



**The relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umlazi district.**

**by**

**Nompumelelo Gcinile Nzimande**

**Student Number: 211517220**

**A dissertation submitted in fulfilment of the requirements for the degree of Master of Education (Teacher Development Studies), School of Education, College of Humanities, University of KwaZulu-Natal, Edgewood Campus**

**Supervisor: Prof Anja Philipp**

## DECLARATION

I, **Nompumelelo Gcinile Nzimande**, declare that

1. The research reported in this thesis, except where otherwise indicated, is my original research
2. This thesis has not been submitted for any degree or examination at any other university.
3. This thesis does not contain other persons' data, pictures, graphs, or other information unless specifically acknowledged as being sourced from other persons.
4. This thesis does not contain other persons' writing unless specifically acknowledged as being sourced from the researcher. Where other written sources have been quoted then:
  1. Their words have been re-written but the general information attributed to them has been referenced.
  2. Where their exact words have been used, then their writing has been placed in italics and inside quotation marks, and referenced.
5. This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the Reference sections.

Signed: 

NG Nzimande

**STATEMENT BY SUPERVISOR**

This dissertation is submitted with my approval,

Prof A Philipp

June 2020

\_\_\_\_\_

Date

## ACKNOWLEDGEMENTS

My heartfelt appreciation goes to my supervisor, Prof Anja Philipp for her consistent commitment, guidance, support and sound academic advice throughout the project. Thank you for dedicating your time to ensuring that I complete this project.

I would also like to thank my amazing and supportive family, especially my mother, Gugulethu Nzimande. Your constant support, encouragement and motivation helped me pull through. Not forgetting the love that surpassed it all.

My gratitude also goes to my best friends (Nana and Deh) who have been supportive and encouraging throughout, I thank you.

Last but not least, I would also like to thank God for being with me throughout the process of conducting and compiling this research project. Through Him, I was able to overcome any obstacle that I came across during the process. Not forgetting my Pastor (W.Ngcobo) and the church for their prayers.

***DEDICATED***

***To***

***My Family and Late Grandparents***

## ABSTRACT

In this study, I explored the relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics. This study was framed under the constructivism and Cognitive Activation (COACTIV) model frameworks. The research design chosen for this study is the mixed-method design. This design comprises quantitative and qualitative study approaches. Data was collected and generated in two sections. The first phase was generated using a questionnaire as part of the quantitative approach. The second section was on the qualitative approach and semi-structured interviews were used to collect data which was later transcribed.

The results of the study suggest that the relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics is strengthened by the types of Continuous Professional Development (CPD) activities teachers attend and how the activities translate to instructional quality as well as how cognitive activation and individual learning support is considered during teaching mathematics. Foundation Phase mathematics teachers attended formal and informal CPD activities, however, they mostly attended formal continuous activities. After attending the CPD activities, they implemented the activities in the classroom which translated into instructional quality (cognitive activation and individual learning support). This translation happens through the types of CPD activities, time spent and frequency for cognitive activation. Individual learning support is through beliefs and attitudes that teachers develop after attending CPD activities. Cognitive activation and individual learning support are considered through the use of new teaching methods that include doing practical work which was acquired from attending CPD activities. The results indicate that implementers and facilitators of CPD should consider teachers' beliefs and motivators as well as teacher interests. CPD activities need to be designed that include practical work and give timeous feedback on issues raised by teachers during the activities. Future studies should consider including learners perceptions, make use of observations and should also consider a larger sample.

## ACRONYMS

ANA-Annual National Assessment

CAPS-Curriculum Assessment Policy Statements

CASME-Centre for the Advancement of Science and Mathematics Education

CK-Content Knowledge

COACTIV-Cognitive Activation

CoP-Communities of Practice

COPSOQ-Copenhagen Psychosocial Questionnaire

CPD-Continuous Professional Development

CPTD-Continuous Professional Teacher Development

DBE-Department of Basic Education

DoE- Department of Education

ECD-Early Childhood Development

ELRC-Education Labour Relations Council

IBM-International Business Machines

IQMS-Integrated Quality Management System

MKT-Mathematical Knowledge for Teaching

OECD- Organization for Economic Cooperation and Development

PCK-Pedagogical Content Knowledge

PD-Professional Development

PLC-Professional Learning Communities

PPK-Pedagogical Psychological Knowledge

SACE-South African Council of Educators

SACMEQ-Southern and Eastern Consortium for Monitoring Education Quality

SPSS- Statistical Package for the Social Sciences

SPSS-Statistical Package for Social Sciences

TIMSS-Trends in International Mathematics and Science Study

UWES- Utrecht Work Engagement Scale

ZPD-Zone of Proximal Development

## LIST OF TABLES

Table 1: spectrum of CPD models

Table 2: Intercorrelations of CPD activities and Cognitive Activation and Individual Learning Support, and Other Study Variables ( $N=15$ ).

## LIST OF FIGURES

Figure 1. Model and Research Questions of the Study.

Figure 2. Guskey's model of the process of teacher change.

Figure 3. Elements of a professional development system

Figure 4. Reids Quadrant of teacher learning.

Figure 5. The COACTIV model of professional competence, with the aspect of professional knowledge specified for the context of teaching

Figure 6. Domains of mathematical knowledge for teaching

Figure 7. COACTIV model of teacher professional competence and links to instruction and learner factors

Figure 8. Sequential mixed methods design

Figure 9. Number of activities attended by teachers

Figure 10. Types of CPD activities attended.

Figure 11. Number of teachers per activity.

Figure 12. Frequency of teacher attendance

## **LIST OF APPENDICES**

Appendix 1- Gatekeeper letter and informed consent from Principals

Appendix 2- Letter to individual participants and informed consent

Appendix 3 - Semi-structured interview schedule

Appendix 4 - Questionnaire

Appendix 5 – Ethical Permission Letters (University of KwaZulu-Natal and KZN  
Department of Education.

Appendix 6 – Turnitin Certificate

## Table of Contents

Declaration.....	i
Statement by Supervisor.....	ii
Acknowledgement.....	iii
Dedication.....	iv
Abstract.....	v
Acronyms.....	vi-vii
List of Tables and Figures.....	viii
List of Appendices.....	ix
Table of Contents.....	x-xiii
<b>1. CHAPTER ONE-OVERVIEW.....</b>	<b>1</b>
1.1. Introduction.....	1
1.2. Background of Study Phenomenon.....	1-3
1.3. The Rationale for this study.....	3-4
1.4. The focus of the Study.....	4-5
1.5. Objectives.....	5
1.6. Research Questions.....	5-6
1.7. Structure of the Study.....	6-8
1.8. Conclusion.....	8
<b>2. CHAPTER TWO – LITERATURE REVIEW.....</b>	<b>9</b>
2.1. Introduction.....	9
2.2. Foundations of Teacher Continuous Professional Development.....	9-11
2.2.1. Forms of Teacher Continuous Professional Development Activities.....	12-20
2.2.2. Functions of Teacher Continuous Professional Development in Classroom Practice.....	20-21
2.3. Instructional Quality of Foundation Phase Mathematics .....	21-23
2.3.1 Dimensions of Instructional Quality .....	23-26

2.3.2 Relevance of Instructional Quality.....	26-27
2.4. Conclusion: the relationship between CPD and Instructional Quality .....	27-28
<b>3. CHAPTER THREE-THEORETICAL FRAMEWORK.....</b>	<b>29</b>
3.1. Introduction.....	29
3.2 Constructivism Theory for the Understanding of Foundation Phase Mathematics.....	29-30
3.2.1 Scaffolding for Constructive Instructional Quality.....	30-32
3.3. Professional Competence of teachers and COACTIV model. ....	32
3.3.1. Professional Competence of teachers .....	32-37
3.3.2. COACTIV Model and Professional Knowledge .....	37-38
3.4. Conclusion.....	38
<b>4. CHAPTER FOUR-RESEARCH METHODS/APPROACH TO STUDY .....</b>	<b>39</b>
4.1 Introduction.....	39
4.2. Study Approach .....	40-41
4.3. Research Design.....	41-43
4.4. Research Paradigm.....	43-44
4.5. Recruitment Strategy .....	44
4.6. Sample and Participants.....	45-46
4.7. Data collection and Generation Method.....	46-47
4.8. Data analysis.....	47-52
4.9. Ethical Considerations.....	52
4.10. Validity, Reliability and Rigour (in the case of empirical research).....	52-53
4.11. Limitations of the chosen methodology .....	54
4.12. Summary of Chapter.....	54
<b>5. CHAPTER FIVE-PRESENTATION AND INTERPRETATION OF RESULTS...55</b>	
5.1. Introduction.....	55

5.2 Continuous Professional Development activities that Foundation Phase mathematics teachers engage in.....	55
5.2.1 Number of activities per teacher and total attended by all teachers.....	55-56
5.2.2 Type of Continuous Professional Development Activities.....	56-57
5.2.3. Content of the Continuous Professional Development Activity Types.....	57-60
5.2.4. Results on Teachers’ Instructional Quality.....	60-62
5.3. Interpretation of Quantitative Findings.....	62-67
5.4. Presentation of Qualitative Results.....	67-68
5.4.1 Continuous Professional Development Activities Attended by Teachers.....	68-72
5.4.2. How the mentioned CPD activities were delivered and how they differed.....	72-74
5.4.3. Reasons for Engaging in Continuous Professional Development Activities.....	74-76
5.4.4. Perceived Usefulness of Continuous Professional Development Activities.....	76-78
5.4.5. Using the knowledge gained in the classroom.....	78-80
5.4.5.1. Consideration of Instructional Quality. ....	80-81
5.4.6. Considering Cognitive Activation.....	81-83
5.4.7. Considering Individual Learning Support.....	83-85
5.4.8. Influence of CPD activities on instructional quality.....	85
5.4.8.1 Links with Constructivism.....	85-86
5.4.9. Improvement after attending CPD activities (Professional Competence and COACTIV model .....	86-87
5.4.10. Difficulties of transferring information from CPD activities into class.....	87-88
5.4.11. Additional Results on Individual Learning Support.....	88-89
5.5. Interpretation of Qualitative Findings.....	89-93
5.6. Summary of Chapter.....	93-94

<b>6. CHAPTER SIX-DISCUSSION (INTEGRATION) OF FINDINGS, CHALLENGES, RECOMMENDATIONS AND CONCLUSION.....</b>	<b>95</b>
6.1 Introduction.....	95
6.2 Integration of Quantitative and Qualitative Results.....	95-98
6.3 Challenges expressed by teachers.....	98-99
6.4 Recommendations.....	99-100
6.5 Conclusion.....	100-101
References.....	102-116
Appendix 1- Gatekeeper letter and informed consent from Principals.....	117-119
Appendix 2- Letter to individual participants and informed consent.....	120-121
Appendix 3 - Semi-structured interview schedule.....	122-124
Appendix 4 - Questionnaire .....	125-132
Appendix 5 – Ethical Permission Letters (University of KwaZulu-Natal and KZN Department of Education.....	133-134
Appendix 6 – Turnitin Certificate .....	135

# CHAPTER ONE

## OVERVIEW OF THE STUDY

### **1.1. Introduction**

This study is about the relationship between teacher's Continuous Professional Development (CPD) activities and instructional quality in Foundation Phase Mathematics in two primary schools at Umlazi district. Here, I provide an introductory chapter that gives a background of the study, followed by the focus and purpose, rationale, objectives of the study and critical questions. A brief structure of the study has been provided, as well as the conclusion of this chapter.

### **1.2. Background of Study Phenomenon**

Mathematics is one of the focus areas of knowledge and capability of individuals. It is not only for the development of an individual, but it has also been identified as a core requirement for the economic and social development of South Africa (Mokhele, 2017). The development of Foundation Phase teachers on the Mathematics subject may be pivotal to ensure that learners get a basic and good foundation of the subject for future benefits. It is also relevant to view Foundation Phase Mathematics in South Africa with regards to the above-mentioned.

Mullis, Martin and Fay (2008) highlight that poor learner performance in Mathematics in South Africa is documented in national and international studies (i.e. The Trends in International Mathematics and Science Study (TIMSS) and The Annual National Assessment (ANA)). Based on the TIMSS 2011 dataset, Arends, Winnaar and Mosimege (2017) investigated teacher classroom practices that influence learner performance in Mathematics. One of the practices that were investigated was classroom instruction. Variables that were selected from the TIMSS 2011 study where classroom instruction is concerned are, for example, teacher clarity, classroom discussion, and feedback and problem-solving strategies. Arends *et al.* (2017) reflect that the measures investigated in their study show that there is an important and positive relationship between classroom practices and the performance of learners in mathematics.

Evidence of a positive relationship between learner achievement and teacher knowledge has been provided in research (Taylor, Christie & Reeves, 2008). Furthermore, the results suggest that the manner of interaction between teacher and learners has a significant hold in learner performance (Arends *et al.*, 2017). Thus, various ways to improve Mathematics in South Africa

are required, such as the improvement of teacher knowledge through development. Foundation Phase being the beginning phase of learning, it is imperative to view learner performance versus teacher knowledge.

Foundation Phase learners find it hard to master the basic skills of the mathematics subject. This concern has also been brought up in the scientific literature, which notes that learners from early as Grade 3 cannot perform basic operations in Mathematics (Machaba, 2013). In the South African context, the mathematics competency of learners seems to have decreased. In the SACMEQ III project report in South Africa (Spaull, 2011), it was mentioned that there was an overall decrease by 6.8 % in mathematics level 3 reach between 2000-2007. According to SACMEQ, the acceptable mathematics level is level 4. Viewing the competency of educators, the SACMEQ results highlight that the knowledge in mathematics differs between educators in different provinces. The overall percentage of educators reaching level 4 and above competency was almost 100 %, of which only 27.8 reached the highest level (i.e. level 8). Thus, suggesting that improvement in teacher competency is required.

Lack of teacher knowledge on the Mathematics subjects could be one of the reasons for learners' below-par performance in these large-scale studies. There have been interventions that have been formulated to improve learner performance such as; The Annual National Assessment (ANA) which was formulated to serve as a large-scale assessment to help improve teaching and learning as mentioned by Frempong, Reddy and Mackay (2013). They also highlighted that the ANA reports for 2011 and 2012 highlight that the performance of average Grades 3, 4, 5, 6 and 9 learners in Language and Mathematics is under 50% (Department of Basic Education (DBE) 2011, 2012). Drawing from this alarming result, one can suggest that Foundation Phase Mathematics requires attention as early as in grade 3 as it is mentioned amongst the grades with a below 50% average in Mathematics.

The results may be because of learners not being able to reason. Hoadley (2012) noted that learners in South African classrooms show low cognitive levels. Heyd-Metzuyanin and Graven (2016) mentioned that in 2003 South Africa was the least performing country out of 50 countries in (TIMSS) study and had the highest percentage of learners that achieved below the international benchmark. Furthermore, they discovered that research done in some South African schools indicates that learners depend on teachers, compliance and careful listening for mathematical success rather than problem-solving and independent thinking (reasoning). It seems that reasoning may need to be given attention in South African schools. Attention may

be given through teachers engaging in CPD activities that will help them cognitively activate learners.

### **1.3. The Rationale for this Study**

Mathematics is utilised in everyday occurrences, and this suggests that basic Mathematical knowledge is a necessity. Basic Mathematics may be acquired in the Foundation Phase. Therefore, Foundation Phase Mathematics teachers may need to be developed through CPD activities to be able to provide Mathematics ‘instruction that enables reasoning in Mathematics. On the note that reasoning in basic operations in Foundation Phase Mathematics is crucial. Wriston (2015) mentions reasons as to why a strong Foundation Mathematics is important. First, mathematics skills learned at the primary level forms a foundation for the mastering of a higher level of Mathematics skills. Thus, Foundations Phase Mathematics’ teachers have an important role in teaching Mathematics for the benefit of the learners’ basic knowledge to be used in daily life occurrences and to be able to master higher level Mathematics. Moreover, certain professions require a learner to enter university with a deep understanding of the Mathematics subject which means that mastering it at a higher level helps builds the learners future and career endeavours. Thus, making this study relevant for CPD of the Mathematics subject.

Learners start the Foundation Phase at the Early Childhood Development (ECD) level. This is the beginning form of schooling for learners which is sometimes termed as grade R. It is a level in which learners must gain basic skills of mathematics such as counting from one to ten. A large number of ECD teachers still use what they learned, which is teacher-controlled lessons (Barnard & Braund, 2016). Such lessons may not promote reasoning because of teachers not being equipped enough to incorporate this into their lessons during instruction.

Constructivist theories support that quality instruction highlights the state to which teachers create favourable opportunities for learner’s self-directed and insightful knowledge construction (Warwas & Helm, 2018). Instructional quality that sparks reasoning takes into consideration, cognitive activation and individual learning support. For this study, these are the chosen two of the three dimensions of instructional quality termed by Kunter and Voss (2013) to be discussed later in the study.

