J., Muller, J., & Tredoux, C. (2008). Time-on-task, technology and mathematics achievement. *Evaluation and Program Planning, 31*(1), 41–50.

Mack, L. (2010). The philosophical underpinnings of educational research.

Maistry, S. M. (2008). Towards collaboration rather than cooperation for effective professional development of teachers in South Africa: Insights from social practice theory. *Southern African Review of Education with Education with Production,* 14(1–2), 119–141.

Mandell, S., Sorge, D. H., & Russell, J. D. (2002). Tips for technology integration. *TechTrends*, *46*(5), 39–43.

Marshall, C., & Rossman, G. B. (1999). *Designing qualitative research*. Thousand Oaks: Sage Publications.

Marshall, M. N. (1996). Sampling for qualitative research. Family practice, 13(6), 522-526.

Maxwell, J. (1997). Designing a qualitative study. In L. Bickman & D. J. Rog (Eds.), *Handbook of applied social research methods*. Thousand Oaks: Sage.

McDermott, R., & Archibald, D. (2010). Harnessing your staff's informal networks. Harvard business review, 88(3), 82-89.

McMillan, J. H., & Schumacher, S. (2006). *Research in education: Evidence based inquiry*. Boston: Pearson Education.

McMillan, J. H., & Schumacher, S. (2010). *Research in education: Evidence-based inquiry* (7th ed.). New York: Pearson.

Merriam, S. B. (1998). *Qualitative research and case study applications in education.* San Francisco: Jossey-Bass Publishers.

Merriam, S. B. (2001). *Qualitative research and case study applications in education*. Jossey-Bass, San Francisco.

Miles, M. B., & Hubberman, A. M. (1994). *Qualitative data analysis*. Beverly Hills: Sage.

Minaidi, A., & Hlapanis, G. H. (2005). Pedagogical obstacles in teacher training in information and communication technology. *Technology, Pedagogy and Education, 14*(2), 241–254.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054.

Mishra, P., & Koehler, M. J. (2007, March). Technological pedagogical content knowledge (TPCK): Confronting the wicked problems of teaching with technology. In Society for Information Technology & Teacher Education International Conference (pp. 2214-2226). Association for the Advancement of Computing in Education (AACE).

Morgan, G. (Ed.). (1983). Beyond method: Strategies for social research. Sage.

Mortimer, E., & Scott, P. (2003). Meaning Making In Secondary Science Classroomsaa. McGraw-Hill Education (UK).

Newhouse, C. P. (2002). *A framework to articulate the impact of ICT on learning in schools*. Western Australian Department of Education.

Nkula, K., & Krauss, K. E. (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. In *8th International Development Informatics Association (IDIA) conference, Port Elizabeth, South Africa.*

Available at http://www.developmentinformatics.org/conferences/2014/papers/20-Nkula-Kirsten.pdf.

Olakulehin, F. K. (2007). Information and communication technologies in teacher training and professional development in Nigeria. *Online Submission*, *8*(1), 133–142.

Onwuegbuzie, A. J., & Collins, K. M. (2007). A typology of mixed methods sampling designs in social science research. *Qualitative Report, 12*(2), 281–316.

Onwuegbuzie, A. J., Leech, N. L., & Collins, K. M. (2008). Interviewing the interpretive researcher: A method for addressing the crises of representation, legitimation, and praxis. *International Journal of Qualitative Methods, 7*(4), 1–17.

Orb, A., Eisenhauer, L., & Wynaden, D. (2001). Ethics in qualitative research. *Journal of Nursing Scholarship, 33*(1), 93–96.

Pachler, N. (2010). ICT CPD Landscape: Final Report November, 2010.

Pachler, N., Cook, J., & Bachmair, B. (2010). Appropriation of mobile cultural resources for learning. *International Journal of Mobile and Blended Learning (IJMBL), 2*(1), 1–21.

Pan African Research Agenda on the Pedagogical Integration of Information and Communications Technologie Observatory. http://www.observatoiretic.org retrieved 15 October 2014

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE.

Pearson, M., & Somekh, B. (2006). Learning transformation with technology: a question of sociocultural contexts?. International Journal of Qualitative Studies in Education, 19(4), 519-539.

Perkins, D. N., & Salomon, G. (1992). Transfer of learning. International encyclopedia of education, 2, 6452-6457.

Polly, D., & Ausband, L. (2009). Developing higher-order thinking skills through WebQuests. *Journal of Computing in Teacher Education, 26*(1).

Presseisen, B. Z., & Kozulin, A. (1992). *Mediated learning—The contributions of Vygotsky and Feuerstein in theory and practice*. Washington, DC: Office of Educational Research and Improvement.

Price, J. H., & Murnan, J. (2004). Research limitations and the necessity of reporting them. *American Journal of Health Education, 35*(2), 66.

Rasool, F. (2011, 13 July). Gauteng Online is failing. *ITWeb*. Available from https://www.itweb.co.za/content/lwrKxv3DY9y7mg1o

Ritchie, J., Lewis, J., & Elam, G. (2003). *Designing and selecting samples* (pp. 77–108). London: Sage.

Ritchie, J., Spencer, L., & O'Connor, W. (2003). Carrying out qualitative analysis. Qualitative research practice: A guide for social science students and researchers, 2003, 219-62.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. Oxford University Press.

Rogoff, B. (1991). Social interaction as apprenticeship in thinking: Guided participation in spatial planning. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 349–364). New York: Oxford University Press.

Rowe, C. (1995). Clarifying the use of competence and competency models in recruitment, assessment and staff development. *Industrial and Commercial training*, *27*(11), 12–17.

Rowley, J. (2002). Using case studies in research. *Management Research News, 25*(1), 16–27.

SAIDE. (2003). *ICTs in schools: Challenges and lesson from related SAIDE research project. Pretoria*: SAIDE

SAIDE. (2010). e-Maturity and e-readiness assessment report. In *Prepared for the Gauteng Department of Education (GDE)* (pp. i-123). GDE.

Savenye, W. C., & Robinson, R. S. (2005). Using qualitative research methods in higher education. *Journal of Computing in Higher Education, 16*(2), 65–95.

Scott, D., & Morrison, M. (2005). *Key ideas in educational research.* New York: Continuum International Publishing Group.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(2), 63–75.

Sherman, K., & Howard, S. K. (2012, March). Teachers' beliefs about first- and second-order barriers to ICT integration: Preliminary findings from a South African study. In *Society for Information Technology & teacher Education International Conference (pp. 2098–2105). Association for the Advancement of Computing in Education (AACE).*

Shulman, L. 1986. Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Silverman, D. (2005). Instances or sequences? Improving the state of the art of qualitative research. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research, 6*(3).

Singh, P. (1997). Review essay: Basil Bernstein (1996). Pedagogic, symbolic control and identity. *British Journal of Sociology of Education, 18*(1), 119–124.

Sinkovics, R. R., & Alfoldi, E. A. (2012). Progressive focusing and trustworthiness in qualitative research. *Management International Review, 52*(6), 817–845.

Somekh, B. (2008). Factors affecting teachers' pedagogical adoption of ICT. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 449–460). Springer US.

Stake, R. (2000). Case Studies. In N. K. Denzin (Ed.), *Handbook of qualitative research*. New Delhi: Sage Publications.

Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin (Ed.), *Handbook of qualitative research* (pp. 443–466). Sage Publications.

Stake, R., & Kerr, D. (1995). Rene Magritte, constructivism, and the researcher as interpreter. *Educational Theory*, *45*(1), 55–61.

Stamps, D. (1997). Communities of practice. Learning is social, training is irrelevant?. *Training*, *34*(2), 34–42.

Tellis, W. (1997). Application of a case study methodology. *The Qualitative Report, 3*(3), 1–19.

Teodorescu, T. (2006). Competence versus competency: What is the difference?. *Performance Improvement*, *45*(10), 27–30.

Thanh, N. C., & Thanh, T. T. (2015). The interconnection between interpretivist paradigm and qualitative methods in education. American journal of educational science, 1(2), 24-27.

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2008). *Teacher professional learning and development*. BES.

Tinio, V. L. (2003). *ICT in Education*. UN

Tondeur, J., Van Keer, H., Van Braak, J., & Valcke, M. (2008). ICT integration in the classroom: Challenging the potential of a school policy. *Computers & Education, 51*(1), 212–223.

Townsend, T., & Bates, R. (2007). Teacher education in a new millennium: Pressures and possibilities. In T. Townsend & R. Bates (Eds.), *Handbook of Teacher Education: Globalization, Standards and Professionalism in Times of Change* (pp. 3–24). Dordrecht: Springer.

Triggs, P., & John, P. (2004). From transaction to transformation: Information and communication technology, professional development and the formation of communities of practice. *Journal of Computer Assisted Learning, 20*(6), 426–439.

Tzuriel, D., & Shamir, A. (2002). The effects of mediation in computer assisted dynamic assessment. *Journal of Computer Assisted Learning, 18*(1), 21–32.

Underwood, J., & Banyard, P. (2008). Managers', teachers' and learners' perceptions of personalised learning: evidence from Impact 2007. *Technology, Pedagogy and Education, 17*(3), 233–246.

UNESCO (2003). *Consultative workshop on performance indicators for ICT in education*. Bangkok: UNESCO Asia and Pacific Regional Bureau for Education. Available from http://www.unescobkk.org/fileadmin/user_upload/ict/e-books/ICTindicators/ICTindicators.pdf

UNESCO (2005). *Regional guidelines on teacher development for pedagogy-technology integration*. Bangkok: UNESCO Asia and Pacific Regional Bureau for Education.

UNESCO. (2004). *Integrating ICTs into education: Lessons learned*. Bangkok: UNESCO.

UNESCO. (2011). *Competency framework for teachers*. Paris: UNESCO.

Unwin, P. T. H. (Ed.). (2009). *ICT4D: Information and communication technology for development*. Cambridge University Press.

Valsiner, J. (1987). Culture and the development of children's action: A cultural-historical theory of developmental psychology. John Wiley & Sons.

Valsiner, J., & Van der Veer, R. (1988). On the social nature of human cognition: An analysis of the shared intellectual roots of George Herbert Mead and Lev Vygotsky. *Journal for the Theory of Social Behaviour, 18*(1), 117–136.

Villegas-Reimers, E. (2003). *Teacher professional development: An international review of the literature*. Paris: International Institute for Educational Planning.

Vygotsky, L. S. (1930). *Mind in society*.

Vygotsky, L. S. (1978). *Mind in Society*. Cambridge, MA: MIT Press.

Vygotsky, L. S. (1987). The collected works of LS Vygotsky: the fundamentals of defectology (Vol. 2). Springer Science & Business Media.

Vygotsky, L. S. Luria,(1930/1993) Studies on the History of Behaviour.

Vygotsky, LS (1981). Thought and word. Childhood and Learning, 4 (sup1), 15-35.

Wachira, P. & Keengwe, J. (2011) Technology integration barriers: Urban school Mathematics teachers perspectives. *Journal of Science Education and Technology 20*, 17–25.

Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. *Journal of Applied Management Accounting Research, 10*(1), 69–80.

Wang, Q., & Woo, H. L. (2007). Systematic planning for ICT integration in topic learning. *Educational Technology & Society*, *10*(1), 148–156.

Wenglinsky, H. (2000). *How teaching matters: Bringing the classroom back into discussions of teacher quality*. ETS Policy Information Center Report

Wertsch, J. V. (1991). A sociocultural approach to socially shared cognition.

Wertsch, J. V. (1994). The primacy of mediated action in sociocultural studies. Mind, culture, and activity, 1(4), 202-208.

Wertsch, J. V., & Sohmer, R. (1995). Vygotsky on learning and development. *Human Development, 38*(6), 332–337.

Wertsch, J. V., & Tulviste, P. (1992). LS Vygotsky and contemporary developmental psychology. *Developmental Psychology, 28*(4), 548.

Williams, M., & Burden, R. L. (1997). *Psychology for language teachers*. Ernst Klett Sprachen.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17*(2), 89–100.

Yilmaz, N. P. (2011). Evaluation of the technology integration process in the Turkish education system. *Contemporary Educational Technology*, *2*(1), 37–54.

Yin, R. K. (1994). *Case study research: Design and methods*. London: Sage.

Yin, R. K. (2003). *Case study research: Design and methods*. London: Sage.

Younie, S. (2006). Implementing government policy on ICT in education: Lessons learned. *Education and Information Technologies, 11*(3–4), 385–400.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan, 5*(1).

Zepeda, S. J. (2011). *Professional development: What works*. Eye on education.

Appendix A: Application for Ethical Clearance

Wits School of Education

27 St Andrews Road, Parktown, Johannesburg, 2193 Private Bag 3, Wits 2050, South Africa. Tel: +27 11 717-3064 Fax: +27 11 717–3100 Email: enquiries@educ.wits.ac.za Website: www.wits.ac.za



Date: 04 November 2016

Student Number: 512377

Protocol Number: **2016ECE025D**

Dear Khanyisile Mbatha

Application for Ethics Clearance: Doctor of Philosophy

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate, has considered your application for ethics clearance for your proposal entitled:

Mediation in ICT teacher development: towards effective ICT pedagogical integration in the classroom

The committee recently met and I am pleased to inform you that **clearance was granted**.

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely,

MMaseko

Wits School of Education

011 717-3416

cc Supervisors: Dr Ian Moll and Dr Nokulunga Ndlovu

Appendix B: Gauteng Department of Education Research Approval Letter

For administrative use only:
Reference no: D2017 / 330
enquiries: 011 843 6503

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

2017 GDE RESEARCH APPROVAL LETTER

Date:	20 October 2016
Validity of Research Approval:	6 February 2017 to 29 September 2017
Name of Researcher:	Mbatha K.
Address of Researcher:	45 Highgate Street; No. 5 Eastbury Complex; Fairview; 2094
Telephone / Fax Number/s:	011 717 3042; 073 428 4264
Email address:	mbathakhanyisile1@gmail.com
Research Topic:	Mediation in ICT teacher development: towards supporting ICT pedagogical integration in the classroom
Number and type of schools:	FIVE Secondary Schools
District/s/HO	Johannesburg North

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved. A separate copy of this letter must be presented to the Principal, SGB and the relevant District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted. However participation is VOLUNTARY.

The following conditions apply to GDE research. The researcher has agreed to and may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

CONDITIONS FOR CONDUCTING RESEARCH IN GDE

1. *The District/Head Office Senior Manager/s concerned, the Principal/s and the chairperson/s of the School Governing Body (SGB.) must be presented with a copy of this letter.*
2. *The Researcher will make every effort to obtain the goodwill and co-operation of the GDE District officials, principals, SGBs, teachers, parents and learners involved. Participation is voluntary and additional remuneration will not be paid;*

3. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal and/or Director must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
4. *Research may only commence from the second week of February and must be concluded by the end of the THIRD quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
5. *Items 3 and 4 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
6. *It is the researcher's responsibility to obtain written consent from the SGB/s; principal/s, educator/s, parents and learners, as applicable, before commencing with research.*
7. *The researcher is responsible for supplying and utilizing his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institution/s, staff and/or the office/s visited for supplying such resources.*
8. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research title, report or summary.*
9. *On completion of the study the researcher must supply the Director: Education Research and Knowledge Management, with electronic copies of the Research Report, Thesis, Dissertation as well as a Research Summary (on the GDE Summary template). Failure to submit your Research Report, Thesis, Dissertation and Research Summary on completion of your studies / project – a month after graduation or project completion - may result in permission being withheld from you and your Supervisor in future.*
10. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned;*
11. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director/s and school/s concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mrs F.L. Tshabalala

Acting Director: Education Research and Knowledge Management

DATE: 24/10/2016

Appendix C: Information Sheet for the Principal

Dear Principal

My name is Khanyisile Mbatha. I am a PhD student in the School of Education at the University of the Witwatersrand. I am doing research on ICT teacher training. The topic of the study is: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

This study seeks to examine the mediational role in the ICT training and how it influences ICT pedagogical integration in commerce classrooms. It aims to determine if the teachers' ICT pedagogical skills have developed after they have attended ICT training sessions. The study is purely for academic purposes. I will use three data collection instruments: ICT training document analysis, two ICT trainings and two classroom observations and semi-structured (face-to-face) interviews for both teachers and ICT trainers that will be audiotaped. The time of the observations will be done according to the time of the lesson and the time for the interviews will take approximately one hour.