Initiatives to promote the development of teachers were introduced to equip them to provide instructional quality that sparks reasoning adequately. The introduction of the National Policy Framework of Teacher Education and Development in South Africa (2006) addressed the idea

of teachers acquiring enough knowledge and skills to meet education requirements. It aims to develop a teaching profession ready to meet the needs of the new democratic South Africa and to help educators be able to undertake the demanding tasks and continually improve their profession. In line with this policy, the South African Council of Educators (SACE) and the Department of Education (DoE) agreed on Continuous Professional Teacher Development (CPTD) in schools which will address professional development. Furthermore, Polly, Wang, Lambert, Martin, McGee, Pugalee and Lehew (2013) who reflected on the relationship of CPD activities with teachers' instructional quality and in particular of teachers in Foundation Phase mathematics, identified a gap in the relationship between CPD and instructional quality in Foundation Phase mathematics. Addressing professional development in the South African education system may have been one of the hopes the DoE had, to improve the education system.

The South African education system is in a crisis and it is vital to find the source of this crisis. Steyn (2011) asserted that schools are facing a challenge in delivering quality education. Lack of professionally developed educators may be the cause of this challenge as Gulston (2010) mentions that quality education depends on the quality of educators. The implementation of CPD in South African schools addresses the issue of educators lacking quality. SACE (2005) describes CPD as a system that will assist in developing teachers professionally. The Continuous Professional Teacher Development system was introduced by SACE together with the DoE. It aims to address the need for qualified teachers in South Africa as stipulated in the National Policy Framework (2006). To implement a system, it is imperative first to view its purpose and whether it will be suitable for the context it is aimed for. CPD was aimed at South African school educators. Upon matching the overall competency of educators and learners, it proves that in-service professional development activities are therefore crucial for teachers to increase their knowledge and skills. Thus, conducting this study seems relevant.

The relevance of the study is unpacked by what the study aims to do. As the study aims at exploring the relationship between CPD activities and instructional quality of Foundation Phase mathematics, it will highlight the purpose and relevance of professional development for the instructional quality without being ignorant to the challenges that arise in CPD.

#### **1.4. Focus of the Study**

This study aims to explore the relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics.

The proposed research will focus on the types of CPD activities that Foundation phase mathematics teachers engage in and to discover how the CPD activities translate into their instructional quality (cognitive activation and individual learning support). With this focus in my mind, it enabled me to draw the objectives of the study.

### **1.5. Objectives**

The objectives of this study are:

1. To find out which continuous development (CPD) activities Foundation Phase mathematics teachers at two primary schools engage in.
2. To discover how the continuous development (CPD) activities of Foundation Phase mathematics teachers translate into their instructional quality (cognitive activation and individual learning support).
3. To look into teachers' instructional quality (cognitive activation and individual learning support) in teaching mathematics after CPD activities have translated into instructional quality at Foundation Phase level in two primary schools.

### **1.6. Research Questions**

My research questions stem from seeking to explore the types of activities teachers engage in and how they translate to instructional quality to address the identified gap mentioned above. This led me to form the following research questions:

- 1) Which continuous professional development (CPD) activities do Foundation Phase mathematics teachers in two primary schools engage in as well as time spent and frequency of the activities?

*This question aims at investigating which types of CPD activities teachers engage in and which content was covered as well as the duration spent on the CPD activities and the frequency*

- 2) How do the CPD activities translate into instructional quality (cognitive activation, individual learning support) in Foundation Phase mathematics classes of teachers at two primary schools?

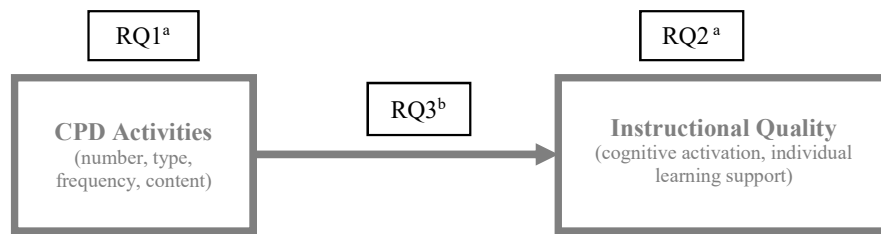
*This question aims at assessing how CPD activities translate into instructional quality in the classroom. Discovering the type of activities from the above question will assist in finding out*

*how the activities influenced instructional quality (cognitive activation and individual learning supportive*

- 3) Do Foundation Phase mathematics teachers at two primary schools consider cognitive activation and individual learning support in relation to instruction quality in the classroom?

*This question aims at exploring if their teaching of mathematics lessons is aimed to be cognitively activating and how teachers provide individual learning support that potentially promotes reasoning and understanding for the learners after CPD has been implemented.*

Figure 1 below depicts the relationships of the study variables.



<sup>a</sup> quantitative, <sup>b</sup> qualitative methods.

Figure 1: Model and Research Questions of the Study.

## 1.7. Structure of the Study

This study contains six chapters as follows:

### Chapter One

This chapter gives an overview of the study. It presents an introduction and a brief background discussion of the study which is then followed by the personal motivation to undertake this study, the focus and objectives. Finally, the critical research questions of this study and the structure of the study are presented.

### Chapter Two

Chapter two reviews the literature taking into consideration the Continuous Professional Development (CPD) of in-service teachers and Instructional quality in Foundation Phase Mathematics teaching in the classroom. It draws on the importance of CPD in promoting

quality teaching by discussing the foundations of CPD for classroom practice and forms of teacher CPD activities under the section of forms of teacher CPD activities, the forms of CPD activities that South African teachers may engage in are discussed. It also reviews instructional quality by mentioning and analysing the dimensions of instructional quality according to the aim of the study. This chapter also creates a link between CPD activities of in-service teachers and instructional quality in Foundation Phase mathematics lessons. Lastly, the relevance of instructional quality is presented of which highlights that there is a relationship between professional development and teachers 'skills, knowledge and attitude (*instructional quality*). A synthesis of chapter two is provided to conclude the chapter.

### **Chapter Three**

This chapter outlines the two theoretical frameworks that support this study. The first framework is Constructivism theory for the understanding of Foundation Phase Mathematics. Constructivism highlights how learners construct knowledge that cognitively activates them concerning Piaget's (1980) theory of constructivism. Next, scaffolding for constructive instructional quality.

The second framework that underpins this study is based on teacher professional competence and (Cognitive Activation (COACTIV) model) developed by Baumert and Kunter (2013). Professional competence of teachers is unpacked by drawing from the COACTIV model of professional competence looking at the first two domains of knowledge (*content knowledge and pedagogical content knowledge*) with the two chosen domains of instructional quality. Furthermore, subject matter knowledge and pedagogical content knowledge will be presented to give an overview of the mathematics subject. Combining these models help me explore the relationship between CPD activities and teachers' instructional quality of Foundation Phase mathematics, through professional competence (COACTIV model) being considered and the new knowledge gained (Constructivism) during CPD.

### **Chapter Four**

This chapter outlines and presents the methodological approach that addresses the objectives and research questions. It begins with an introduction followed by the study approach and research design; the mixed-method design. The mixed-method design comprises of the quantitative and qualitative study approaches (Creswell & Plano Clark, 2007). The outline of the design method is followed by a distinctive discussion of the two approaches that the design comprises of. In this chapter, I also present a research paradigm; pragmatism and the sampling

procedure followed by the recruitment strategy. Sample and participants are presented followed by data collection and generation method. Analysis procedures together with the methods used are then presented. This chapter also includes ethical considerations that touch on validity, reliability and trustworthiness as well as the limitations of the chosen methodology. This chapter also has a conclusion before moving to chapter five which is the presentation and interpretation of results.

## **Chapter Five**

Chapter five presents the results and interpretation of the results using the research questions as themes. For research questions one and two I first deductively analyse the quantitative results with descriptive statistics assessing means, standard deviations, frequencies and relationships between variables. The data is then transferred to visual overviews to be presented and interpreted. Secondly, for question three, I present the qualitative results from the semi-structured interviews using a content analysis approach then I interpret it. A summary of the findings is presented as a conclusion for this chapter.

## **Chapter Six**

This is the final chapter that serves as a conclusion chapter that presents the discussion (integration of findings), challenges, recommendations and conclusion. Also; as an answer to the presented research questions and objectives of the study. Recommendations are also included in this chapter.

### **1.8. Conclusion**

Chapter one has introduced the entire research, mentioning the background of the study. The personal motivation for undertaking this study has been discussed, followed by the study focus. I have also presented the objectives of the study and the research questions. Lastly, I provided the structure of the study. In the next chapter, I will focus on the literature review taking into consideration Continuous Professional Development (CPD) of In-service teachers and Instructional quality in Foundation Phase mathematics.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The previous chapter has highlighted the background and given an overview of the study. This chapter will present the literature review on the phenomenon. I will first define and discuss the foundations of teacher CPD, then look at the forms of teacher CPD activities and the functions of CPD for classroom practice. Secondly, I will focus on instructional quality as conceptualised by Kunter, Tsai, Klusmann, Brunner, Krauss and Baumert (2008) who focus on three components, i.e., classroom management, cognitive activation and individual learner support. This study will, however, only focus on the latter two components of instructional quality and the literature review will, thus, specifically summarise research on cognitive activation and individual learner support. Lastly, this chapter will review the link between the relationship between CPD activities of in-service teachers and instructional quality in Foundation Phase mathematics lessons.

#### **2.2 Foundations of Teacher Continuous Professional Development**

Educational research communities have made progress in enhancing our understanding of Professional Development (Evans, 2014). This understanding has been drawn from different literature that has defined teacher CPD. In early research on CPD, Hoyle (1980) defined Professional Development as the acquisition of subject or content knowledge and teaching skills. Day (1999) used the above definition as reference for his work. Day (1999) concluded that Professional Development comprises of all-natural learning experiences and the planned activities which are for the direct and indirect benefit to the teacher, peers or school which contribute to the quality of classroom practice. The above definition reflects how complex the process of Professional Development is (Day, 1999). In addition to the early research, Coetzee (2001) viewed professional teacher development as activities that improve teachers' skills and knowledge through support and training leading to effective classroom practice.

Professional development leads to effective classroom practice that improves learner performance. Thus, teacher CPD is not for individual benefit, it improves classroom practice which reflects on subject and learner outcomes. Various authors have further defined Professional Development by bridging the complexity through models such as the ones by

Guskey (2002) ‘*process of teacher change*’ and Ball (2009) ‘*Generative Change*’. I have chosen to review the literature on Guskey’s (2002) model of the process of teacher change because engaging in CPD may require the teacher to change from usual patterns of teaching to new patterns or strategies of teaching, particularly the Mathematics subject.

Originally, Guskey (2002) defined teacher Professional Development as processes and activities that improve the knowledge, skills and attitudes of teachers to improve how learners perform. He later viewed teacher Professional Development as a structured effort that brings about change in teachers’ classroom practice, attitude and beliefs (Guskey, 2003). This is an alternative view of Professional Development that looks at teacher change as a result of seeing evidence of improvement in learners (Guskey, 2002). This is explained further through the model of teacher change

There are three areas of change mentioned by Guskey (2002) that one looks at when defining CPD of teachers, namely, classroom practises, the attitude and the beliefs of teachers. Guskey (2002) further created a model of teacher change to enhance our knowledge on teacher change resulting from CPD activities. This model highlights the goals of programs of CPD. It suggests that a notable change in teachers’ attitudes and beliefs happens after they gain evidence of improvement (Guskey, 2002). Teachers attend programs with the hope to gain knowledge that will help them change their classroom practice to improve their teaching. Teaching is a classroom practice of which its pattern may keep changing to improve the learning outcomes of learners. This then may change teachers’ beliefs and attitudes towards CPD, positive or negative change. The figure below illustrates the three areas where change happens upon engagement in CPD activities and explains how Guskey (2002) defines CPD. In Guskey’s further works on CPD, he looks at what makes teacher CPD effective (Guskey, 2003) and what works in CPD (Guskey, 2009) which does not seem relevant to the focus of this study.

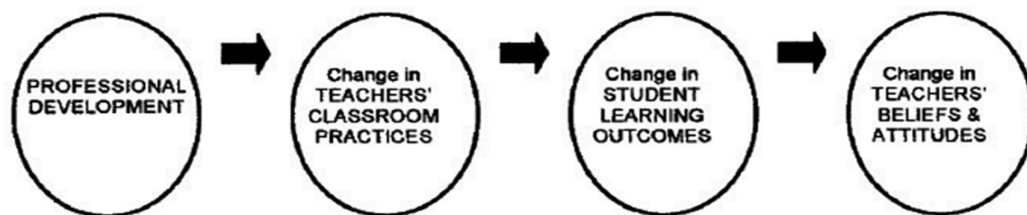


Figure 2: Guskey’s model of the process of teacher change (Guskey, 2002, p. 383).

The above model suggests that Professional Development informs the change in teachers' classrooms after having attended CPD activities. The shift in teachers' classroom practices may lead to change in the learning outcomes (positive) which may then spark change in teachers' attitudes and beliefs. Guskey (2002) states that according to the model, crucial change in teachers' attitudes and beliefs primarily happens after there is proof of improvements in learners. This improvement stems from the changes made in classroom practices. This view seems relevant to my study as I aim to explore the relationship between CPD activities and Foundation Phase mathematics' instructional quality (*classroom practice*). In summary, when teachers gain more knowledge through CPD activities, it may influence classroom practices. This, in turn, provides a positive learner outcome and instils positive belief and attitude of teachers toward the CPD activities. In the following section, empirical evidence to support this argument will be presented.

Lessing and De Witt (2007) believe that Continuous Professional Development is a means of enhancing the knowledge and skills of teachers through orientation, learning and support. Enhancement of skills may act as an influence on the change in classroom practices. Avalos (2011) views teacher development as learning for teachers, how teachers translate their knowledge into practice for learners' benefits (*processes found in Guskey's model*). Amadi (2013) denotes that Professional Development refers to skills and knowledge gained for both career improvement and personal development. It may be summed up that CPD updates teacher knowledge and skills (de Vries, Jansen & van de Grift, 2013). This knowledge leads to a change in classroom practices that lead to positive learning outcomes and beliefs in PD activities.

Furthermore, Lessing and De Witt (2007) also highlighted that various authors believe that Professional Development should begin with identifying the needs of teachers. After having identified the needs of teachers, the next focus should be on proper planning of the activities that teachers will engage in. Ono and Ferreira (2010) brought to our attention that the Professional Development of teachers is done for different purposes and in different forms of activities. The purpose is determined by the need for the professional development of teachers, for example, professional development of teachers may be needed to help teachers improve learner performance by enhancing knowledge. Also, mathematics reasoning skills may require a certain form of CPD activity.

### 2.2.1 Forms of Teacher Continuous Professional Development Activities

Professional Development of teachers has been conducted in different forms for different purposes (Ono & Ferreira, 2010). There are several forms of Continuous Development opportunities available. CPD for in-service teachers consists of various kinds of learning opportunities, from informal to formal activities (Collin, Van der Heijden & Lewis, 2012). Amadi (2013) states that opportunities range from university degrees, formal coursework, conferences and informal learning opportunities situated in practice. These workshops, conferences, consultation, coaching, both peer coaching and expert coaching (Geldenhuys & Oosthuizen, 2015). The mentioned various types fall under formal or informal activities. To understand learning opportunities, it is vital to examine the various types of teacher learning activities (Akiba & Liang, 2016). Furthermore, Borko (2004) states that when looking at forms of CPD, it is important to look at the key elements that form CPD activities. Facilitators initiate PD activities that teachers attend and must translate into their contexts (*see figure 2 below*). The PD activities seem to be significant in bringing together these elements.

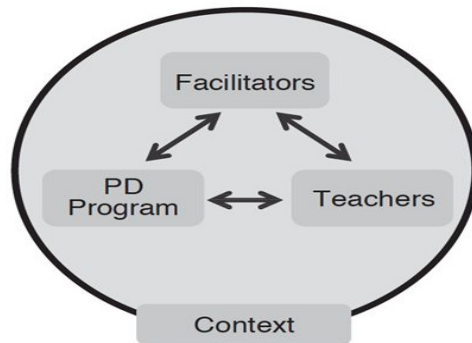


Figure 3: Elements of a professional development system (Borko, 2000, p.4).

Therefore, it is suitable to study the different forms of teacher CPD activities in finer detail. There are three different forms of teacher CPD activities classified in research over two decades ago by Lieberman (1996). These are; direct teaching, learning in school and out of school learning. Direct teaching takes the form of courses and workshops. Peer coaching, friendships and monitoring fall under the category of learning in school. Out of school learning involves activities such as; learning networks, visiting other schools and partnerships. This is a concise categorisation of CPD activities and other researchers have further developed models to frame the forms of CPD activities.