I kindly request commerce teachers in your school to participate in this study. The reason why I have chosen teachers in your school is because they are integrating ICT into teaching and learning of commerce subjects and they also participating in the ICT training.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their participation at any time during this project without any penalty. There are no foreseeable risks in their participation in this study. The participants will not be paid for their participation.

The names of the research participants and identity of the school will be kept confidential at all times and in all academic writing about the study. The school and the participants' individual privacy will be maintained in all published and written data resulting from the study. The data and results of the study may be

used in future for other academic purposes such as conference presentations and journal article publications.

All research data will be destroyed between 3–5 years after completion of the project.

Please let me know if you require any further information. I look forward to your response as soon as it is convenient to you.

Yours sincerely,



SIGNATURE:

NAME: Khanyisile Mbatha

ADDRESS: 45 Highgate Street, No.5 Eastbury Complex, Fairview, 2094

EMAIL: mbathakhanyisile1@gmail.com

TELEPHONE NUMBERS: 0734284264

Appendix D: Principal's Consent Form

Please fill in and return the reply slip below indicating your willingness for your school to participate in this study.

I, _____ give my consent to the research project called: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom, to collect data in my school.

Informed Consent

I understand that:

- Participants do not have to answer every question and can withdraw from the study at any time.
- The name of the school and information will be kept confidential and safe.
- Conference presentations and publications on this research will not use the name of the school or any participant in this institution.
- All the data collected during this study will be destroyed within 3–5 years after completion of the project.

Sign_____ Date_____

Appendix E: Information Sheet for ICT Training Institution

Dear ICT Training Director,

My name is Khanyisile Mbatha. I am a PhD student in the School of Education at the University of the Witwatersrand. I am doing research on ICT teacher training. The topic of the study is: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

This study seeks to examine the mediational role in the ICT training and how it influences ICT pedagogical integration in the classroom. It also aims to determine if teachers' ICT pedagogical skills have developed after they have attended ICT training sessions. The study is purely for academic purposes such as the research report, conference presentations and writing of journal articles. The research will use three data collection instruments: ICT training program or document analysis, two ICT training observations and two classroom observations and semi-structured (face-to-face) interviews. If you give permission I will observe trainers during ICT training and I will also interview them one on one after training in the training classroom or in a place of their convenience. All interviews will be audiotaped and will take approximately an hour per interview and observations will be determined by the duration of the training session.

The research focuses on the ICT teacher training and seeks to draw data that will provide meaningful understanding of how ICT teacher training influences effective ICT pedagogical integration in the classroom. The reason why I have chosen your institution is because you are offering an ongoing ICT training to teachers. I kindly request the institution to participate in this study.

Your institution's name and identity will be kept confidential at all times in all academic writing or conference presentations about the study. Your individual privacy will be maintained in all published and written data resulting from the study. The data and results of the study may be used in future for other academic

purposes such as conference presentations and journal article publications. All research data will be destroyed between 3–5 years after completion of the project.

Your institution will not be advantaged or disadvantaged in any way. Participation is voluntary, so the institution can withdraw participation at any time during this project without any penalty. There are no foreseeable risks in participating and the institution will not be paid for its involvement in this study.

Please let me know if you require any further information.

Thank you for your assistance in this regard.

Yours sincerely,



SIGNATURE

NAME: Khanyisile Mbatha

ADDRESS: 45 Highgate Street, No.5 Eastbury Complex, Fairview, 2094

EMAIL: mbathakhanyisile1@gmail.com

TELEPHONE NUMBERS: 0734284264

Appendix F: Consent Form: ICT Training Institution

Please fill in and return the reply slip below indicating your willingness to participate in my research called: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

I, _____ give my consent for the following:

Please encircle one of the options.

I give the researcher permission to analyse the ICT training program or document

Yes/No

I give the researcher permission to observe ICT training provided by this institution

Yes/NO

I know that the audiotapes will be used for this project to capture data for this study.

YES/NO

I know that the interviewee (ICT trainer) can stop at any time if she/he wants and does not have to

answer all the questions asked. YES/NO

Informed Consent

I understand that:

- Information about the institution will be kept confidential and safe. My name and the name of my institution will not be revealed in all writing and conference presentation about this study.
- Participants do not have to answer every question and they can withdraw from the study at any time.

- The data and results of the study may be used in future for other academic purposes such as conference presentation and journal article publications.
- All the data collected during this study will be destroyed within 3–5 years after completion of the project.

Sign_____ Date_____

Appendix G: Information Sheet for ICT Trainers

Dear ICT trainer,

My name is Khanyisile Mbatha. I am a PhD student in the School of Education at the University of the Witwatersrand. I am doing research on ICT teacher training. The topic of the study is: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

This study seeks to examine the mediational role in your ICT training and how it influences ICT pedagogical integration in trained commerce teachers' classrooms. The research will use three data collection instruments: ICT training document, two ICT training observations and two classroom observations and semi-structured (face-to-face) interviews. If you agree to participate you will be observed during ICT training and you will also be interviewed one on one after ICT training in your classroom or in a place of your convenience. All interviews will be audiotaped and will take approximately an hour per interview and observations will be determined by the duration of your training session.

I kindly request your participation in this study. The reason why I have chosen you is that you an ICT teacher trainer for X institution that provides teachers with ongoing ICT training and you have commerce teachers in your class.

Your name and identity will be kept confidential at all times in all academic writing and conference presentations about this study. Your individual privacy will be maintained in all published and written data resulting from the study. The data and results of the study may be used in future for other academic purposes such as conference presentation and journal article publications. All research data will be destroyed between 3–5 years after completion of the project.

You will not be advantaged or disadvantaged in any way. Your participation is voluntary, so you can withdraw your participation at any time during this project without any penalty. There are no foreseeable risks in participating and you will not be paid for this study.

Please let me know if you require any further information.

Thank you for your assistance in this regard.

Yours sincerely



SIGNATURE

NAME: Khanyisile Mbatha

ADDRESS:33 45 Highgate Street, No.5 Eastbury Complex, Fairview, 2094

EMAIL: mbathakhanyisile1@gmail.com

TELEPHONE NUMBERS: 0734284264

Appendix H: Consent Form: ICT Trainer

Please fill in and return the reply slip below indicating your willingness to be a participant in my research called: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom

I, _____ give my consent for the following:

Please Circle one

Permission to be observed

I agree to be observed during ICT training YES/NO

Permission to be interviewed

I agree to be interviewed for this study. YES/NO

Permission to be audiotaped

I agree to be audiotaped during the interview YES/NO

I know that the audiotapes will be used for this project and other academic purposes such as conference presentation and journal article publications.

YES/NO

I know that I can stop the interview at any time and don't have to answer all the questions asked. YES/NO

Informed Consent

I understand that:

- My name and information will be kept confidential and safe and that my name and the name of my institution will not be revealed in all writing and conference presentations about this study.

- I do not have to answer every question and can withdraw from the study at any time.
- Data and results of the study may be used in future for other academic purposes such as conference presentation and journal article publications.
- All the data collected during this study will be destroyed within 3–5 years after completion of my project.