Kennedy (2005) categorised nine models that the forms of teacher CPD can be explored under (see Table 1 below).

Table 1: Spectrum of CPD models (Kennedy, 2005, p. 248).

Model of CPD		
The training models The award-bearing model The deficit models The cascade model	Transmission	Increasing capacity for professional autonomy
The standards-based model The coaching/mentoring model The community of practice model	Transitional	
The action research model The transformative model	Transformative	

The above table shows that the models of CPD can be categorised under the transmission, transitional and transformative. According to Kennedy (2014), the models increase the capacity for teacher autonomy. Teacher autonomy is associated with job satisfaction (Skaalvik & Skaalvik, 2014). Engaging in CPD activities may enable job satisfaction which may lead to positive learner outcomes.

Hagvall Svensson, Lundqvist and Middleton (2017) proposed that the transmission category looks at the need for the introduction of methods and tools. This may be the process of training through CPD. The transactional category looks at interaction which can be linked with the process of implementing what has been learnt during training for the benefit of the learners and the community. Transformative looks at the purpose and identity which is the outcome after implementing what has been learned. Kennedy (2014) suggests that autonomy occurs during the move from one category to the next.

Furthermore, Reid’s quadrant of analysis offers two dimensions (*see fig 3 below*); formal-informal planned and incidental (Fraser, Kennedy, Reid & McKinney, 2007). This quadrant summarises the framework of models by Kennedy (2005). I will firstly look at the formal activities and existing research then follow with the informal activities also going in-depth with existing research on it as well as identified gaps.

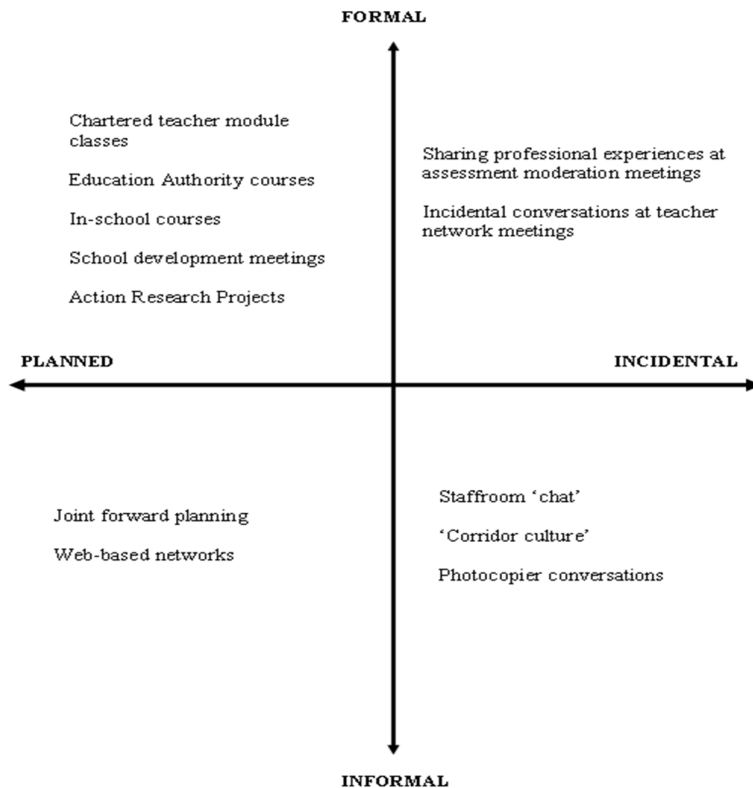


Figure 4: Reids Quadrant of teacher learning (Fraser, Kennedy, Reid & McKinney, 2007, p.161).

CPD activities looked at in this study can take the form of formal and informal activities. This is suitable for my study because I am to look at the formal and informal CPD activities that teachers engage in for instructional quality in the classroom. I will now focus on this categorisation distinctively in the South African context and identifying the activities that fall under each category.

### ***Formal Activities***

Formal learning is learning activities that are systematic looking at the time, space, goals, and support (Kyndt, Gijbels, Grosemans & Donche, 2016). According to Fraser *et al.* (2007), who presented Reid's quadrant, formal activities are those that are established by an agent other than the teacher. These are derived from government leads aimed at the implementation of educational standards (Vangrieken, Meredith, Packer & Kyndt, 2017). Formal activities are characterised by regular meetings with experts to impart knowledge to the teachers and involve pre-set goals (Vangrieken *et al.*, 2017). Formal activities have different outcomes. These outcomes map their relevance to the objective of this study. Some of the South African formal

teacher CPD activities that can be categorized as formal learning opportunities based on the above-mentioned structures are Integrated Quality Management System (IQMS), workshops (CASME and Jika iMfundo), and official courses offered by the department of education, for example, the mathematical concepts. Next, I will elaborate further on these activities.

### **Integrated Quality Management System**

IQMS is a system that aims to find out what the district offices, schools and teachers need. In addition, it provides support, promotes accountability, evaluates teachers' performance and monitors the school's effectiveness with the aim of rewarding teachers that have outstanding performances. IQMS is an appraisal system for teachers, it is an agreement that was reached in the Education Labour Relations Council (ELRC) on the 28<sup>th</sup> of July 1999 (Biputh & Mckenna, 2010). The major stakeholders in the ELRC are the Department of Education (DoE) and teachers' unions. Hlongwane and Mestry (2013) state that IQMS is a strategy that materialised after the ineffective implementation of performance management. In a study conducted by Thobela and Mtapuri (2014), it is denoted that the IQMS policy was made to help teachers to identify their shortcomings and engage in personal development, improvement of teaching and the culture of learning in the school. Engaging in personal development to improve the teaching and learning culture in school is the aspect that requires the teacher to attend CPD activities relating to IQMS. IQMS is a system that addresses areas of concern in South African schools. The South African Council of Educators (SACE, 2014) denotes that IQMS has three programmes which are Development Appraisal, Performance Management and Whole School Evaluation. The three programs ensure that this system promotes quality public education not just CPD.

**Development Appraisal:** transparently appraises teachers to help identify strength and weakness areas and create a plan for the development of an individual.

**Performance Management:** assesses individual teachers for progression of their salaries, grade progression, incentives, state of appointment and rewards.

**Whole School Evaluation:** evaluates the general effectiveness and the quality of teaching and learning.

Development appraisal is one of the three programs that allow teachers to engage in CPD activities as a plan for an individual development plan and may require professional development. Although teachers may feel overwhelmed or maybe this is a redundant act, they

may partake in it for salary progression under the performance management program. Thobela and Mtapuri (2014) presented challenges regarding the performance management program. One of them is that teachers make inaccurate ratings for the benefit of a 1% salary increase. However, the whole school evaluation program may serve as a corrective measure by directing IQMS as a CPD activity. This can be done by focusing on aspects of quality teaching and learning instead of placing focus on the salary progressions. Other formal activities are reflected as CPD activities that teachers engage for CPD such as, workshops.

### **Workshops**

Workshops are CPD formalised activities. They are a common type of activity in the Professional Development context (Garet, Porter, Desimone, Birman, & Yoon, 2001). Dating back, Garet *et al.* (2001) viewed workshops as a systematic perspective of Professional Development that happens outside teachers' classrooms. It is conducted by a facilitator with specific expertise and teachers attend the sessions at a scheduled time. Although this is a traditional method of conducting CPD teacher activities, it is criticized for not being effective in developing teacher knowledge and creating a shift in the classroom (Garet *et al.*, 2001). Steinert (2010) viewed workshops as popular because they are flexible and encourage active learning. Researchers agree that Professional Development activities must include active learning, be coherent, be of a noteworthy duration and have a content focus not forgetting collective participation (Whitworth & Chiu, 2014). However, there is a debate on the efficiency of workshops.

Vangrieken *et al.* (2017) mentioned that workshops were considered insufficient. In recent literature, the quantity and quality of workshops are in question. A study done by Govender (2018) in South Africa, it indicated that participants (teachers) expressed unhappiness about the content and quality of workshops that get from the Department of Basic Education. Quantity may refer to the duration of the workshops and quality refers to the content covered in workshops. It was also indicated that the duration of workshops seems insufficient to accommodate changes in the South African system. The changes require adequate training however is imperative to view what is being done in the actual workshops, the specific activities to measure their relevance in CPD. The translation of the activities done in workshops may provide relevance of workshops for teacher CPD. Not only workshops may be relevant, but courses may also be relevant.

## **Courses**

Teachers attend courses to develop themselves personally or may be seen as a requirement for professional learning to help improve classroom practice for the benefit of the learner. In a study by Parise and Spillane (2010), the authors argue that literature suggests that formal professional learning activities are in the form of graduate courses and short courses. These courses are courses that occur out of the classroom, organised by an expert to pass knowledge to a group of teachers. Parise and Spillane (2010) suggest that such learning opportunities do not have much impact on teacher classroom practice change. They focus mostly on the theory of training more than being practical.

Furthermore, although courses are similar to workshops in the sense that they take place outside the classroom, they have become widely available to teachers over the years (Parise & Spillane, 2010). Workshops take place for a short time and mostly involve practical activities, whereas courses have a longer duration and focus more on theory. However, with courses being indicated under formal activities, fewer concentrate on the relationship between teacher formal learning opportunities and learner achievement (Parise & Spillane, 2010). Furthermore, Parise and Spillane (2010) highlight that teachers participate in most professional learning activities and research suggests that they are may not facilitate teacher learning and change in classroom practice alone. A combination of activities may be adequate to facilitate the change. It does not necessarily have to be a combination of formal activities only, but a combination of formal and informal activities. Shirrell, Hopkins and Spillane (2019) denote that formal and on the job learning opportunities (informal) interact to impact practices and change in the classroom. Thus, suggesting that it may strengthen the relationship between CPD activities and the instructional quality of the subject concerned. Below you find a summary of selected informal activities.

### ***Informal Activities***

Recent research Professional Development activities show that informal learning processes of teacher Professional development have been brought to the fore (Kyndt, Gijbels, Grosemans & Donche, 2016). Earlier studies on informal learning defined it as learning that occurs in the workplace without systematic support is absent which does not follow a curriculum and is not limited to particular environments (Hoekstra, Beijaard, Brekelmans & Korthagen, 2007, Richter, Kunter, Klusmann, Lüdtke & Baumert, 2014). Informal learning is seen by less planning in terms of the context of learning, learning support, learning time, and learning

objectives (Kyndt, Gijbels, Grosemans & Donche, 2016). Informal learning opportunities are on restricted by the environment. For example, if teachers at work exchange ideas or knowledge that could be useful in classroom practice in a casual setting, it is regarded as professional learning yet no time, place and organisation when it took place, it happened informally.

In a study done by Kyndt, Gijbels, Grosemans and Donche (2016) that aimed at identifying informal activities through everyday teaching, it was highlighted that there were 371 non-unique activities inventoried by many studies that focused on identifying informal learning activities. They were reduced to 129 unique learning activities. A further reduction to 124 of the learning activities was done based on an analysis that showed that they are not part of everyday teaching practices. This reveals that there are quite several informal learning activities. Some of these activities are viewed as teacher Communities of Practice (CoP's) and Professional Learning Communities (PLC) (Vangrieken, Meredith, Packer & Kyndt, 2017). The feasibility of these activities may differ according to the context of a country as Hallinger (2003) indicated in early literature that the context of a school is important where specific and different circumstances are concerned.

### **Professional Learning Communities**

PLCs are required for collaborative teamwork on outcomes and intervention activities in teaching and learning (Botha, 2012). A necessity for teachers to engage in professional learning communities for teacher development is apparent. South Africa being in a reforming stage, teachers require development, “With all of the problems and/or challenges affecting education in South Africa, the creation of professional learning communities is a way to build teacher confidence, trust and to provide them with the skills and knowledge for their educational professional growth” (Botha, 2012, p.406). PLC's are therefore suitable for the South African context.

Vangrieken, Meredith, Packer and Kyndt (2017) argue that PLCs are better than CoPs because they are specific to the educational context. The authors also referred to Dufour and Eaker (1998) as the origins of PLCs. PLCs enable teachers to work together to improve teaching; they add value and have been presented as an added value as workshops seem insufficient (Vangrieken, Meredith, Packer & Kyndt, 2017). Dufour and Reeves (2014) argue that schools have created PLCs but do not implement strategies to classroom practice. It could be the reason that there are factors that affect PLC development in schools.

In a Study by Schaap and de Bruijn (2018), it is mentioned that PLCs affect school culture. Having to change from the norm can prove to be challenging if the school is resistant to change. The lack of reflective dialogue and collaborative activities decrease teacher professionalism and learner outcome (Schaap & de Bruijn, 2018). Reflective dialogue is an inquiry learning, exchange of knowledge and understanding of problem-solving (Schaap & de Bruijn, 2018). The exchange of knowledge leads to the development of teachers that leads to positive learner outcomes. Therefore, successful PLCs require collaborative inquiry and reflective dialogue.

### **Communities of Practice**

Communities of Practice (CoPs) form part of the teacher communities and are characterised under informal activities. Parise and Spilane (2010) emphasise that teachers do learn outside of formal settings. This learning occurs throughout a school day in many different activities (Parise & Spilane, 2010). According to Lom and Sullenger (2011), there is minimal attention directed to informal learning, yet teachers prefer ongoing informal learning. Vangrieken *et al.* (2017) denote that CoPs are common in the educational realm as informal development activities. CoPs are groups of people who share the same interest, problems, have a similar passion. They strengthen their understanding and specialisation in a particular area by communicating continuously (Vangrieken, Meredith, Packer & Kyndt, 2017).

CoPs have three principles; mutual engagement, a joint enterprise and shared repertoire. Vangrieken *et al.* (2017) discuss the third principle (shared repertoire) in such a way that it links to professional development. The shared repertoire is sharing teaching knowledge, techniques and different ideas that are important for professional development goals (Vangrieken *et al.* 2017). These goals may be goals related to instruction in the classroom. Wenger, McDermott and Snyder (2002) mentioned how CoPs add value to an organisation; they help with strategy, start a different line of business, efficiently solve problems, translate good practice, develop professional skills and help organisations recruit and keep talent in schools. The development of professional skills seems more relevant to the subject matter for creating an influence on learner achievement.

An overview of the forms of teacher CPD activities has been provided above. Upon conducting my study, I identified the above-mentioned activities with the objectives of my study in mind. The CPD activities that teachers engaged in, translated into the instructional quality of Foundation Phase mathematics in the classroom. It might be useful to understand the functions

of CPD. The functions map out the relationship CPD has with the instructional quality of mathematics as a classroom practice. Understanding the functions of CPD activities for my study seemed relevant because it enabled me to understand why teachers engaged in CPD activities for classroom practice particularly instructional quality.

### **2.2.2 Functions of Teacher Continuous Professional Development in Classroom Practice**

The importance of CPD to help encourage quality teaching has been noted at a global level (Martin & Thompson, 2018). Teachers in the world are experiencing a transformation in their roles of which increases demands on them in classroom practices (Amadi, 2013). It seems that throughout the world education systems require development. Brighouse (2008), states that all countries aspire to acquire higher standards of education and training. The impact of professional development on learning and achievement has been examined in literature (Evans, 2014). The examination points out functions of CPD that I will outline in this section in terms of teaching and learning, school goals and the functions of CPD, in general, mentioning the South African Context.

Teachers may be regarded as change agents. Fullan and Hargreaves (1992) highlighted that change requires teachers to alter their pedagogy, curriculum content, the resources and technology used and assessment styles. CPD helps teachers review, renew and extend their commitment as change agents (Murphy & de Paor, 2017). Engaging in development may assist them in fulfilling their commitment and reflect on their teaching strategies. In addition, Murphy and de Paor (2017) mention that teachers critically gain and develop skills, knowledge and emotional intelligence through teacher CPD activities. Thus, it enables them to provide quality education in the classroom by using new teaching strategies. For example, if a teacher taught using rote learning, the teacher may change this teaching strategy to a constructive and COACTIV approach (framing of this study).

Through CPD activities, teachers learn new teaching ways to improve instructional quality. Teacher professional development has been long seen as a major focus of systemic reform initiatives (Garet, Porter, Desimone, Birman & Yoon, 2001). This allows them to make changes in the way they present lessons to their learners, adding innovative teaching methods in the classroom. Moreover, Teaching and Learning is the main business of a school and CPD improves teaching and learning which then reflects on classroom performance. Through CPD activities, teachers may change the way they provide instructional quality in the classroom.

Murphy and de Paor (2017) further elaborate on four purposes of CPD outlined by the Organization for Economic Cooperation and Development (OECD, 2005). These are; activities that facilitate the implementation of policies or educational reforms. Task orientated professional development geared towards the preparation of staff or new functions. School-based professional developments are aimed at achieving the goals of school development and personal professional development for the enhancement of education. These purposes serve different aims where CPD at large is concerned. In this study for the South African context, it can be said that the purpose CPD serves from the outlined purposes is the; school-based development aimed at serving the goals of the schools. The quality of instruction may be viewed as the goal of the school as it may help in providing quality education and improve learner performance. Evan (2014) believes that professional development has often been related to school effectiveness and improvement. However, this consideration should not disregard the context of where professional development is being implemented as well as the classroom practice (instructional quality) that is aimed at being improved and this

### **2.3. Instructional Quality of Foundation Phase Mathematics.**

Professional Development has been implemented in South Africa to professionalise teaching. “Since the beginning of South Africa’s democracy, there have been several policy changes that have sought to professionalise teaching” (Kimathi & Rusznyak, 2018, p.3). Professional development of teachers seems to be an important lead in enhancing standards of South African schools (Kempton & Steyn, 2015). In a study titled; “Continuing Professional Development in South African Schools: Staff perception and the Role of Principals” done by Steyn (2011). The focus groups involved agreed that CPD is “vital”, “crucial”, “extremely important” and needed for professional growth. In it being important, there are challenges to it, one of the challenges experienced is many of the official CPD programmes often had little or no impact on teachers or schools as there was a lot of repetition. There may be a need to view the direct link of CPD to classroom practice for example; Instructional quality of Foundation Phase Mathematics. The provision of instructional quality by teachers may be one of the classroom practices to focus on.

Teachers can create opportunities to construct knowledge by providing quality instruction of the Foundation Phase mathematic subject. Quality instruction can result from teachers being

adequately developed according to a need to deliver the Foundation Phase mathematics subject. If a teacher finds that learners are struggling with reasoning constructivist theories support that instructional quality highlights the level to which teachers create favourable opportunities for learner's self-directed and insightful knowledge construction (Warwas & Helm, 2018). Furthermore, it can be viewed as "as creating challenging and adaptive learning situations, as well as carefully guiding students through the learning process" (Kunter, Tsai, Klusmann, Brunner, Krauss & Baumert, 2008, p. 470.). Warwas and Helm (2018) denote that constructivist theories support that instructional quality shows the degree to which teachers create opportunities that are favourable to learner's knowledge construction. The teacher needs to be developed on how to offer quality instruction where reasoning is concerned.

Engaging with the quality of instruction to view its influence in the classroom may require setting measures that reveal its success in the classroom. "Quality of instruction has not been directly measured in many accountability systems because few assessment tools exist that have the potential to directly measure the quality of classroom practice on a large-scale basis" (Junker, Weisberg, Matsumura, Crosson, Wolf, Levison & Resnick, 2005, p. 2). This is due to the reason that, a few tools are available that can directly measure the quality of classroom practice. Teacher quality has been measured in different focus areas. Gitomer (2019) denotes that, research has focused on the evaluation of teacher quality in terms of policy and practice. Furthermore, it seems that a direct measure that reveals the influence on learner achievement has not been researched much. Researchers use different measures and instruments when conducting research on the quality of instruction or classroom practice. More research is needed for the inspection of instructional quality in depth in the Foundation Phase (Grosse, Kluczniok & Roszbach, 2019). Upon conducting research, one must be aware of what has been used before as measures.

A multitude of opportunities for capturing instructional quality have been used (Praetorius & Charalambous, 2018). In previous research, Praetorius, Pauli, Reusser, Rackoczy and Klieme (2014) mentioned that researchers normally use teacher reports, observer reports when measuring the dimensions of instructional quality. Dimension may provide a direct measure to instructional quality when looked at in isolation. Investigations show that there are large differences in the stability of instructional quality dimensions and there seems to be no possible reason, therefore, a general distinction of the dimensions is supported by several researchers

(Praetorius *et al.*, 2014). Research chooses the opportunity that captures instructional quality with relevant dimensions.

Instructional quality has been viewed by several dimensions. However, dimensions that seem relevant for the study and what it aims to achieve are; cognitive activation and individual learning support which are two of three that are identified by Praetorius *et al.* (2014). Praetorius *et al.* (2014) suggest that instructional quality should be defined according to three dimensions: a) classroom management, b) cognitive activation and c) individual learning support. Recent studies focus on these three broad dimensions namely; classroom management, cognitive activation and individual learning support that reveal the structures of high-quality instructions, (Kunter & Voss, 2013). Examining these dimensions in relation to Foundation Phase mathematics instruction may be the start in exploring the relationship it has with CPD. I will distinguish between these above-mentioned dimensions drawing my focus on the latter two dimensions for Foundation Phase mathematics.

It is vital to know the area of focus when describing the quality of instruction. Kunter and Voss (2013) denote that the quality of instruction can be described by asking whether it corresponds with good teaching or learner's outcome. The latter informs this study as the translation of CPD activities into instructional quality in the classroom reflects on teaching and learning. The translation process can be measured by the dimensions of instructional quality. Instructional Quality is an important topic in the learning context (Grosse, Kluczniok & Rossbach, 2019). Hill, Blunk, Charalambous, Lewis, Phelps, Sleep and Ball (2008) denote that due to sample sizes which is one teacher per case study, there are a few measures on mathematical knowledge and instructional quality to date. Present studies are shifting focus to the dimensions of instructional quality (Grosse *et al.*, 2019). In the study by Kunter and Voss (2013), it is mentioned that there are dimensions that can relate to instruction. This study will focus on cognitive activation and individual learning support which aim at linking instructional quality to mathematics' instruction

### **2.3.1 Dimensions of Instructional Quality**

The chosen dimensions come from a list of dimensions. To empirically examine the instructional quality, a reduction of the complexity of the list is required to make the construct measurable (Kunter & Voss, 2013). Praetorius *et al.* (2014) believe that instead of describing surface-level characteristics of instruction, instructional quality should be described according

to three dimensions: 1) classroom management, 2) cognitive activation and 3) individual learning support. However, this study will focus on cognitive activation and individual learner support as measures for instructional quality.

### ***Cognitive Activation***

Kunter *et al.* (2008) mention that through cognitive activation, cognitive activities enable learners to develop new insight and understanding that is related to their former knowledge. Cognitive activation can be adhered to in the classroom by teachers being able to select appropriate tasks. Kunter *et al.* (2008) suggest that such activities draw on prior knowledge and experience. Consideration of different approaches to tasks and learners' (mis)-conception in class discussions is required (Kunter & Baumert, 2006). In a study by Holzberger, Philipp and Kunter (2013), it was discovered that some teachers promote cognitive activation in the classroom by letting learners go astray until they figure something is wrong. This discovery may lead to discovering how teachers promote cognitive activation in the classroom for Foundation Phase mathematics. Letting learners go astray help them think of many possibilities before reaching the answer causing them to reason. As I conduct the study it gives me a head start on things I must explore where cognitive development is concerned although teachers have different ways of cognitively engaging their learners.

Teachers may promote cognitive activation in a mathematics classroom by their understanding of cognitive activation or by their mathematics subject knowledge. Richland, Begolli and Frausel (2016) define cognition as the ability that includes memory, reasoning, spatial processing, problem-solving, language and perception. Hill, Blunk, Charalambous, Lewis, Phelps, Sleep and Ball (2008) stated that strong teacher knowledge produces benefits for classroom instruction and learner achievement. Having the above definition in mind, a teacher may first ensure that the learners can memorise certain steps first for example; memorising that before multiplying the second number in a column method of multiplying, a learner must place a zero to show place value. This can be informed by a professional development activity that teachers may engage in.

In a study on mathematics knowledge for teaching and the mathematical quality of instruction by Hill *et al.* (2008), it was discovered that cognitive guided instruction programs (professional development activity) improve teachers' knowledge of how learners think about and learn numbers and operation concepts. One teacher that attended the cognitive guided activity on

instruction promoted classroom discussion as a strategy to improve learners' rationalising skills. "Lack of specifics regarding how knowledge affects instruction leaves critical gaps in theoretical knowledge" (Hill *et al.*, 2008, p.431). This suggests that more specifics regarding the quality of instruction is needed. The context of my study aims to explore the specifics by investigating the relationship between teacher CPD activities in Foundation Phase and instruction quality in mathematics drawing on the dimension in question and individual learning support.

### ***Individual Learning Support***

According to Praetorius *et al.* (2014), individual learning support promotes a positive teacher-learner relationship which encourages learning in learners. Kunter *et al.* (2008) note that; effective teachers provide a supportive environment in which learners get personal guidance and feel valued personally. Warwas and Helm (2018) describe individual learning support as the extent to which a teacher is considerate to individual learner's understanding difficulties and encourages learners to engage in demanding tasks while they assist in correcting misconceptions. This provides a sense of belonging and security to the learners. Doğan and Yurtseven (2017) mention that providing individual learning support in a mathematics classroom requires teachers to use approaches such as small group work and ability grouping. It will allow the teachers to foster more individual learning support where it is much needed. Individual learner support being part of instructional quality, Ottmar, Decker, Cameron, Timothy, Curb and Rimm-Kaufman (2014) state that high-quality instruction is defined in terms of teacher-child interaction in the classroom and this interaction promotes individual learner support. Through this interaction, one may get to witness the translation of CPD activities into instructional quality in a foundation mathematics classroom.

### ***Classroom Management***

Classroom management is defined as a systematic space with minimal disruption levels and logical time usage (Warwas & Helm, 2018). Kayıkçı (2009) defines classroom management as the organisation of learning. Classroom management plays a crucial role in teachers' instructional quality. Walberg and Paik (as cited in Kayıkçı, 2009) mention that, effective classroom management strategies are considered important for learner achievements. Classroom management is a dimension that does not form part of my study. However, I have mentioned and highlighted minimal research because it forms a big part of instructional quality. Dating back, Martin and Baldwin (1993) viewed classroom management in three dimensions;

a) personality which speaks to teachers' beliefs in learners and the degree to which individual support is provided. b) Teaching, all that is done to maintain and establish learning activities in the classroom and c) discipline which is the actions taken to set a standard of behaviour. Watkins and Wagner (2000) mention integrative behaviour and directive behaviour as broad dimensions of classroom management. Integrative behaviour sees to the common goal and directive behaviour is related to behaviour that is required for a specific task. Behaviour does not form part of my study as it focuses on rationalising skills and learner support and classroom management has been vastly studied.

From the first work done by Kounin (1970), several studies have concentrated on classroom management (Praetorius *et al.*, 2014). My aim is not to add to this great body of research on classroom management. Dogan and Yurtseen (2018), however, suggest that instead of using one dimension, using two or more is appropriate. In line with this suggestion, I have chosen to focus on two dimensions; cognitive activation and individual learning support mentioned above. The two dimensions I will focus on seem relevant because both foster reasoning skills in learners for mathematics: Cognitive activation seems suitable for the acquisition of skill by learners and teachers structuring appropriate tasks that develop new insights for the mathematics subject. Individual learning support allows for interaction and a positive relationship with learners for learning. It enables the teacher to provide needed support to meet the learners' needs. Therefore, this suggests that an empirical study is necessary to explore the relationship between Foundation Phase teachers' CPD activities and instructional quality of mathematics looking at the two dimensions of the study. These dimensions are likely to map out this relationship.

### **2.3.2 Relevance of Instructional Quality**

Teacher's abilities and professional roles are best revealed in classroom practices. Classroom Instruction is the most important area of professional activity (Kunter & Voss, 2013). Bruns, Eichen and Gasteiger (2017) mentioned that CPD activities are needed to inform Foundation Phase Mathematics instruction. Teachers' CPD activities are important to improve teachers' knowledge and instruction and learners' learning (Akiba & Liang, 2016). Thus, there seems to be a close relationship between CPD activities and the instructional quality – which is relevant to Foundation Phase Mathematics lessons to promote the reasoning skills of learners early. In this study, however, I will solely focus on the relationship between CDP activities of Foundation Phase mathematics teachers and their instructional quality.

Jacob, Hill and Corey (2017) believe improving mathematics instruction relies on teacher professional development. Furthermore, research shows a positive relationship between professional development and teachers' skills, knowledge and attitude (Tajudin, Chinnappan & Saad, 2016). "Previous empirical studies on effectiveness of teachers' professional learning activities on student achievement focused on specific types of activities such as professional development programs, teacher collaboration, or professional learning communities" (Akiba & Liang, 2016, p. 100). In the mathematics field, studies on CPD have found programs that improve teacher knowledge and instructional practices (Akiba & Liang, 2016). However, there seems to be a gap in research focusing on the empirical relationship between CPD activities and teachers' instructional quality in Foundation Phase mathematics (Polly, Wang, Lambert, Martin, McGee, Pugalee & Lehew, 2013). Thus, exploring the relationship between CPD activities and Mathematics instructional quality in the Foundation Phase may provide some significant understanding.

#### **2.4. Conclusion: the relationship between CPD and Instructional Quality**

The variety of classroom practices that are used in the process of interacting with learners play a crucial role in understanding and the overall performance in mathematics (Arends *et al.*, 2017). Decristan, Kunter, Fauth, Hardy and Hertel, 2016 note that to promote understanding, instructional quality seems suitable because it is crucial to learners 'achievement. Improvement of instruction as a classroom practice seems to need in-service teachers to engage in CPD activities. "A considerable body of research also revealed a positive relationship between Professional Development and teaching practices." (Tajudin, Chinnappan & Saad, 2016, p.4).

Teachers experience change after having attended CPD activities. This change is directed towards classroom practices (instructional quality) and beliefs. In a study conducted by Lessing and de Witt (2007) on the value of teachers' perception for Continuous Professional Development, it was reported that teachers found certain CPD workshops important. The workshop was crucial for their skills and personal development, teaching confidence, habits, support as well as information. In this study, the interest lies more on personal and skill development and to a lesser degree on teaching confidence and habits. The results showed that more than 90% of the teachers agreed on the importance of CPD for personal development and 96.2% for skills and teaching habits. For the development of teaching confidence, the majority (95.8%) agreed on the relevance of CPD activities. From personal development, one can derive

aspects such as belief and motivation. Skills, teaching habits and confidence relate to the instructional quality administered after attending the CPD activities. Thus, CPD seems pivotal.

Recent research also shows that “there is a need for professional development courses on Foundation Phase Mathematics” (Bruns, Eichen & Gasteiger, 2017, p.80). Jacob, Hill and Corey (2017) believe that attempts to improve mathematics instruction depend on teacher professional development. Through teacher Professional Development, in-service teachers acquire new ways of teaching to improve the quality of instruction (Amadi, 2013). The Professional Development needed for the Foundation Phase mathematics instruction may be achieved through the previously mentioned formal and informal Continuous Professional Development activities.

Moreover, Grosse, Kluczniok and Rossbach (2019) reveal that quite a vast body of research relating to instructional quality and its importance for learner development has been mostly conducted with learners at the end of primary grades or in secondary schools. Thus, there is little evidence on younger primary school learners. A substantial body of studies indicates that instructional quality in school influences different aspects of learner achievement (Grosse, Kluczniok & Rossbach, 2019). These aspects are mathematics, reading, vocabulary and adaptive skills. Thus, it makes my study relevant because it aims to explore the relationship between CPD activities and instructional quality in Foundation Phase mathematics. To carefully explore this relationship, I had to make sure that I am following a theoretical framework. In the next chapter, I present the theoretical frameworks that guided this study.

## CHAPTER THREE

### THEORETICAL FRAMEWORK

#### 3.1. Introduction

In the previous chapter, I have presented a literature review for this study. This chapter is about the theoretical frameworks that frame this study. This study is guided by two theoretical frameworks. The first framework is *constructivism*. Pritchard (2009) views constructivism as learning that happens when new information is gained based on an individual's prior knowledge, understanding and skills. The second theoretical framework for the study is based on the professional competence of teachers which is summarised with a *model of teacher professional competence* (COACTIV) developed by Baumert and Kunter (2013). Combining these two models will help me frame the exploration of the relationship between CPD activities and teachers' instructional quality of Foundation Phase mathematics. This relationship may be strengthened by the new knowledge acquired (Constructivism) during CPD activities. Also, professional competence (COACTIV) being considered during instructional quality in the classroom as a part of the model suggests that from professional competence teachers can provide instruction taking into consideration classroom management, cognitive activation and individual learners support for the benefit of the learners. The latter being the focus of my study.