Sign_____ Date_____

Appendix I: Information Sheet for Teachers

Dear Teacher,

My name is Khanyisile Mbatha. I am a PhD student in the School of Education at the University of the Witwatersrand. I am doing research on ICT teacher training. The topic of the study is: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

This study seeks to examine the mediational role in the ICT training and how does it influence ICT pedagogical integration in the classroom. It also aims to determine if teachers' ICT pedagogical skills have developed after they have attended ICT training sessions. The study is purely for academic purposes such as conference presentation and journal article. The research will use three data collection instruments: ICT training document, two ICT training observations and two classroom observations and semi-structured (face-to-face) interviews. I kindly request your participation in this study. If you agree to participate you will be observed your classroom teaching and you will also be interviewed one on one after school in your classroom or in a place of your convenience. All interviews will be audiotaped and will take approximately an hour per interview and observations will be determined by the duration of your lesson.

The study focuses on ICT teacher training and how does it influences ICT pedagogical integration in the classroom. The reason why I have chosen you is because you have been attending ongoing ICT training that is provided by X ICT training institution.

Your name and identity will be kept confidential at all times in all academic writing and conference presentations about this study. Your individual privacy will be maintained in all published and written data resulting from the study. The data and results of the study may be used in future for other academic purposes such as conference presentation, journal article or development of

policy. All research data will be destroyed between 3–5 years after completion of the project.

You will not be advantaged or disadvantaged in any way. Your participation is voluntary, so you can withdraw your participation at any time during this project without any penalty. There are no foreseeable risks in participating and you will not be paid for this study.

Please let me know if you require any further information.

Thank you for your assistance in this regard.

Yours sincerely



SIGNATURE

NAME: Khanyisile Mbatha

ADDRESS: 33 45 Highgate Street, No.5 Eastbury Complex, Fairview, 2094

EMAIL: mbathakhanyisile1@gmail.com

TELEPHONE NUMBERS: 0734284264

Appendix J: Teacher's Consent Form

Please fill in and return the reply slip below indicating your willingness to be a participant in my research: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom

I, _____ give my consent for the following:

Please Circle one

Permission to be observed

I agree to be observed during my teaching YES/NO

Permission to be interviewed

I agree to be interviewed for this study. YES/NO

Permission to be audiotaped

I agree to be audiotaped during the interview YES/NO

I know that the audiotapes will be used for this project and other academic purposes such as conference presentation and journal article

YES/NO

I know that I can stop the interview at any time and don't have to answer all the questions asked. YES/NO

Informed Consent

I understand that:

- My name and information will be kept confidential and safe and that my name and the name of my school will not be revealed in all writing and conference presentations about this study.
- I do not have to answer every question and can withdraw from the study at any time.

- Data and results of the study may be used in future for other academic purposes such as conference presentation, journal article or development of policy.
- All the data collected during this study will be destroyed within 3–5 years after completion of my project.

Sign_____ Date_____

Appendix K: Information Sheet for Parents

Dear Parent,

My name is Khanyisile Mbatha. I am a PhD student in the School of Education at the University of the Witwatersrand. I am doing research on ICT teacher training. The topic of the study is: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

This study seeks to examine the mediational role in the ICT training and how does it influence ICT pedagogical integration in the classroom. It also aims to determine if teachers' ICT pedagogical skills have developed after they have attended ICT training sessions. The study is purely for academic purposes such as conference presentation and journal article. The research will use three data collection instruments: ICT training document, two ICT training observations and two classroom observations and semi-structured (face-to-face) interviews. I kindly request your child's participation in this study. If you agree your will be observed during teaching and learning of commerce subject.

The study focuses on ICT teacher training and how does it influence ICT pedagogical integration in the classroom. The reason why I have chosen your child is taught by the teacher who is the participant of this study.

The name and identity of your child will be kept confidential at all times in all academic writing and conference presentations about this study. His /her individual privacy will be maintained in all published and written data resulting from the study. The data and results of the study may be used in future for other academic purposes such as conference presentation, journal article or development of policy. All research data will be destroyed between 3–5 years after completion of the project.

Your child will not be advantaged or disadvantaged in any way. Participation is voluntary; you can withdraw your child's participation at any time during this

project without any penalty. There are no foreseeable risks in participating and he /she will not be paid for this study.

Please let me know if you require any further information.

Thank you for your assistance in this regard.

Yours sincerely



SIGNATURE

NAME: Khanyisile Mbatha

ADDRESS:33 45 Highgate Street, No.5 Eastbury Complex, Fairview, 2094

EMAIL: mbathakhanyisile1@gmail.com

TELEPHONE NUMBERS: 0734284264

Appendix L: Parent's Consent Form

Please fill in and return the reply slip below indicating your willingness for your child to be a participant in my research: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom

I, _____ give my consent for the following:

Please Circle one

Permission to be observed

I agree to be observed during my teaching YES/NO

I know that the data collected will be used for this project and other academic purposes such as conference presentation and journal article

YES/NO

I know that my child can stop participating in this study any time without penalties YES/NO

Informed Consent

I understand that:

- My child's name and information will be kept confidential and safe and that the name of my school will not be revealed in all writing and conference presentations about this study.
- He/she have can withdraw from the study at any time.
- Data and results of the study may be used in future for other academic purposes such as conference presentation, journal article or development of policy.
- All the data collected during this study will be destroyed within 3–5 years after completion of my project.

Sign_____ Date_____

Appendix M: Learner's Information Sheet

Dear Learner,

My name is Khanyisile Mbatha. I am a PhD student in the School of Education at the University of the Witwatersrand. I am doing research on ICT teacher training. The topic of the study is: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom.

This study seeks to examine the mediational role in the ICT training and how does it influence ICT pedagogical integration in the classroom. It also aims to determine if teachers' ICT pedagogical skills have developed after they have attended ICT training sessions. The study is purely for academic purposes such as conference presentation and journal article. The research will use three data collection instruments: ICT training document, two ICT training observations and two classroom observations and semi-structured (face-to-face) interviews. I kindly request your participation in this study. If you agree you will be observed during teaching and learning of commerce subject.

I kindly request your permission to observe the lesson. The study focuses on ICT teacher training and how does it influence ICT pedagogical integration in the classroom. The reason why I have chosen you is because you are taught by the teacher who is the participant of this study. Remember, this is not a test, it is not for marks and it is voluntary, which means that you do not have to do it. Also, if you decide halfway through that you prefer to stop, this is completely your choice and will not affect you negatively in any way.

Your name and identity will be kept confidential at all times in all academic writing and conference presentations about this study. Your individual privacy will be maintained in all published and written data resulting from the study. The data and results of the study may be used in future for other academic purposes such as conference presentation, journal article or development of

policy. All research data will be destroyed between 3–5 years after completion of the project.

Please let me know if you require any further information.

Thank you for your assistance in this regard.

Yours sincerely



SIGNATURE

NAME: Khanyisile Mbatha

ADDRESS: 33 45 Highgate Street, No.5 Eastbury Complex, Fairview, 2094

EMAIL: mbathakhanyisile1@gmail.com

TELEPHONE NUMBERS: 0734284264

Appendix N: Learner's Consent Form

Please fill in and return the reply slip below indicating your willingness to be a participant in my research: Mediation in ICT teacher development: towards supporting effective ICT pedagogical integration in the classroom

I, _____ give my consent for the following:

Please Circle one

Permission to be observed

I agree to be observed during my learning YES/NO

I know that the data collected will be used for this project and other academic purposes such as conference presentation and journal article

YES/NO

I know that I can stop participating in this study any time without penalties

YES/NO

Informed Consent

I understand that:

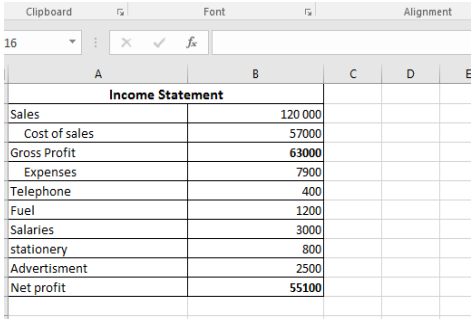
- My name and information will be kept confidential and safe and that the name of my school will not be revealed in all writing and conference presentations about this study.
- He/she have can withdraw from the study at any time.
- Data and results of the study may be used in future for other academic purposes such as conference presentation, journal article or development of policy.
- All the data collected during this study will be destroyed within 3–5 years after completion of my project.