#### 3.2 Constructivism Theory for the Understanding of Foundation Phase Mathematics

The first framework this study has been framed under is constructivism. Constructivism is a knowledge theory that is a legacy of Jean Piaget (1896-1980). According to Powell and Kalina (2009), Piaget's central focus of constructivism is about the individual and how knowledge is constructed by the individual. Powell and Kalina (2009) mention two types of constructivism which are cognitive and social constructivism. This study links to cognitive constructivism as it proposes that humans construct their knowledge through the stages of development (Powell & Kalina, 2009). There are four stages of development that Piaget (1964) mentions. The first stage is a sensory-motor, pre-verbal stage that lasts 18 months. The second is the pre-operational representation stage which involves the start of language and the reconstruction of the sensory-motor stage. The third stage involves the appearance of the first operations; it is when children operate on objects. The last stage which is the fourth stage is, the surpassing of

operations of which the child has reached the level of hypothetic deductive operations and can now reason.

This cognitive theory relates to my study as I aim to understand the cognitive activation of a learner in the classroom through the translation of CPD. The fourth stage relates directly as it speaks of the child's reasoning, CPD, therefore, influences this reasoning as the learners construct new knowledge linking it to previous knowledge. Jardine (2006) views constructivism as the idea that humans actively construct new knowledge based on previously acquired knowledge. In this study, this suggests that instructional quality in the classroom is influenced by previously acquired knowledge as learners match what is being implemented by the teachers after attending CPD activities for their cognitive development. When teachers attend CPD activities, it is not that they are completely blank, but they go there to gain knowledge that is related to what they already know. For example, teachers are aware of what the primary mathematics subject requires as well as its concepts.

Pritchard (2009) sees constructivism as learning that happens when new information is learned based on an individual's prior structure of knowledge, understanding and skills (professional competence). Professional development activities of teachers may aim at improving their professional competence. This suggests that through CPD activities, teachers are professionally developed to improve instructional quality in the classroom. In the history of constructivism research, Wood (1995) perceived that constructivism grants a strong way to rethink education practices. CPD activities provide teachers with the opportunity to rethink their practices and design strategies for instruction of the Foundation Phase Mathematics' subject. A strategy that teachers can use in constructive classroom practices is scaffolding.

### **3.2.1 Scaffolding for Constructive Instructional Quality**

Scaffolding as a new strategy for teaching may enable teachers to develop learners' mathematical reasoning skills through cognitive activation and individual learning support by the translation of knowledge gained from CPD activities into classroom practice. Scaffolding is a term that was developed by Wood, Bruner and Ross (1976) to help describe what interaction does between learners and the skilled (teachers). Vygotsky (1978) stated that when learners are supported by the teacher as knowledgeable sources of instruction, they improve. This suggests that there should be an interaction between the learner and the teacher to enable support.

Interaction between a child and knowledgeable adults, peers and teachers can be a result of the Zone of Proximal Development (ZPD). ZPD is a concept developed by Lev-Vygotsky (1896-1934) which helps me unpack the concept of instructional quality. It can be viewed as the difference between what a child knows and does not know. The role of constructivism and scaffolding comes in through educational contexts which fosters a relationship between the teacher and learner. In the scaffolding process, the teacher helps the learner in his/her ZPD. Vygotsky (1978) stated that the role of education is to give children experiences and knowledge within their ZPD by encouraging and developing individual learning. ZPD impacts learning through curriculum, instruction and assessment processes. A relevant process for this study is instruction as it is a concept embedded in this study. Instruction has been viewed as instructional quality in this study with a specific focus on cognitive activation and individual learning in Foundation Phase Mathematics. Instructional quality can be viewed as instructional scaffolding for this study's theoretical framework. Delen, Liew and Wilson (2014) view instructional scaffolding as a term for describing the relationship of interaction between learners and teachers. Instruction is a process of scaffolding in the educational context. In instruction, learners need to be exposed to knowledge that is common, knowledge that they can relate to their daily lives. Such knowledge gives way to cognitive activation as learners will be able to learn individually after having been supported of which would not happen without support. Through scaffolding, learners may be able to reason in mathematics after receiving support from teachers. Individual learning support as an aspect of instruction is seen in the process of supporting learners to gain experience and knowledge of what they do not know so they may know. This is a constructivist's point of view on scaffolding.

In constructivism, knowledge is not passively received (Yilmaz, 2008). Children must be able to provide feedback in oral or written work. This is where constructivism meets the cognitive reasoning skills of the learner, e.g. teachers should plan activities that will allow the learner to actively engage in mathematics activities that promote reasoning and also linking the activity to prior knowledge. The learner can be provided with real-life examples that draw on already known knowledge as well as practical tasks. Practical tasks may require individual learning support when learners are tackling them.

Individual learning support is evident when a teacher explains an activity and follows up on the individual learner in how far they need scaffolding in constructing their knowledge and reasoning skills. Thus, the learners are allowed to think and the teacher needs to provide individual learning support where needed. Constructivism promotes interaction between the

learner and the teacher (Bada & Olusegun, 2015), e.g., through the process of providing individual learning support to promote interaction between teachers and learners. Constructivism, therefore, helps develop teachers' instructional quality using the support (scaffolding) given to learners after teachers have attended CPD activities. Constructivism being the development of new knowledge that links to prior knowledge (Jardine, 2006), it is pivotal that the knowledge constructed is to master specific situations where instructional quality is concerned. The knowledge needs to be insightful and thus lead to a positive learning outcome. This can be achieved through the steps or procedures covered in Baumert and Kunter's (2013) COACTIV model, hence my study is framed under this model as the second theoretical framework.

### **3.3 Professional Competence of teachers and COACTIV model**

#### **3.3.1 Professional Competence of teachers**

It seems likely that competence gives way to the ability to carry out tasks where teaching and learning is concerned. According to Hunt (2011), competence is a relation between the individual's ability and the satisfactory completion of appropriate tasks. When teachers provide instructional quality in the classroom, certain aspects of professional competence are evident. These aspects are to be further elaborated on below. Liakopoulou (2011) views professional competence in terms of the work carried out by a teacher. The way that the work is done is determined by a combination of the personality traits of a teacher and acquired knowledge. This is an early view of knowledge of teachers by Shulman (1987). Furthermore, taking into consideration this combination, professional competence can be viewed as the skills, knowledge, attitudes and motivational variables to help master situations (Kunter, Klusmann, Baumert, Richter, Voss & Hachfeld, 2013). Competence relates to my study because building competence has been identified as the main objective of education (Klieme, Hartig & Rauch, 2008). This objective took the angle of professional development in teacher education. The professional competence of teachers in relation to knowledge has a range of aspects.

In the early works of literature knowledge of teachers has been viewed in three categories; a) Subject Matter Content Knowledge (SMK), b) Pedagogical Content Knowledge (PCK) and c) Curricular Knowledge. A focus was on content knowledge and "referred to as the amount and organisation of knowledge per se in the mind of the teacher" (Shulman, 1986, p. 9). However, Shulman (1986) believed that a teacher needs to have different kinds of knowledge that will

enable the teacher to explain why a hypothesis is guaranteed and worth knowing. The knowledge types are those categorised above.

After Shulman's (1986) work on content knowledge, there were new education reforms that inspired a refined approach to content knowledge for teaching. The reforms presented reported on how to improve teaching as a profession and an activity (Shulman, 1987, p.3). Shulman (1987) based his position on the subject matter on the influence of scholars; amongst many, there was Schwab (1983) and Dewey (1904). Discussions were presented on what qualities, understandings, skills, abilities, traits and sensibilities make an individual a competent teacher. Shulman (1987) highlighted that a teacher understands something that is not understood by the learners. Learners are given instruction and opportunities for learning and this can be done through aspects of knowledge that are acquired by teachers or rather expected from teachers. Although "subject matter is a nearly universal vehicle for instruction" (Shulman, 1987, p. 7), teaching needs to be for learners' comprehension as well. Seven categories constitute content knowledge in the refined argument of content knowledge for educators. Categories set forth are; "general pedagogical knowledge (GPK), curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, and knowledge of educational ends, purposes, and values, and philosophical and historical grounds" (Shulman, 1987, p.8).

Liakopoulou (2011) later viewed the above-mentioned categories as a basis of professional knowledge and provided distinctions between the seven. Professional knowledge also forms the basis of teacher professional competence. Amongst the seven two seemed relevant for this study where professional competence is concerned as well as the aim of the study; a) content knowledge and b) pedagogical content knowledge. These categories are clearly outlined in the study by Baumert and Kunter (2013) of the COACTIV Model of Teachers' Professional Competence as summarized in figure 4 below. The theoretical objective of COACTIV is to identify the competence needed by teachers to meet what is required by the profession (Baumert & Kunter, 2013). Professional knowledge seems to be one of the competencies needed by Foundation Phase Mathematics teachers.

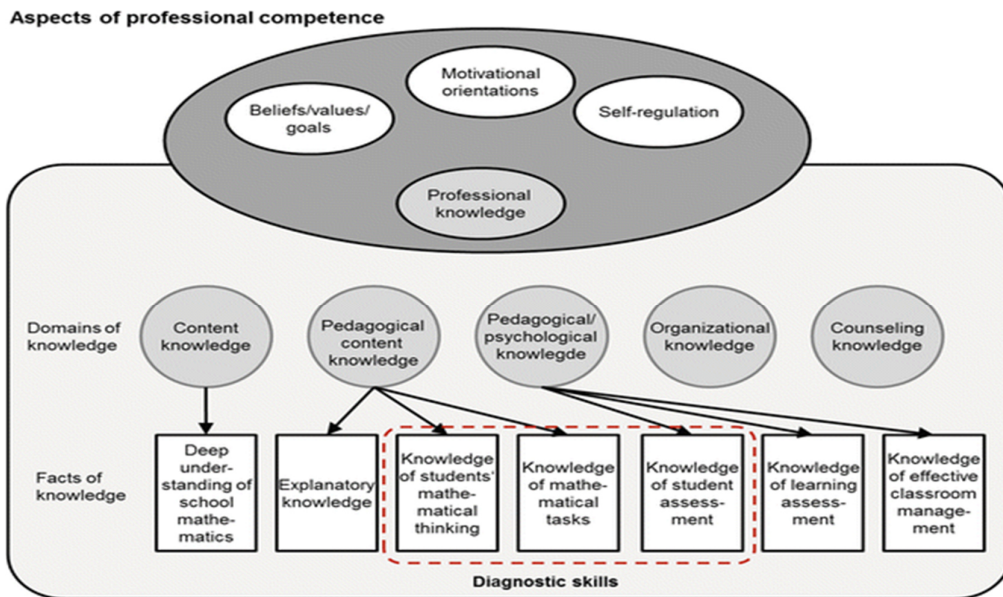


Figure 5: The COACTIV model of professional competence, with the aspect of professional knowledge specified for the context of teaching (Baumert & Kunter, 2013, p.29)

The COACTIV model presents different domains of professional knowledge in the mathematics subject with facets of knowledge. These domains are; content knowledge (CK) which refers to the deeper understanding of school mathematics, pedagogical content knowledge (PCK) which is about explanatory knowledge, knowledge of learners ‘mathematical reasoning and mathematical tasks as stated in figure 4 above. There is also the domain of Pedagogical Psychological Knowledge (PPK), Organisational Knowledge and Counselling Knowledge which did not seem relevant in this study. These facets of knowledge have a link to the aspects of Instructional Quality (Cognitive activation, Classroom management and Individual learning support). Thus, validating the relationship between CPD and Instructional Quality of Foundation Phase Mathematics. However, not all these domains seemed relevant to the focus of this study because the focus is on learner’s mathematical reasoning and acquiring basic skills through instructional practices in class that are influenced by CPD. The aspects to be focused on are CK and PCK because the facets of knowledge presented by these domains link to the focal dimensions of instructional quality in this study; cognitive activation and individual learner support.

### ***Content Knowledge and Cognitive Activation***

A deeper understanding of subject content is vital where the quality of instruction is concerned and for the ability to activate cognition in learners. Shulman (1986) viewed content knowledge

as knowledge of the subject and its planning systems. Phelps and Schilling (2004) referred to content knowledge as the idea that teachers need to understand the subject before they present it to learners. Klieckmann, Richter, Kunter, Elsner, Besser, Krauss, Cheo and Baumert (2013) support that; CK represents teachers' understanding of the subject matter. In the early work of Phelps and Schilling (2004), they stated researchers have often used proxy measures such as tests and courses to measure content knowledge and this has been considered as common knowledge. Furthermore, "there was little about specialized content knowledge needed for teaching specific subjects" (Phelps & Schilling, 2004, p.32). This suggested more research on specialized content knowledge for subject teaching is needed.

However, in some subjects there was a development on specialized content knowledge, "in areas such as mathematics and science, developing teacher content knowledge has been a major concern because it is generally accepted that teachers who know these subjects are better able to teach them" (Phelps & Schilling, 2004, p.32). Teachers require a deeper understanding of the subject so that they can provide quality instruction in terms of cognitive activation and giving learners the right cognitive activities. On the mathematics subject, Baumert and Kunter, (20) highlighted that Content Knowledge (CK) is the deeper understanding of school mathematics. Teachers may be able to cognitively activate learners upon acquiring specialized content knowledge from attending CPD activities. Kunter *et al.* (2008) believe that cognitive activities enable learners to develop new insight and understanding that is related to their former knowledge. During classroom instruction, cognitive activities may be created by the teachers from their deeper understanding of the subject gained through CPD. This deeper understanding may be referred to as PCK, the second category from Shulman's (1987) seven categories of knowledge and the category chosen for this study. It encompasses the second aspect of instructional quality forming part of the focus of this study (*individual learning support*).

### ***Pedagogical Content Knowledge and Individual Learning Support***

In the early works on professional competence by Shulman (1987), Pedagogical Content Knowledge (PCK) was viewed as a critical combination of content and pedagogy for teachers and their particular form of professional understanding. PCK was also observed as a kind of knowledge that is distinctive to teachers and the meaning of teaching (Cochran, DeRuiter & King 1993), before teachers become subject aspects, they must know about teaching. It is what

makes teachers before being subject are aspects (Cochran, King & DeRuiter, 1991), PCK is therefore pivotal for teacher competence.

Kunter *et al.* (2013) believe that PCK is about the content knowledge needed to make the subject accessible to learners. Such knowledge enables the teacher to give demanding tasks to learners to allow the opportunity of correcting misconceptions. Giving of tasks is part of practice within the classroom, tasks related to specific subjects. Newsome, Taylor, Carlson, Gardner, Wilson and Stuhlsatz (2019) mentioned that PCK relates teacher knowledge and practice in the teaching of a particular subject. In this practice, it is where aspects of instructional quality can be seen. Such an aspect that filters through is individual learning support.

In teaching Foundation Phase Mathematics, PCK can be seen in aspects of instructional quality, cognitive activation and individual learner support. According to Warwas and Helm (2018), individual learning support is the degree to which a teacher is considerate to individual learner's understanding difficulties and encourages learners to engage in challenging tasks while they assist in correcting misconceptions. Pedagogical Content Knowledge (PCK) is about explanatory knowledge, knowledge of learners 'mathematical reasoning and mathematical tasks (Baumert & Kunter, 2013). It supports cognitive activation as learners engage in demanding tasks that require them to reason. Learners need to be willing to receive support by making a subject accessible to them through explanatory knowledge.

### ***Subject Matter Knowledge and Pedagogical Content Knowledge.***

Mathematics as a subject provides its knowledge domain that Hill, Ball and Schilling (2008) term as Mathematical Knowledge for Teaching (MKT). This is what I have discussed next in this chapter where I relate it with PCK. It is not enough to view only the aspects of the COACTIV model (*teachers, instruction and students*) when looking at professional knowledge. It is also pivotal to view the content knowledge of the subject in concern, "demands of teaching require knowledge at the intersection of content and knowledge" (Ball, Thames & Phelps, 2008, p. 402). Ball, Thames and Phelps (2008) map out usable professional knowledge of the subject matter. Figure 5 below presents the correspondence between Shulaman's (1987) one of the chosen knowledge categories (*PCK*) and aspect of the subject matter knowledge (*MKT*). Hill, Ball and Chilling (2008) identified that primary teachers' CK and PCK in primary

mathematics are combined in a single body of knowledge. It is labelled as mathematical knowledge for teaching (MKT). Thus, making these domains suitable for this study.

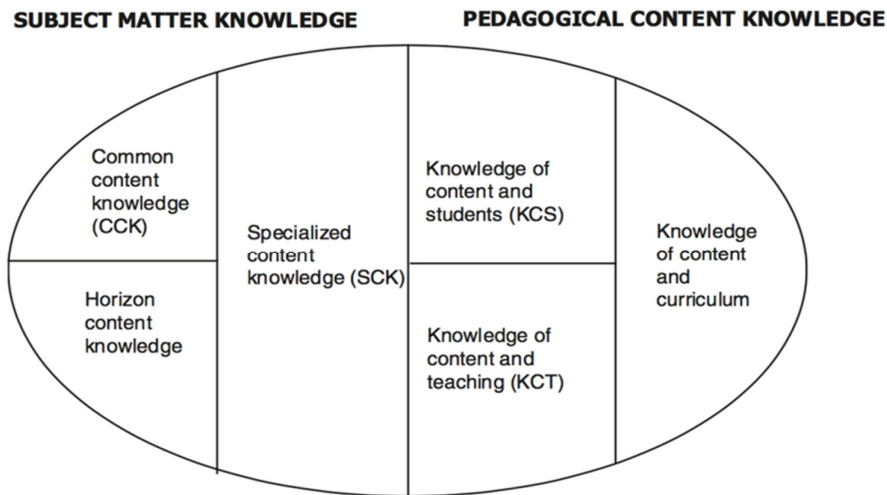


Figure 6: Domains of mathematical knowledge for teaching (Ball, Thames & Phelps, 2008, p.403).

### 3.3.2 COACTIV Model and Professional Knowledge

In the professional competence aspects, the focus in this study is the professional knowledge that is gained after engaging in CPD activities. Professional Knowledge leads to instruction. From instruction, insightful learning processes take place (Baumert & Kunter 2013). This produces learner results where mathematical knowledge is concerned (*see figure 6 below*).

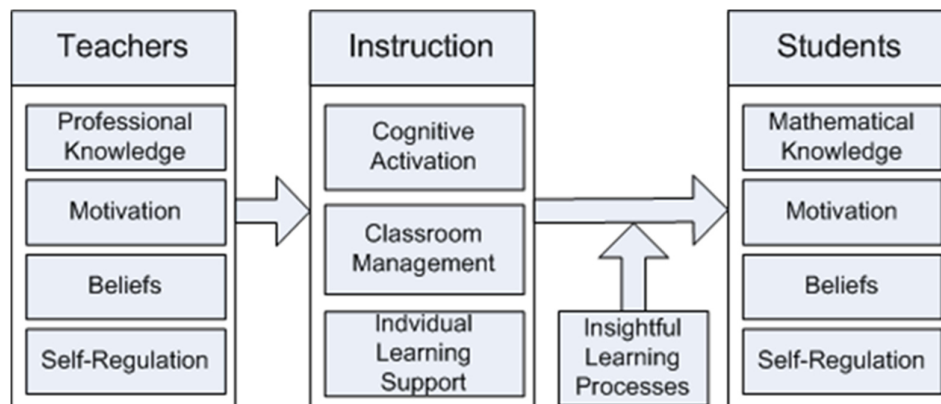


Figure 7: COACTIV model of teacher professional competence and links to instruction and learner factors (MPI, 2009).

This model describes that certain aspects are part of the professional competence of teachers: Professional knowledge, beliefs/values/goals, motivational orientations and self-regulation (Baumert & Kunter, 2013). “The COACTIV model of teachers’ professional competence describes the qualities needed to succeed in the teaching profession from a multidimensional perspective” (Baumert & Kunter, 2013, p.42). The major dimensions relating to instruction are classroom management, cognitive activation and individual learning support. The latter being the focus of my study.

Furthermore, the model of teacher competence is relevant to this study. Continuous Professional Development activities will inform teacher professional competence through the activities done that will translate into the instructional quality of Foundation Phase mathematics in the classroom. Teachers’ CPD activities are crucial to improve teachers’ knowledge and instruction as well as learners’ learning (Akiba & Liang, 2016). The model has been assessed with mathematics teachers (Baumert *et al.*, 2010) and therefore, forms as support for this study.

### **3.4. Conclusion**

This chapter has discussed the theoretical frameworks that underpin my study. The first framework that has been presented is constructivism. It highlights how learners construct knowledge that cognitively activates them as stated in Piaget’s (1896-1980) theory of constructivism. This study relates to the fourth stage that touches on the child’s reasoning ability. Thus, relating it to cognitive activation in the classroom. The second framework is the COACTIV model that is presented in the work of Baumert and Kunter (2013). However, it was necessary to discuss Shulman’s (1986) work on professional competence as it lays a foundation for the knowledge construct of the COACTIV model. The knowledge spoken of may be gained through PD activities attended by teachers; hence the second framework relates to my study. Using these two models in combination helped me explore the relationship between CPD activities and teachers’ instructional quality of Foundation Phase mathematics, through new knowledge gained and cognitive activation of learners (constructivism) and professional competence (COACTIV) being considered during CPD. In the following chapter, I present the methodological approach applied in the study which helped in answering the questions of this study.

## CHAPTER FOUR

### RESEARCH METHODS/APPROACH TO STUDY

#### 4.1 Introduction

In the theoretical framework chapter, I have discussed the theoretical frames for my study. Here, I will outline and discuss the methodology used for conducting this study. Creswell (2008) defines methodology as the plan of action or strategy that links methods to outcomes and guides our method choices. This study made use of a quantitative study approach which served as the basis for explaining the qualitative study approach (mixed-method approach; Creswell & Plano Clark, 2007). This study aimed at investigating the empirical relationship of CPD activities with teachers' instructional quality in Foundation Phase Mathematics using a mixed-method approach, mixing quantitative (questionnaire) and qualitative (semi-structured interview) research methods.

Firstly, I will mention how I collected *quantitative data* by making use of a questionnaire. This approach has a twofold benefit: a) it served as an introductory instrument to the participants and for answering questions one and two of the research questions b) it allowed me to answer the research questions on a quantitative basis. Secondly, semi-structured interviews with the participants were conducted on a one-on-one basis to generate *qualitative data*. These interviews served as part of the explanatory data to the questionnaire and helped with arriving at a deeper understanding of the topic. I asked the interviewees to elaborate on the types of CPD activities they engaged in (both formal and informal). Moreover, it allowed me to generate in-depth data on Foundation Phase Mathematics teachers' instructional quality in class (cognitive activation and individual learning support). I also gained a deeper understanding through the interviews on how CPD activities translate into instructional quality.

Lastly, I highlight how I sequentially interpreted the information for the quantitative part of my study (questionnaire) and the qualitative data (semi-structured interviews). Sequentially analysing and interpreting data using the explanatory design is the process of beginning with the quantitative research method and follow up with qualitative methods to explain quantitative (Bergman, 2008).

## 4.2. Study Approach

The chosen study approach is the mixed-method approach and below, I discuss the appropriateness of this approach for my study, taking into consideration both quantitative and qualitative approaches. An approach is a plan or proposal to conduct research that involves the interaction of philosophy, research designs and specific methods (Creswell, 2014). The approach for this study is a mixed-method approach which also influences my choice of paradigm, design and methods chosen (please see details below).

Tashakkori and Creswell (2007) highlight that in about three decades, different researchers have discussed and argued the concepts, methods, and standards of quality for studies that make use of a combination of qualitative and quantitative approaches. One of the approaches that use a combination of methods is the mixed-method approach. They broadly defined mixed methods research as “a process in which the researcher collects and analyses data, integrates findings and draws reasoning using both qualitative and quantitative approaches” (Tashakkori & Creswell, 2007, p.4). In recent literature, McKim (2017) mentions that the increase in mixed-methods research gives reason to the question of determining the perceived value of mixed-methods research compared to using qualitative only or quantitative only. This proves that mixed-method has developed and is still developing. However, engaging in mixed-method research requires careful consideration as it requires a combination of qualitative and quantitative methods as well as additional resources (McKim, 2017).

This careful consideration requires a comprehension of the characteristics of mixed-method research. Creswell (2015) mentions the main characteristics of mixed-method research which are: the collection and analysis of quantitative and qualitative data in response to research questions, as well as the use of rigorous qualitative and quantitative methods. The integration of quantitative and qualitative data using a specific type of mixed-method design and interpretation of this integration. Lastly, it requires the framing of the design within a theory or philosophy (Creswell, 2015). In this study, I incorporated these characteristics to strengthen my approach.

Elements of both quantitative and qualitative methods are included in mixed-method research. The researcher needs to be skilled and knowledgeable about both methods, including the advantages and disadvantages of both (Creswell, 2015). Below, I outlined the design of the study (following a *mixed-method approach*) for maximising the scope of both methods.

Creswell (2015) states two key elements that enable the rigorous use of both methods, the type of design and gaining access to a research site that allows for a balanced integration.

### ***Philosophical Worldview***

I have chosen and discussed two theoretical frameworks; constructivism and the COACTIV framework and which are suitable for this study and its approach concerning the objectives of this study. Constructivism has to do with the construction of knowledge by the learner from the knowledgeable adult (teacher). The teacher may acquire this knowledge through CPD activities and the quantitative part of this research focuses more on the type of CPD activities that teachers engage in, frequency and duration as well as how it translates into instructional quality. Furthermore, constructivism also supports the interaction between the learner and the teacher. Individual learning support enables interaction. It did not seem adequate to look at the above-mentioned elements only, to meet the objectives of this study. Therefore, a second theoretical framework (COACTIV) seemed suitable for a deeper understanding of how instructional quality is considered when teaching mathematics. This framework relates more to the qualitative approach which builds on the quantitative approach, thus allowing for integration (*mixed-method approach*).

### **4.3. Research Design**

A research design is one of the aspects found in a study approach. Creswell (2014) views a research design as the different types of inquiry within different study approaches. Bertram and Christiansen (2014) describe a research design as a systematic plan of how the researcher collects and analyses data. For this study, I chose a sequential explanatory design that has two different phases, a quantitative phase followed by a qualitative phase (please see figure 8). In such a specific design of the mixed-method approach, quantitative data is collected first and the generation of qualitative builds on the quantitative phase (Ivankoya & Creswell, 2009). In a sequential explanatory design, quantitative data is collected and analysed first, then follows a qualitative phase to help elaborate and interpret the findings of quantitative data.

In my particular study, the first (*quantitative*) phase explores the type of CPD activities, their frequency and duration as well as how they translate into instructional quality. The second (*qualitative*) phase explains the findings of the quantitative via analysing the semi-structured interviews. The qualitative phase explains how cognitive activation and individual learning support are translated into instructional quality in the classroom. This phase will help to explore

the role of CPD activities of the Foundation Phase Mathematics teachers about instructional quality in the classroom.

## Sequential explanatory design



14

Figure 8: Sequential explanatory mixed methods design (Creswell & Plano Clark, 2007, p. 14)

I used questionnaires and semi-structured interviews for data generation. This aimed at combining the strengths of both, the qualitative and the quantitative method as implied in the mixed-method approach. Below you find a discussion of the distinct components of the study.

### ***Quantitative phase***

Quantitative researchers regard the world as being outside of themselves (Almalki, 2016). Many types of quantitative research can be classified (e.g., survey research, questionnaire studies, experimental research, casual-comparative research and correlational research; Sukamolson, 2007). In this study, I have made use of a questionnaire study. Almalki (2016) mentions that in quantitative research, the reality is subdivided into manageable pieces to be investigated within a study. I obtained the manageable pieces for my study through the use of questionnaires which formed a base for the qualitative phase.

### ***Qualitative Phase***

Qualitative research aims to describe and understand the meaning and value held by a specific individual or a group for the researcher's interests (Arcidiacono, Procentese, Di Napoli, 2009). This rich information was generated using a suitable instrument (i.e. semi-structured interviews). I generated rich information through the interview sessions, and the findings helped me strengthen some of the information gained from the quantitative (questionnaire)

method. In this phase, I have made use of semi-structured interviews to understand which CPD activities Foundation Phase Mathematics teachers engage in and how these inform the instructional quality of their lessons. Qualitative research helped me with maintaining the focus on understanding the meaning that the participants have about a phenomenon by asking the relevant question aimed at answering the research questions posed. The qualitative method helped me develop the measures of the quantitative method to gain deeper meaning from participants, which in turn helped me interpret and explain the quantitative data.

#### **4.4 Research Paradigm**

The paradigm chosen for this study is pragmatism. Pragmatism is a term that was first used by William James in 1898, “it embraces the plurality of methods” (Kaushik & Walsh, 2019, p.2). Pragmatism is a single paradigm that holds within both qualitative and quantitative research methods (Hall, 2013). Pragmatism allowed me to study the phenomenon looking at both, quantitative and qualitative methods and to, thus, embrace the findings fully. Working with pragmatism accepts that both qualitative and quantitative methods are compatible and can be mixed. In this particular study, mixing refers to collecting and analysing quantitative data using a questionnaire and generating qualitative data using semi-structured interviews.

The three research questions of this study were formulated with the research design in mind: Research questions one and two required me to assess the types of CPD activities, duration and frequency. It draws more to description and explanation. Therefore, quantitative methods of collecting and analysing data seemed suitable. Question three aimed at understanding and exploring CPD activities and how they translate into teachers’ instructional quality using dialogue. Qualitative methods seemed suitable to achieve this. The scope of my research questions required the use of a paradigm that enables the combination of two research methods.

Pragmatic studies combine two paradigms (Graff, 2013). According to Kivunja and Kuyini (2017), the pragmatic paradigm has a characteristic that rejects the need to locate a study in either a positivist or a constructivist paradigm. One states that there is a reality outside the human that can be seen, measured and understood (constructivist); the second defines a worldview that is grounded in the scientific method of investigation (positivist). These two assertions are equally essential claims about the nature of human experience (Morgan, 2014). The paradigms are in line with the different aspects of this study: using questionnaires as a quantitative data collection method is in line with the positivist paradigm assuming that there is one truth and that reality can be described by data (the type of and time spent on CPD

activities and how strongly teachers engage in cognitive activation and individual learning support). Using a qualitative (semi-structured interview) method of generating data is of the idea that there is no one reality (constructivist), but the interpretations and truths of each participant (in-depth understanding of CPD activities, the reason for choosing that particular type of activity as well as how the activities translate into instructional quality). What this study aimed to explore required a combination of the world views to meet the objectives of the study through analysing the quantitative and qualitative data generated.

#### **4.5 Recruitment Strategy**

The sample chosen was from two schools located in the area of Umlazi. These schools are well resourced and have teachers that engage in CPD activities. First, I approached the principals of the schools to obtain their permission in the form of gatekeeper letters. Ethical clearance was obtained from the Human and Social Science Ethics Committee of the University of KwaZulu-Natal. Permission to conduct the study was obtained from the Department of Education of KwaZulu-Natal. After all permissions and clearances were in place, I visited the chosen schools to hand out the questionnaire to the participants and to explain the process of the study. Codes were used to hide the identities of the schools and participants and maintain confidentiality. The design of the code was the first two letters of the participants' mothers' first names, their days of birth and the first two letters of their mothers' birth names.

##### ***Recruitment Strategy – Quantitative Part***

For the quantitative segment, I requested a briefing session with Foundation Phase mathematics teachers that were available, and it is here that I explained my study and its objectives. Participants were interested, and I handed them questionnaires on which they declared their informed consent by ticking in a box provided on the front page of the questionnaire (*see Appendix 4*).

##### ***Recruitment Strategy - Qualitative Part***

For the qualitative part, I made use of the quantitative briefing session to inform the participants verbally about the semi-structured interview part of the study. Those interested provided their codes and numbers on a piece of paper colour coded per school. After selecting the six to be interviewed, I gave them letters that explained their rights before they agreed to take part in the interviews and gave their consent (*see Appendix 2*). The selection of the six was based on the information provided in the questionnaire (*number and type of CPD activities attended by the teacher, the number of years in the phase and filled in the questionnaire*).

## 4.6. Sample and Participants

### *Sample and Participants – Quantitative Part*

For the quantitative method, I used purposive sampling because I had a purpose in mind - to explore the relationship between CPD activities of Foundation Phase Mathematics teachers and their instructional quality in the classroom. I chose Foundation Phase mathematics teachers in the Umlazi district who had attended CPD activities. As mentioned by Maree and Pieterse (2016), purposive sampling in the quantitative method involves having a purpose in mind. I had a target of 16 Foundation Phase teachers (eight from each school) for the questionnaire phase. School one had eight Foundation Phase teachers, and School two had ten. A total of 18 teachers attended the first briefing sessions. I handed out 18 questionnaires in the briefing sessions, in which I introduced the topic of my study and elaborated on the objectives. Next, I introduced the section on the interview in the same briefing session. Potential participants were very responsive and expressed their frustrations regarding the CPD activities they had attended.

I returned to the schools after one week to collect the questionnaires. I received a total of 16 completed questionnaires; one was returned blank, resulting in a sample of 15 questionnaires (a 94% response rate judging on the initial target). This resulted in analysing data based on the 15 filled in questionnaires. Thus, my sample size for the quantitative phase was  $N=15$ . The age of these 15 participants ranged from 35-60 years ( $M=49.53$ ,  $SD=7.57$ ). All participants were females that taught in the Foundation Phase Mathematics. Their time in the profession ranged from 1 year to 26 years with different qualifications related to the profession.