Sign_____ Date_____

Appendix 0: Observation from Bheki's Training

The excerpt in Table below displays an example of mediation and interactive dialogic between the ICT trainer and trainees. Prior this excerpt Bheki was modelling different Microsoft tabs to the trainees and his presentation elicited the question below

(Bheki session 2) session 2	Excerpt 1 of	Open Coding	Axial Coding	Selective themes	Descriptors	Theory Development
Trainer: trainee turns in the excerpt						
Teacher 2: Bheki, I want to show you this and my questions will be based on this spreadsheet (income statement).		providing example	seeking understanding	interactive	Tr starts conversation	



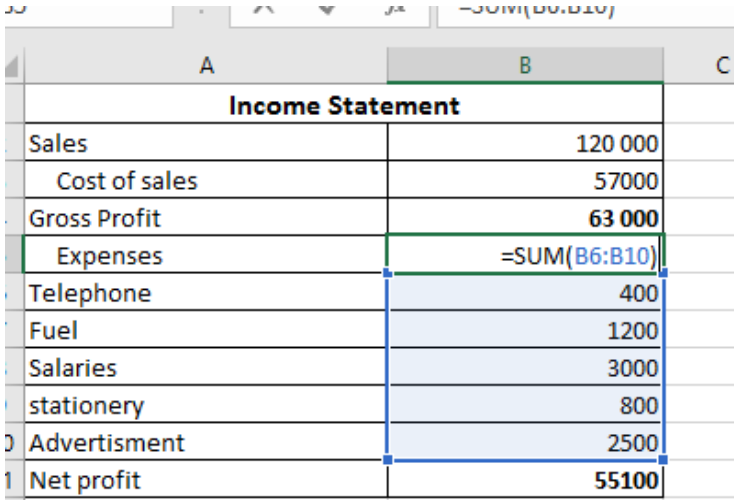
Clipboard | Font | Alignment

16

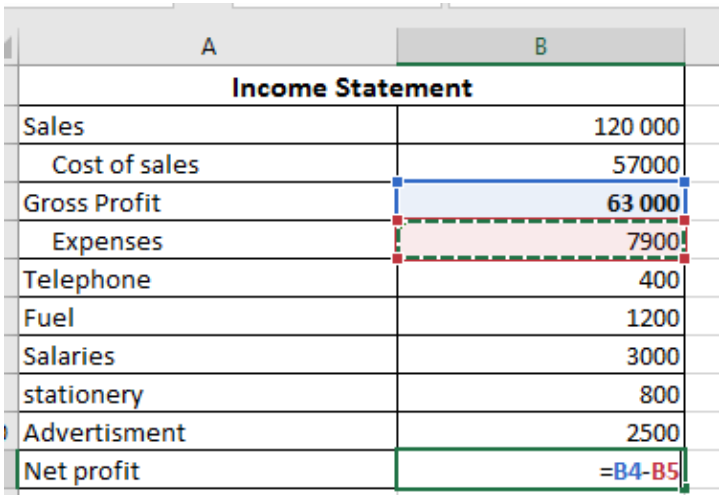
	A	B	C	D	E
	Income Statement				
Sales		120 000			
Cost of sales		57000			
Gross Profit		**63000**			
Expenses		7900			
Telephone		400			
Fuel		1200			
Salaries		3000			
stationery		800			
Advertisment		2500			
Net profit		**55100**			

Teacher 2: This is a very basic income statement in fact it is straight and forward. Please show me, how can I use formulas instead of calculating manual?	clarifying question	seeking understanding		
Bheki: Is there anyone who wants to assist in this regard?	opening to the floor	seek trainees intervention	interactive dialogue	Deliberately guides the interaction

Teacher 3: I normally do formula for Gross profit, Expenses and net profit/loss.	Provide solution	Subject knowledge/ Technological knowledge	interactive dialogue	give and take of ideas



	A	B	C
	Income Statement		
	Sales	120 000	
	Cost of sales	57000	
	Gross Profit	**63 000**	
	Expenses	=SUM(B6:B10)	
	Telephone	400	
	Fuel	1200	
	Salaries	3000	
	stationery	800	
0	Advertisment	2500	
1	Net profit	**55100**	

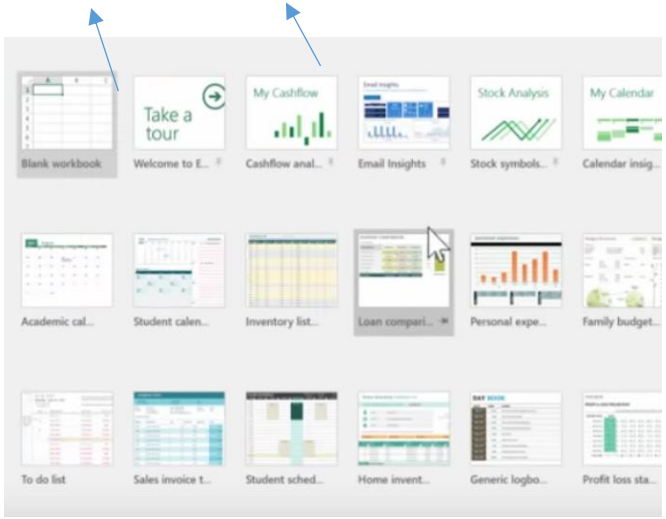


	A	B
	Income Statement	
	Sales	120 000
	Cost of sales	57000
	Gross Profit	**63 000**
	Expenses	7900
	Telephone	400
	Fuel	1200
	Salaries	3000
	stationery	800
	Advertisment	2500
	Net profit	=B4-B5

showing calculations	clarifying the answer	interactive dialogue	Tr responds	
Bheki: I think it is clear to everyone this spreadsheet uses only basic Excel formulas. It should not be a problem. Unless you want something else.	confirming	checking understanding	interactive dialogue	T responds

Appendix P: Observation

(Bheki session 2) Excerpt 2 of session 2	Open Coding	Axial Coding	Selective themes	Descriptors	Theory Development
Trainer: trainee turns in the excerpt					
Teacher 1: first open this page then he asked "is there a readily available work book for cash flow statement for Grade 11 may be"	presenting a question	seeking understanding	interactive dialogue	T start conversation	
Bheki: you mean blank workbook that you can customised for your class?	redirecting the question	seeking clarity		T probes	



Teacher 1: Look at this page I do not mean the first one but something like this cash flow (pointing at the cash flow in Excel templet projected in the screen).

Clarifying the question

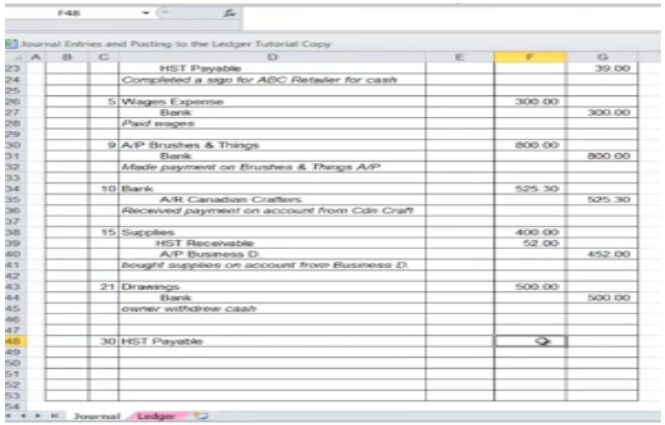
interactive dialogue

T responds

Bheki: Esh! I am not sure if I get you well, colleagues come to my rescue please.	opening it to the floor	Looking for trainees intervention	interactive dialogue	Deliberately guides the interaction
Teacher 3: You mean a table with already calculated cells for cash flow statement.	redirecting the question	trying to understand	interactive dialogue	T responds
Teachers 1: Yes you understand what I mean			interactive dialogue	
Teacher 3: No, there is nothing like that in Excel.	providing answer	giving explanation	interactive dialogue	give and take