### *Sample and Participants – Qualitative Part*

Purposive sampling was chosen for the qualitative data generation. It targets a small number of people and specific sites (Creswell & Plano Clark, 2007). Also, groups or individuals that know about the phenomenon of interest (Creswell & Plano Clark, 2007). I was able to interview six participants from a large group of the 18 that attended the questionnaire briefing session, in which I told them about the interview part of my study. Participants were invited based on their interest to elaborate further on what they may respond to the questionnaire and willingness. To ensure confidentiality, I asked interested teachers to provide only their codes and their contact details if they are interested in being part of the interview phase and put them in a sealed small box I provided during the session and that only I had access to. Twelve seemed interested, and

confidentiality was kept by only using codes and phone numbers for communication. The names and surnames of participants were not used.

After collecting questionnaires, I matched the codes on the questionnaires with ones on the box for careful selection of participants (information-rich) to interview from the 12 teachers who expressed interest to be interviewed. “Purposive sampling is utilized in qualitative research for finding cases that are information-rich” (Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, 2015, p.2). Out of the 12, I then invited six participants to the semi-structured interview sessions. Out of the 12 that were interested, I matched their codes with questionnaires to carefully select ones with information-rich responses. To avoid any disturbances or inconvenience for the teachers, I avoided the beginning and the end of a term which are busy times, and participants might not have time to participate. Therefore, I conducted my study mid-term.

#### **4.7. Data Collection and Generation Methods**

It was pivotal to choose methods taking into consideration my research questions and the pragmatic paradigm in line with a statement by Bertram and Christiansen (2014). Having identified the research questions and paradigm, the suitable methods were questionnaires and semi-structured interviews.

##### ***Quantitative Data Collection***

Firstly, a questionnaire tool was used as a method of collecting quantitative data was handed out. The questionnaire assessed different aspects:

Types of CPD activities they engage in, their frequency and duration and the translation of CPD activities to instructional quality of Foundation Phase Mathematics. Via the questionnaire, I also assessed how teachers consider cognitive activation, individual learning support, academic success as well as workload total hours per week. The items to assess all four in the questionnaire were adapted from the context questionnaire of the Trends in International Mathematics and Science Study (TIMSS, 2015). To assess commitment in the workplace, possibilities of development and social support I incorporated 13 items from the Copenhagen Psychological Questionnaire (Nübling, Vomstein, Schmidt, Gregersen, Dulon & Nienhaus, 2010) and to assess work engagement, 17 items from the Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2006) were included.

### ***Qualitative Data Generation***

I conducted semi-structured interviews. Semi-structured interviews have open-ended questions (Creswell, 2009). The interviews helped me with exploring the types of CPD activities based on how they selected the activities, what they did in the activities and why they chose these activities. It also asked questions to gain a deeper understanding of how teachers cognitively activate their learners and how they provide individual learning support. Moreover, the third set of interview questions aimed at unearthing *how* CPD activities translate into instructional quality while teaching Mathematics at the Foundation Phase.

The semi-structured interview schedule consisted of 13 questions with an addition of two to three probing questions per question (*see Appendix 3*). I conducted the interviews at schools during the participants' free time; they took a minimum of 15 minutes to a maximum of 45 minutes. The interviews were then partially transcribed (transcription of relevant parts of the interviews) after the process of interviewing has been completed. This transcription enabled me to content-analyse the data.

### **4.8. Data Analysis**

First, I analysed the quantitative data, followed by generating and analysing qualitative data. I analysed the data in two sections using a deductive approach (*quantitative*) and inductive approach (*qualitative*) then triangulated the data aligned with the mixed-method approach and the sequential explanatory design chosen for this study. Both methods of analysing were given enough time in between before moving to triangulate the data. I had to complete analysing quantitative data first to help build upon it during qualitative data analysis.

#### ***Quantitative data***

I calculated descriptive statistics using International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) Statistics for Windows, Version 25.0. This was done for the variables (types, duration and frequencies of CPD activities and means and standard deviations of scales assessing individual learning support and cognitive activation). I introduced dummy coding as had categorical data that needed to be transformed for interest in predicting frequency and time of CPD activities attendance by the teachers. On the frequency, dummy coding was transformed to once-off, continuous and once-off & continuous. For time spent on the CPD activities, the values were minutes, hours and minutes & hours. This was

done because there were quite a large number of varieties in terms of frequency and time. Therefore, dummy coding was needed for further analyses (i.e., correlations). I chose to conduct Pearson product-moment correlations because my dependent variable is on interval scale level (Spearman correlations would only require ordinal data level). Also, I aimed at analyzing linear relationships between my variables. Spearman rank correlations would not have allowed me to do this. I then transformed and summarised the quantitative data into overviews that are visual, such as a table or graphs.

### *Assessment of CPD activities*

The first section of the questionnaire was on identifiers, consent, school, and the types of CPD activities. It was assessed using descriptive and frequencies. On the types of activities, teachers provided 53 activities of which only 39 had information. Of the 39 I grouped them into 3 (workshops, meetings and courses), to be able to analyse according to frequency and time of attendance. As indicated above I introduced dummy coding as had categorical data that needed to be transformed for interest in predicting frequency and time of CPD activities attendance by the teachers. On the frequency, dummy coding was transformed to once-off, continuous and once-off & continuous. For time spent on the CPD activities, the values were minutes, hours and minutes & hours.

### *Assessment of Instructional Quality*

The next section was on demands (cognitive activation, individual learners support, commitment to the workplace, and work engagement). To assess cognitive activation I used the scale of the cognitive demand (seven items, e.g., how often do you relate to learners' daily lives?) had an internal consistency of Chronbachs Alpha=.75. Individual learning support (e.g., how often do you show learners a variety of problem-solving strategies?) showed an internal consistency of Chronbachs Alpha=.77. The scales used had good internal consistency scales as the coefficient reported is .70 and above (Pallant, 2011).

The level of cognitive activation and individual learning support was measured using a 4 point Likert-type scale with labels of 1-Never, 2- Some lessons, 3- About half of the lesson and 4- Every/Almost every lesson. Transformed variables of cognitive activation and individual learner support were created by grouping the items into one per the above-mentioned variables for purpose of correlation.

### ***Assessment of and Motivational Orientation***

Engagement and commitment were assessed as the motivational orientation of teachers. To assess commitment to the workplace, 10 items of the Copenhagen Psychological Questionnaire (COPSOQ) commitment scale were included (e.g., do you feel that your place of work is of great importance?) with an internal consistency of Chronbachs Alpha=.78. The variables on commitment were measured using a 5 point Likert-type scale with labels of 1-To a very small extent, 2-To a small extent, 3-Somewhat, 4-To a large extent, 5-To a very large extent. Work engagement (17 items) was assessed with the work engagement scale (Schaufeli & Bakker, 2006); with 6 items for vigour, 5 for dedication and 6 for absorption). (Chronbachs Alpha vigour=.78, Chronbachs Alpha dedication =.97, Chronbachs Alpha absorption =.85). The scales used had good internal consistency scales as the coefficient reported is .70 and above (Pallant, 2011). The variables on work engagement were measured using a 7 point Likert-type scale with labels of 1- Never, 2-Almost Never, 3-Rarely, 4-Sometimes, 5-Often, 6-Very Often and 7-Always

### ***Assessment of Self-regulation Resources***

The third section focused on self-regulation resources. It was assessed in how far participants receive social support (assessed with 3 items, and 3 items, respectively, from the COPSOQ (Nübling, Vomstein, Schmidt, Gregersen, Dulon & Nienhaus, 2010) with an internal consistency of Chronbachs Alpha social support=. 85. It was measured using a 7 point Likert-type scale with labels of 1- Never, 2-Almost Never, 3-Rarely, 4-Sometimes, 5-Often, 6-Very Often and 7-Always. Also, it was assessed how meaningful teachers perceive their work (3 items of 6 were used; Cronbachs Alpha=.77) and if they predominantly focus on academic success, 4 items from the 4 were used; Cronbachs Alpha=.83. The scales used had good internal consistency scales as the coefficient reported is .70 and above (Pallant, 2011). Social support and academic success were measured using a 5 point Likert-type scale with labels of 1-To a very small extent, 2-To a small extent, 3-Somewhat, 4-To a large extent, 5-To a very large extent.

### ***Demographic variables***

The last section was on demographics (sample characteristics, school characteristics and subjects taught and position). The participants were given one week to fill in the questionnaire. After going through the questionnaires, participants who were interested in taking part in the semi-structured interviews were visited for scheduling interview dates.

Next, I calculated inferential statistics to assess the relationship between variables using Pearson bivariate correlations. A Pearson bivariate correlation helps describe the direction and strength of a relationship between two variables (Pallant, 2011). I used Pearson correlations because it indicated the strength of relationships between variables that would enable me to check how CPD activities translate into instructional looking at the significance level.

To assess linear relationships between study variables, bivariate Pearson product-moment correlations were chosen. I chose to conduct Pearson product-moment correlations because my dependent variable is on interval scale level (Spearman correlations would only require ordinal data level). Also, I aimed at analyzing linear relationships between my variables, these seemed appropriate because items were assessed at interval scale level (using Likert-type scales) which are a prerequisite for Pearson product-moment correlations. The aim was to assess *linear* relationships between two study variables, which Pearson-moment correlations allowed me to assess.

On the contrary, calculating a Spearman rank correlation would not have allowed me to do this because “It assesses how well an arbitrary monotonic function can describe the relationship between two variables, without making any assumptions about the frequency distribution of the variables. Unlike Pearson’s product-moment correlation coefficient, it does not require the assumption that the relationship between the variables is linear, nor does it require the variables to be measured on interval scales; it can be used for variables measured at the ordinal level.” (Hauke & Kossowski, 2011, p. 89).

### ***Qualitative Data***

I generated qualitative data by conducting semi-structured interviews, and it seemed suitable to analyse this data from interviews using a content analysis approach. Content analysis is a replicable and systematic technique for taking many words and turning them into fewer content categories using coding (Nieuwenhuis, 2016). There are two approaches to content analyse qualitative data: inductive and deductive reasoning (Bertram & Christiansen, 2014); I chose

the former. The inductive approach starts from specific data to generalisation and theory. It allowed me to analyse patterns that assisted in generating a conclusion. In analysing the patterns, I looked at similarities related to the research questions. Thomas (2006) denotes that utilising an inductive approach seeks to summarise raw textual data and find links between the research questions and findings.

Using an inductive approach in content-analysing data from the semi-structured interviews in this study assisted me in analysing data about the type of CPD activities of teachers and why they prefer those activities. Furthermore, it helped me in understanding how teachers cognitively activate their learners and provide individual learning support and how the CPD activities link up with this.

From the transcriptions, I formulated a table that allowed me to code general statements from the participants. I had general 1 and general 2 statements that I analysed to generate a suitable single statement. From these statements, I was able to decide on how I want to generate my themes. I used the questions as my themes then I group statements according to similarities in answers. These statements formed patterns from which I was able to analyse the data and discuss finding under the themes (research questions). I ensured that the data was adequately analysed by going through the patterns and linking data from the different participants to ensure it was under the right pattern. I also took much time analysing the data. Research questions one and two were used to analyse quantitative data, and question three was for qualitative data. Having analysed the data, I interpreted it to meet the objectives of the study following the research design of the study.

### ***Triangulation***

Triangulation of the data aimed at a more comprehensive understanding of my data. My data was collected in two parts (*quantitative and qualitative*), and these parts needed to be integrated after interpretation, for the final conclusion and findings. This interpretation followed the sequential mixed method explanatory design (*see figure 8*). Results from quantitative data were used to explore results from qualitative data. From this exploration, I triangulated the data to meet the objectives of the study and match design. This was suitable because it enabled me to conclude the phenomenon. Flick (2018) denotes that the major task of triangulation is the confirmation of results from one approach by those of another approach. One does not weigh more than the other; they complement each other to respond to research questions and meet the objectives of the study. The triangulation process adopted in this study was so to answer all

three research questions which helped me explore the relationship between Foundation Phase CPD activities and teachers' mathematics instructional quality (*cognitive activation and individual learning support*). I first analysed quantitative data and interpreted it, followed by analysing qualitative data and its interpretation. From these interpretations, I looked for common findings and ones that complement each other and discussed them as one.

#### **4.9. Ethical Considerations**

I considered the importance of ethical processes as important for research. Ethical processes focus on the behaviour of the people involved in the research (Bertram & Christiansen, 2014). Ethics matter because it is “also a safeguard for you as a researcher in case anything goes wrong” (O’Hara, Carter, Dewis, Kay & Wainwright, 2011, p.100). Flick (2006) states that researchers have to make sure that no harm is done to the participants by respecting and taking into account their interests. In ensuring this, Bertram and Christiansen (2014) specify three ethical principles to be considered in research studies: Autonomy, Non-maleficence and Beneficence. Autonomy refers to getting consent from the participants of the research, and I received consent in the form of a written and signed letter for permission before the research was carried out (refer to Appendix 1 and 2). Their rights were thoroughly explained as well as the options they have should they no longer want to partake in the research. The consent of participants is a main ethical issue when engaging in research (Fouka & Mantzourou, 2011). It serves as participants’ right to autonomy. Non-maleficence means “do no harm” (Fouka & Mantzourou, 2011). I as the researcher avoided harm to the participant, physically, emotionally or socially. To ensure that harm is done, I ensured the participants of confidentiality by masking their identities. I used codes to mask their identity, and these codes were formed by the participants.

#### **4.10. Validity, Reliability and Trustworthiness**

##### ***Validity in qualitative research***

In a method of research chosen, *validity* was assessed through the way data is collected and analysed. Valid research is shown through accuracy, which Abrahams and Millar (2008) describe as the soundness of a study. I took validity into account through data collection in the qualitative method, and I formulated questions that aimed to understand the participants ‘reality where the relationship between CPD activities and teacher’s instructional quality in Foundation Phase Mathematics is concerned. I took into consideration the open and transparent nature of the research procedures by having an interview schedule accessible to participants.

### ***Reliability in quantitative research***

Research needs to be reliable. Mors (2015) views reliability as being able to obtain the same results should the study be done again, allowing any researcher to use it in a different circumstance. As far as possible, established items and scales were used to assess relevant study variables. Cronbach's alpha as a measure of reliability (internal consistency) of study scales were calculated. These suggest that the scales are reliable and acceptable; therefore may be used interpreted within my study. Content analysing data enables another researcher to use the data again as the content analysis is a replicable technique (Nieuwenhuis, 2016). However, this technique was able to present the participants' reality.

Furthermore, reliability may be attained through credibility. Research is credible when it reflects the participants' reality (Bertram & Christiansen, 2014). To reflect the participants' reality, in the quantitative method used in this study, reliability was represented in the way items were designed in the questionnaire in a way that represents participants' reality. Identifiers, consent, school, and the types of CPD activities, demands, work organisation, school emphasis, and demographics are sections presented on the questionnaire which show participant's reality.

### ***Trustworthiness***

In both qualitative and quantitative approaches, I ensured that the processes and data generation methods are trustworthy. Trustworthiness now labelled as rigour is what makes qualitative research believable (Mors, 2015). Trustworthiness was strengthened by a thorough description of data, and this description was followed through in the triangulation process.

Triangulation was conducted to strengthen the research. Golafshani (2003) defines triangulation as a way of using several methods, such as combining both qualitative and quantitative methods. Through triangulation, I was able to strengthen the validity of the study. The use of two methods helped expand the knowledge from phase one (quantitative part) with in-depth information from phase two (qualitative part). Making use of two methods was not to disregard other methods, but these methods complemented each one another for the sake of meeting the objectives.

#### **4.11. Limitations of the chosen methodology**

##### ***Quantitative Limitations***

The selected method for quantitative data collection (questionnaires) was suitable for the study. However, not having enough participants would have jeopardized data collection and finding adequate participants did not guarantee that all the questionnaires would be filled in. The solution was to keep checking on the sites and reminding the participants on when the questionnaire will be collected as well as ensured them confidentiality.

##### ***Qualitative Limitations***

The chosen method for qualitative data collection, which was interviews seemed suitable for study as it allowed me to generate the necessary data. Its limitation was choosing an appropriate sample aligned with purposive sampling criteria (explained above), having started with a larger sample under the quantitative design in the first phase. Choosing the right sample for the second phase, which is a smaller sample in the qualitative study phase seemed challenging. The solution was to select the same participant from the first phase by choosing the ones willing and interested in participating in an interview also looking at their responses in the questionnaires to see which participant would provide relevant data.

##### ***Mixed-Method Limitations***

Having the required skill to conduct mixed-method research is essential, it becomes a limitation to the study if there is a lack of the required skill. I acquired the skill by engaging with relevant literature (Creswell & Plano Clark, 2007). The other possible limitation was that of deciding on which design seemed suitable for the study (Almaki, 2016). The chosen design was the sequential explanatory design because it allowed me to incorporate both the quantitative and qualitative methods. A third method which is; observation seemed suitable as well. The advantage of using observation is that I would have been able to study behaviour in relation to the research (Bertram & Christiansen, 2014) however, time did not allow for it.