Teacher 1: If it does not exist then as teacher you supposed to do your own calculation.	providing answer	seeking understanding	interactive dialogue	
Teacher 2: Exactly no other way	confirming the answer		interactive dialogue	
Bheki: as I mentioned earlier, I am not familiar with Accounting so, I do not understand what you are asking about. I can see that you understand in fact you know your content very well, Can someone share what he /she normal do with Excel in teaching Accounting.	acknowledge and open it to the floor	looking for teacher intervention	interactive dialogue	Deliberately guides the interaction

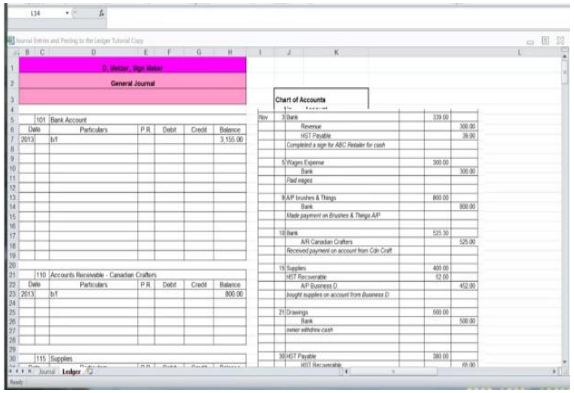
(Bheki session 2)	Excerpt 3 of session 2	Open Coding	Axial Coding	Selective themes	Descriptors	Theory Development
	Trainer: trainee turns in the excerpt Teacher 4 showing each other how to do Journals and ledger using Microsoft Excel. Teacher 4: I am going to show you using General Journal and post it to general ledger right. Please open Grade 10 Accounting book for adjustment I will do them here in the board. All teachers reading out adjustments Teacher 4: completed General Journal using Excel formulas. See diagram 1 below					



		HST Payable			39.00
		Completed a sign for ABC Retailer for cash			
	5	Wages Expense		300.00	
		Bank			300.00
		Paid wages			
	9	A/P Brushes & Things		800.00	
		Bank			800.00
		Made payment on Brushes & Things A/P			
	10	Bank		525.30	
		A/R Canadian Crafters			525.30
		Received payment on account from Cdn Craft			
	15	Supplies		400.00	
		HST Receivable		52.00	
		A/P Business D			452.00
		bought supplies on account from Business D			
	21	Drawings		500.00	
		Bank			500.00
		owner withdrew cash			
	30	HST Payable			

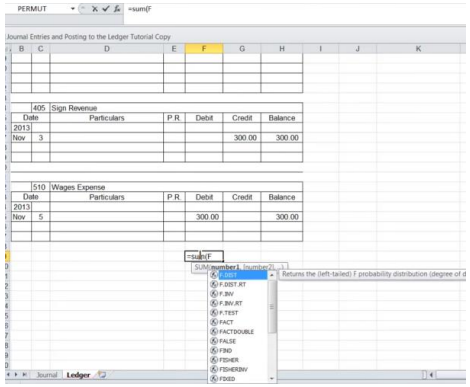
After preparing General Journal Teacher 4 did Ledger Accounts. See from diagram 2 to 5.

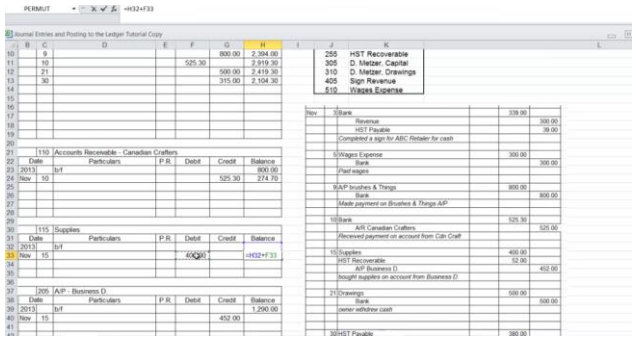
Teacher 4: I am going to put these two table side by side so that you can see



Teacher 4: take them step-by-step, he is the only one speaking at this point

Bheki: colleagues are you following. If you notice teacher 4 here is using mostly sum function to add these entire column.	Checking understanding	Technical knowledge	interactive dialogue	Deliberately guides the interaction





	9				800.00	2,394.00
	10			525.30		2,919.30
	21				500.00	2,419.30
	30				315.00	2,104.30

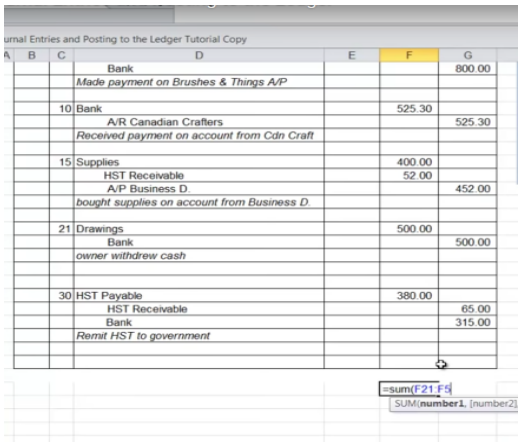
	110	Accounts Receivable - Canadian Crafters				
Date		Particulars	P.R.	Debit	Credit	Balance
2013		b/f				800.00
Nov	10				525.30	274.70

	115	Supplies				
Date		Particulars	P.R.	Debit	Credit	Balance
2013		b/f				
Nov	15			400.00		=H32+F33

	205	A/P - Business D.				
Date		Particulars	P.R.	Debit	Credit	Balance
2013		b/f				1,290.00
Nov	15				452.00	

255	HST Recoverable	
305	D. Metzer, Capital	
310	D. Metzer, Drawings	
405	Sign Revenue	
510	Wages Expense	

Nov	3	Bank		339.00	
		Revenue			300.00
		HST Payable			39.00
		Completed a sign for ABC Retailer for cash			
	5	Wages Expense		300.00	
		Bank			300.00
		Paid wages			
	9	A/P brushes & Things		800.00	
		Bank			800.00
		Made payment on Brushes & Things A/P			
	10	Bank		525.30	
		A/R Canadian Crafters			525.00
		Received payment on account from Cdn Craft			
	15	Supplies		400.00	
		HST Receivable		52.00	
		A/P Business D.			452.00
		bought supplies on account from Business D.			
	21	Drawings		500.00	
		Bank			500.00
		owner withdrew cash			
	30	HST Payable		380.00	



urnal Entries and Posting to the Ledger Tutorial Copy

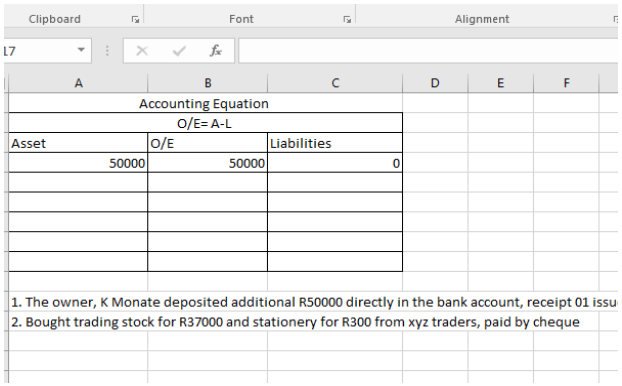
		Bank				800.00
		Made payment on Brushes & Things A/P				
	10	Bank			525.30	
		A/R Canadian Crafters				525.30
		Received payment on account from Cdn Craft				
	15	Supplies			400.00	
		HST Receivable			52.00	
		A/P Business D.				452.00
		bought supplies on account from Business D.				
	21	Drawings			500.00	
		Bank				500.00
		owner withdrew cash				
	30	HST Payable			380.00	
		HST Receivable				65.00
		Bank				315.00
		Remit HST to government				

=sum(F21:F5

SUM(**number1**, [number2])

Appendix Q: Observation from Tumi's Training

(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
Teacher 1: As I mentioned at the beginning of this training that I am anticipating to walk away with the ICT integration skill from this training. Tumi, I want your assistance in this one. We have been doing Excel formulas so; I was wondering how can I use formulas to teach accounting equation to my learners. I want to incorporate Accounting formulas with Excel formulas. I want to do something like this but using formula because what you see here I have done it manual. Is it possible?	Expectations wondering inquisitive	Seeking deeper understanding	Interactive dialogue	Tr asks question	Pose genuine questions Trainer and trainees explore ideas and generate new meanings

(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
	providing example	Clarifying the question		Deliberately guides the interaction	

Clipboard Font Alignment

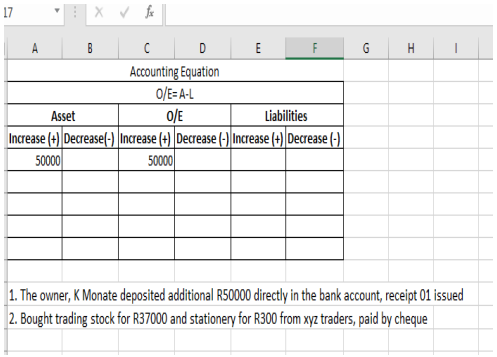
L7

A	B	C	D	E	F
Accounting Equation					
O/E= A-L					
Asset	O/E	Liabilities			
50000	50000	0			
1. The owner, K Monate deposited additional R50000 directly in the bank account, receipt 01 issu					
2. Bought trading stock for R37000 and stationery for R300 from xyz traders, paid by cheque					

Initially, I wanted to put plus (+) before R50 000 to show learners that there is an increase in assets and in Owners' Equity.

(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
Tumi: I think you need Accounting software that are strictly designed to perform Accounting calculations. Excel can assist there but it will require lot of work. For example, you cannot type + in cell as you would do in word the moment you move to the next cell + will disappear. Colleagues I am not familiar with your subjects I see what you asking but I do not understand how it is supposed to be done. Maybe ask me certain formula you think it can work for these calculations. Colleagues can you assist?	not sure; Excel functions acknowledging	Trainer speculates the answer; Technological knowledge Lack of subject knowledge	intentionality and reciprocity		

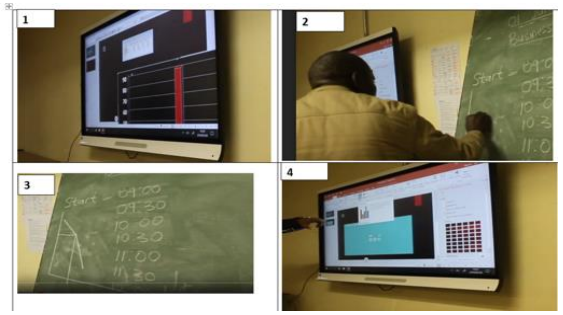
(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
	Excel functions	Technological Knowledge		T elicit discussion	
	Opening to the floor.	Looking for teachers views			
Teacher 2: I am not sure of the formulas but alternatively you can use a different format for your accounting equation. Where you show increase and decrease per account. Like this. 	provides alternative	understanding of the subject	Interactive dialogue	Tr responds	

(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
	Providing an example	Clarifying the answer			
As an Accounting teacher, I understand what you want to do. You want to put formulas in these cells. So that when learners entering amount in the cell it will be calculated automatically. Unfortunately, I do not know much about Excel I wish I can help.			Interactive dialogue	Tr respond	
	Clarifying	Subject knowledge		Tr respond	

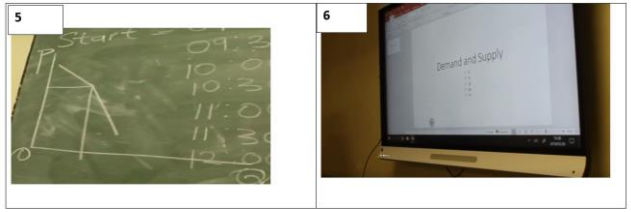
(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
If this can be done in Excel most of, our problems will be solved because learners do not understand accounting equation well.			intentionality and reciprocity	Give and take of ideas	
Tumi: Colleagues, I think the table makes more sense however, it will be much better if we can figure out how to use formulas to automate the whole spreadsheet. I will advise Sir to learn all the formulas so that he will know exactly what formula should be used where.	No Excel knowledge	Lack of technological knowledge		the mediator is changing incidental to intended learning experience by anticipati	
	Hoping for the best				
	Giving advise	Pedagogical knowledge			

(Tumi session 1) Excerpt 1	Open Coding	Axial Coding	Selective themes	Descriptor	Theory Development
				ng for the better	

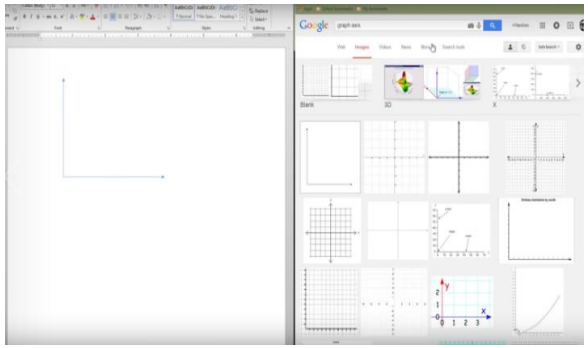
After the facilitator presented how to convert/present data in a chart form. Please see picture 1.

Teacher 3: asked if there is a demand-and-supply graph on Excel.  Tumi did not understand what the teacher was asking about. Teacher 3: draw on the chalkboard the graph that he was asking about. The chalkboard was written but the teacher used the small space on the side to show what he was asking, see picture 3. Even after drawing the graph on the board the Tumi did not understand, see picture 4 Tumi: you mean something like this. Sir you mean this one? (he is	Seeking understanding	Lack of technological knowledge Lack of subject knowledge	Tr initiates discussion interactive dialogue

depicting different chart from the one in picture 1and he is asked the).	confused			
	confused, seeking clarity			
Teacher 3: No, I mean the graphs that we do in Economics not these charts.	explains	subject knowledge	interactive dialogue	Tr probes

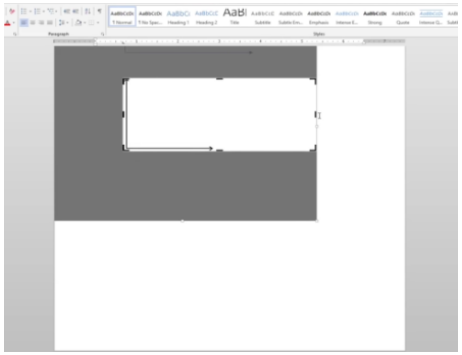
This is the only charts we have but remember it will be according to your data. I have not seen a demand graph in Microsoft suites.	confirms	Technological knowledge	interactive dialogue	T responds
If you say it is according to the data provided does that mean if I provide demand table will it give me a demand graph?	follow up/seek clarity	Lack of understanding	interactive dialogue	Tr probes
As I have indicated there is no demand-and-supply graph on Microsoft suit.	Confirms	Technological knowledge	interactive dialogue	T responds
 Tumi opens PowerPoint presentation and write demand and supply but he did not finish what he was trying to do.	providing alternative	subject knowledge	interactive dialogue	T responds

	confusion	Lack of subject knowledge	interactive dialogue	
Teacher 2: you can draw this graph using shapes but you cannot provide Excel with demand-and-supply tables/ data and expect it to produce demand-and-supply graph.	Provides alternative cautions	subject knowledge	interactive dialogue	T responds
Teacher 2: colleagues this is how I normally draw demand-and-supply graphs for exams. Here I will show you two ways of drawing economics graphs be it demand, supply or elasticity graphs **A**. using Microsoft Word **B**. Searching online graphs.	Providing alternative/ solution to teacher 3	technological knowledge/subject knowledge	Monologue	



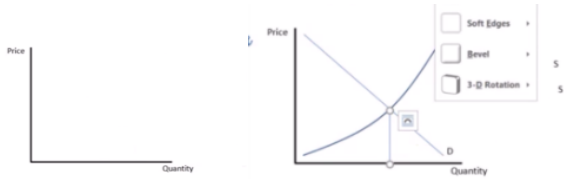
Examples

Let me start with the one from internet:	Example 1	Technological knowledge	interactive dialogue

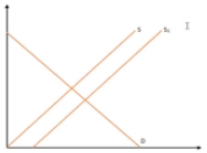


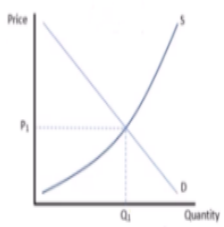
Teacher 3: colleagues can I suggest that we leave out the one from internet because it will demand internet and at times we work from home and we do are not connected. Everyone: yes you correct	suggestion	Thinking access/limited knowledge	interactive dialogue	T forward suggestion
Tumi: I think it is best to do the one using Microsoft Word.	in agreement			
	in agreement	Thinking about access	interactive dialogue	
Teacher 2: okay, let me focus on this one 1. Draw and label straight lines 2. Add curved lines 3. Lock your picture.	in agreement		Monologue	forwarding one view point

(The diagrams below present how the teacher draw demand-and-supply curves as he was showing the class how to do it)

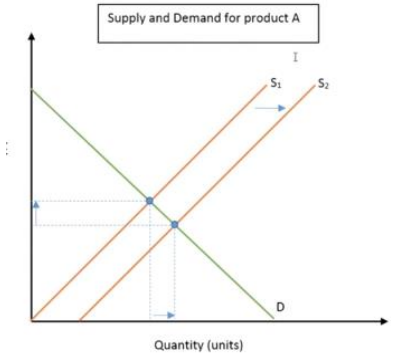


You can you use the same method you used to label your graph to add point of equilibrium in this graph. Of course, yes in fact you have a point there.





Monologue forwarding one viewpoint



Monologue

Tumi: thank you Sir, I also learned something today. The way you are drawing it looks so interesting. Can we give him a round of applause.	acknowledging / compliment	displaying understanding	interactive dialogue	T accepts correction by Tr

Appendix R: Observation from Sive's Training

(Sive session 1) 1 of session 1	Excerpt	Open Coding	Axial Coding	Selective themes	Descriptors	Theory Development
Trainer: trainee turns in the excerpt						
Teacher 1: Do you have to calibrate all the time? For example each period?		asking question	seeking understanding	interactive dialogue	Tr start conversation	
Sive: It depends.		providing an answer				
Teacher 1: Oh.						
Teacher 3: if you calibrate and the board takes long (almost half a period) to reboot what could be the problem?		asking a question	seeking understanding	interactive dialogue	Tr start conversation	

Sive: Surely, it a technical problem you need to call your technicians to assist.	Providing an answer	clarifying	interactive dialogue	
Teacher 3: I know that but I am trying to understand what can I do as a teacher in trying to serve the situation before calling for an assistance?	elaborating the question	seeking understanding	interactive dialogue	Tr probes
Sive: In all honest you not supposed to tackle technical issues because you are not a technician.	Providing an answer	clarifying	interactive dialogue	
Teacher 2: Is there any risk associated with us knowing technical part of the Smartboard?	follow up question	seeking understanding	interactive dialogue	Tr probes
Sive: We do not know but we told that if teachers experience	Providing an answer	clarifying	interactive dialogue	

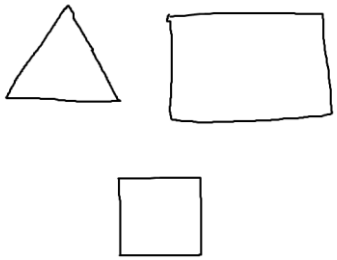
technical problems they need to report it to technician.				
Teacher 3: Sometimes I find it difficult to use my hand to move the mouse in the Smartboard. Can I plug a mouse in this board?	asking a question	seeking understanding	interactive dialogue	T start conversation
Teacher 2: I think you can but where are you going to put that mouse? Because there is, no space provided for that. Maybe if you can put a small table close to the board you can.	providing answer	giving explanation	interactive dialogue	give and take
Sive: Exactly.	confirming			
Teacher 4: I find using smart pen on a PDF document so useful and I normal use it with my eBooks however I am wondering how can I send the notes I make during my presentation to my	asking a question	seeking understanding	interactive dialogue	T start conversation

learners? For example during class, I highlight with different colour pens to emphasise some points.				
Sive: You can save your notes like you normal save other documents and share them using different medium e.g. email or save on a memory stick,	providing answer	giving explanation	interactive dialogue	give and take
Teacher1: As indicated earlier I am not familiar with technology, I use free hand a lot because I am still learning how to use other tools. I do not know how to convert it to text.	asking a question	seeking understanding	interactive dialogue	T start conversation
Sive: this how you do it write your notes direct on the screen. To convert notes to text click on the select button on the toolbar,	providing answer	giving technological knowledge	interactive dialogue	give and take

select the text to be converted and a dropdown box will appear, choose recognise “your word” and your handwritten notes will be converted to text. Colleagues, You can also convert hand-drawn shapes to objects, the shape recognition pen converts hand-drawn shapes and lines into objects. This tool can be used to create diagrams. To convert hand-drawn shapes to objects, draw shape using pen, click the select button on the toolbar and select the shape to convert, click the dropdown box and select recognise shape.	Elaborating further	providing technological knowledge	monologue	Give and take
Teacher 1: This is what I want for my subject (Economics), you	asking a question	seeking understanding	interactive dialogue	T start conversation

know this board is small and if you hand write on it at times learners do not see. Is it possible to convert the whole graph (supply and demand) after drawing it?

Sive: I do not know the graphs you are talking about (supply and demand) but shapes like this can be converted.	Providing an answer	providing technological knowledge	interactive dialogue



Can be converted to prover:

triangle 

Rectangle 

Square 

Teacher 4: I think you can hand write graphs and convert them like you converted the shapes but you will do them one by one: example	Providing an answer	providing technological and content knowledge	interactive dialogue
You first draw your y-axis and convert because that will just a straight line and you add your x-axis and you do the same until you finish your graph.			
Sive: may be try that and see how it goes because I really do not know but I am sure that any	confirming the answer		

recognised sharp it will recognise.					
Sive; teachers how do you clean your smart boards?	Asking the question	looking for teacher explanations	interactive dialogue	Deliberately guides the interaction	T probes
Teacher: Our GAs (general assistance) clean them when they clean classrooms.	Providing an answer	providing technological knowledge	interactive dialogue		
Sive: perhaps do you know what they use when cleaning them?	Follow up question				
Teacher 1: usually a wet cloth.	Providing an answer				
Sive: Using water to clean your board is not advisable. It is recommend to use an alcohol free window cleaners. Spray a small amount on to a soft, clean cloth,	Providing an answer	providing technological knowledge	interactive dialogue		

and then wipe your board clean. Be sure to spray it directly on to the cloth, and not on the board, as cleaner may drip down into the electrics that are stored in the frame around your board. Some teachers/people have found that alcohol free antiseptic wipes are another good cleaning alternative. I hope you will keep your boards clean to avoid board freezing.

Appendix S: Language Editing Certificate

WORDPLAY EDITING
Copy Editor and Proofreader
Email: karien.hurter@gmail.com
Tel: 071 104 9484
Website: http://wordplayediting.net/

26 June 2021

To Whom It May Concern:

This letter is to confirm that *Mediation in information and communication technology teacher development: Towards effective ICT pedagogical integration in the classroom* by Khanyisile Mbatha was edited by a professional language practitioner.

Regards,



Karien Hurter