#### **4.12. Summary of Chapter**

In summary, I have presented the research approach, research paradigm, sampling methods, data generation and data analysis, reflected on the quality of the study, ethical considerations, as well as the limitations of the methodology used. In the following chapter, I will present and discuss the results of the study.

## CHAPTER FIVE

### PRESENTATION AND INTERPRETATION OF RESULTS

#### 5.1. Introduction

Having discussed my methodological approach above, I will now present the results from my study, taking into consideration the mixed-method approach of my study. I will present the results in two segments according to the research design and research questions. I will first present results on the quantitative data analysis and provide an interpretation followed by the qualitative data and an interpretation. In the first segment, I will first present quantitative data addressing the first two research questions. In the second segment, I present data on the third research question.

#### Presentation of Quantitative Results

#### 5.2 Continuous Professional Development activities that Foundation Phase mathematics teachers engage in.

In the first step, I summarise descriptive results from the quantitative part of my study. These results address research question one, which focuses on investigating the types of CPD activities teachers engage in, which content was covered and the duration spent on the CPD activities as well as the frequency of attendance.

As summarised in the literature review, there is a distinction between formal and informal types of activities; examples of formal teacher CPD activities are Integrated Quality Management System (IQMS), workshops, or other courses. Informal learning activities include teacher communities, Communities of Practice (CoP's) and Professional Learning Communities (PLC). In the next section, I will present quantitative results on the number of CPD activities attended by the study participants, which types of activities teachers attended and which content these have covered.

##### 5.2.1 Number of activities per teacher and total attended by all teachers.

In the questionnaire, teachers were asked to provide information on a maximum of five of their CPD activities in the last year. The total number of CPD activities attended by the 15 teachers was 53. On average, one participant attended three to four activities ( $M=3.53$ ,  $SD=.92$ ). The frequency calculation shows that participants attended between two and five activities,

indicating that the participation rate in the CPD activities attended by the participants varied. This suggests that not all teachers were receiving the same opportunities for Professional Development (for details, please see figure 8 below).

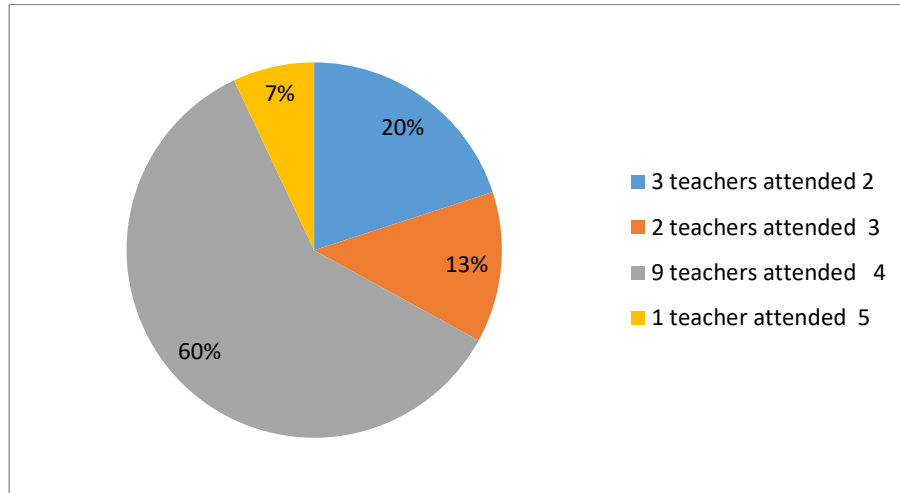


Figure 9: Numbers and percentages of CPD activities attended by participants (N=15).

These descriptive results indicate that participants varied on how many CPD activities they attended, with a majority attending three to four CPD activities and few teachers attending only two activities. One teacher even attended five CPD activities within one year. Next, I will focus on descriptive results on the types of activities the participants attended.

### 5.2.2 Types of Continuous Professional Development Activities

Out of the total of 53 CPD activities attended, participants provided detailed information on 39 activities (i.e., on the content of the activity, the type of activity, how often it took place and the amount of time it took). The 39 activities consisted of workshops, meetings and courses. There were 35 workshops, two meetings and two courses attended. The majority of the teachers attended workshops (for details, please see figure 9 below).

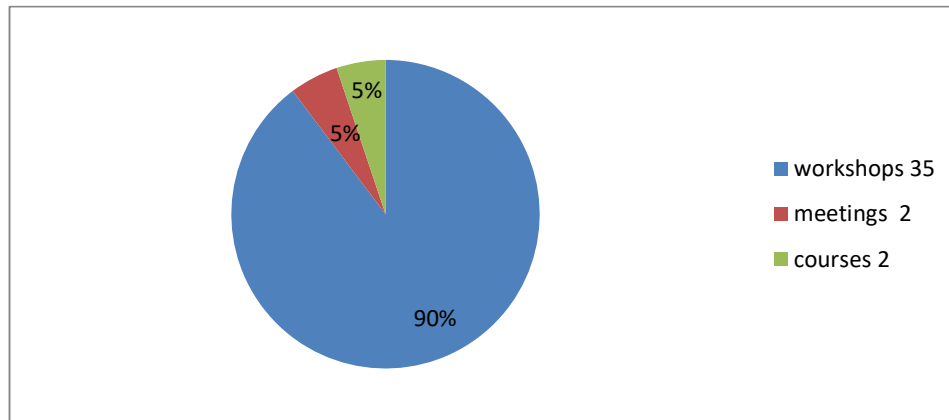


Figure 10: Number and percentage of types of CPD activities of participants (N=15).

The above data indicate that formal workshops form the vast majority of CPD activities. A few participants reported participating in formal courses, and only two mentioned meetings as CPD activities. In the next step, I will focus on the content of these activities.

### 5.2.3. Content of the Continuous Professional Development Activity Types.

Of the 39 CPD activities that were described in more detail by the participants, I have summarised the contents these were focusing on. I have grouped them according to the related topics and specified the number of teachers that attended activities related to the grouping. It is important to note that a participant may have attended more than one because it speaks to the variety of activities and frequency of the activities attended and how it translates to instructional quality. Below you find a list of the content of the workshops, courses and meetings attended.

#### Grouping of CPD activities according to content:

- *Centre for the Advancement of Science and Mathematics Education (CASME) (all primary maths concepts)*
- *Improved Job Performance, Increased duties and responsibilities, Management, Participation in Prof learning, Job assignment and Approaches to professional learning*
- *Inclusive Education and Barriers to learning-two teachers attended*
- *Foundation Phase Mathematics Concepts*
- *Integration of all subjects*
- *Jika iMfundo*
- *Maths Assessment*

Figure 10 presented below summarises the numbers of teachers for each of these activities.

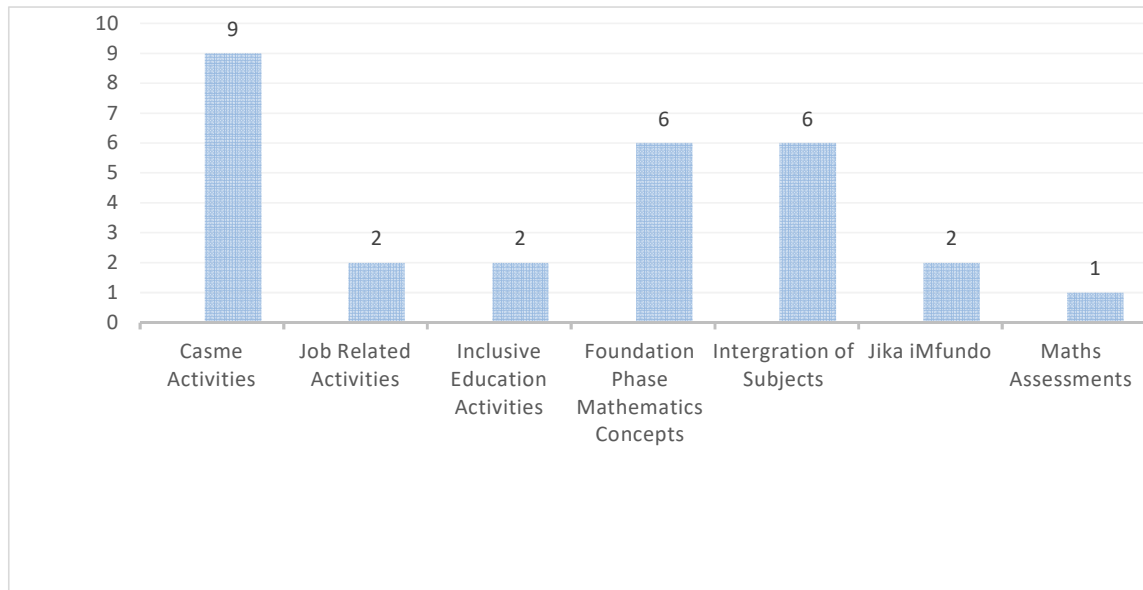


Figure 11: Number of teachers per content type of CPD activity ( $N=15$ ).

According to figure 10 above, the content covered the most is the CASME activities which are mathematics-related. They are then followed by Foundation Phase Mathematics topics, integration of subjects. Job-related, Inclusive Education and Jika iMfundo are all at the same level. However, job-related activities and inclusive education are not specific to mathematics learning. The least attended activity is on Maths Assessment content.

#### *Frequency and Time*

Next, the focus was on *how often teachers attended the above-listed activities*. Based on the overall number of CPD activities, I have categorised them as once-off activities, continuous activities, and the third category consisted of both the once-off and continuous activities. The once-off activities are activities that teachers only attended once in the year. Continuous activities are those that teachers attended throughout the year, once per term. This means that CPD activities' attendance is not standard to all of the activities attended by these teachers. This may contribute to the level of development or how CPD activities are translated to the Instructional quality of the Foundation Phase Mathematics subject. Teachers mostly attended continuous CPD activities, followed by once-off as well as a mix of one-off and continuous CPD activities (for details, please see figure 11 below).

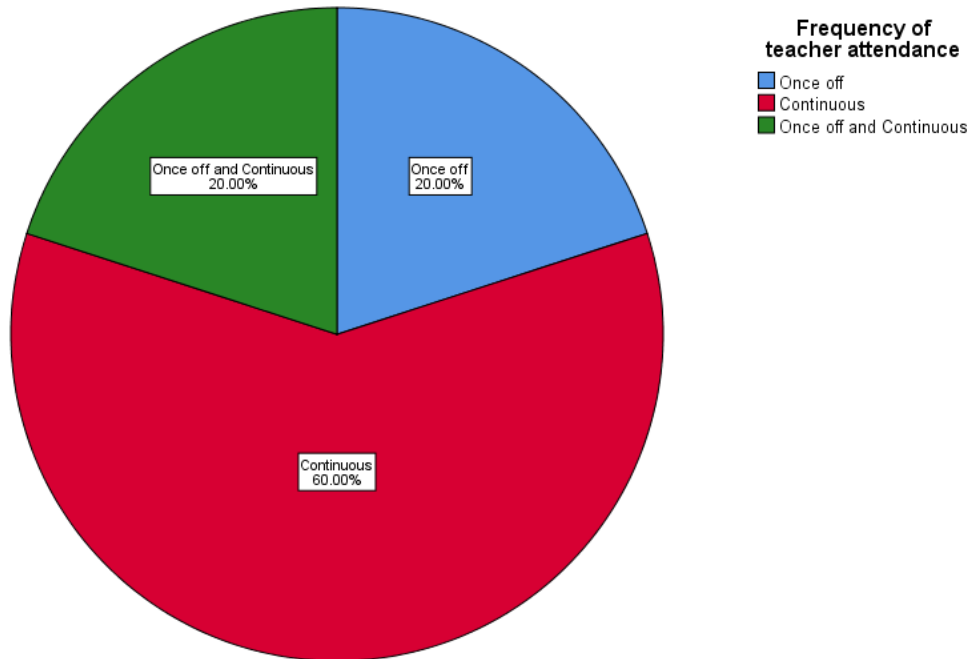


Figure 12: Frequency of teacher CPD attendance ( $N=15$ ).

Having categorised the teacher CPD activity attendance above, I have also summarised the time spent on each activity. Again, participants' responses vary on this. Whereas three teachers attended sessions that took only minutes, a large number of 12 participants attended sessions that took an hour or more.

To sum up the results on the frequency of CPD activities attended, their types and contents, it becomes clear that teachers attended CPD activities and reported mostly the formal activities focusing predominantly on CASME Activities, Foundation Phase mathematics concept and Integration of subjects activities. The frequency of attendance and time spent on these activities varied per teacher. However, participants reported that they attended mostly continuous activities. These activities are related to the instruction of Foundation Phase Mathematics; therefore, the data collected seemed suitable to answer the first research question as aimed. The question being; Which Continuous Professional Development activities that Foundation Phase mathematics teachers engage in? It seemed pivotal to explore how the CPD activities translate into instruction quality (*cognitive activation and individual learning support*) in Foundation Phase Mathematics classrooms (*research question 2*).

In the next step, I look beyond the descriptive data on the CD activities of participants. I am now focusing on how these may translate into instructional quality. Thus, the next section

addresses research question two: *how Continuous Professional Development Activities translate into instructional quality in Foundation Phase Mathematics classes?*

#### **5.2.4. Results on Teachers' Instructional Quality.**

In this section, I will first present the descriptive results of the self-reports of participants on the Instructional Quality of their Mathematics lessons at the Foundation Phase. I will outline to what extent they make their lessons cognitively activating and to what extent they provide individual learning support.

##### ***Extent of Cognitive Activation and Individual Learning Support in Mathematics lessons***

On average, teachers reported that their lessons are moderately cognitively activating ( $M=2.87$ ,  $SD=0.41$ ). Teachers reported that they cognitively activate their learners in approximately half of their lessons. The relatively low standard deviation implies that results do not vary much across participants.

Participants reported that they offer individual learner support about half of the lesson ( $M=3.33$   $SD=0.48$ ). The standard deviations indicate that participants' responses do not vary much, which means that participants' way of offering individual learner support does not differ much across participants.

##### ***Inter-correlations of CPD activities of participants and Instructional Quality of their lessons***

After having established the extent of the cognitive activation and individual learning support the participants provide during their lessons, I will now look into the inter-correlations of the variables on CPD activities participants have attended and the instructional quality of their lessons. In addition, I also included scales assessing the engagement of the participants (as well as results on the dedication, vigour and absorption subscales) and their commitment to assess which role they play for engaging in CPD activities and Instructional quality. These results will allow me to answer my research question two.

*Table 2: Intercorrelations of CPD activities and Cognitive Activation and Individual Learning Support, and Other Study Variables (N=15).*

	1	2	3	4	5	6	7	8	9	10
1 Dedication	-									
2 Commitment	.92**	-								
3 Vigour	.88**	.77**	-							
4 Absorption	.87**	.83**	.84**	-						
5 Social Support	.75**	.76**	.68**	.83**	-					
6 Meaning of work	.93**	.83**	.79**	.69**	.56*	-				
7 Academic Success	-.30	-.38	-.35	-.34	-.48	-.34	-			
8 Individual learning support	.47	.52*	.54*	.21	.21	.56*	-.48	-		
9 Cognitive activation	-.01	.06	.16	-.04	.05	.09	-.68**	.61*	-	
10 CPD Activities	-.36	-.30	-.19	-.21	-.32	-.39	.14	.26	.56*	-

\*\*p<.01, \*p<.05.

Table 2 summarises results on the links between CPD activities and instructional quality. To summarise this, the commitment and engagement of the participants (i.e., vigour) seem to play a crucial role in the provision of individual learning support. Other variables also showed a strong positive correlation with individual learning support, especially participants' dedication (albeit non-significant). With cognitive activation, a positive relationship with CPD activities became evident. The types and number of CPD activities attended influenced cognitive activation.

Overall, quantitative results indicate that the 15 participants attended 53 activities altogether. The reported activities were formal and in those formal activities teachers indicated that the predominant type of CPD activity attended was workshops not disregarding meetings and courses reported. The content covered varied, but the most covered content was CASME followed by Foundation Phase mathematics concepts and integration of subjects. The least being mathematics assessment activities. In terms of frequency of attendance, the results showed that teachers attended continuous (60%) CPD activities the most compared to once-off (20%) and continuous and once off (20%). Next, a presentation of results to answer question

two was done. The results indicate that participants reported that the extent of cognitive activation in the mathematics classroom is moderate and the provision of individual learning support is about half of the lesson. Inter-correlation of results indicates that the types, frequency and content of CPD activities attended influence cognitive activation, not individual learning support. With individual learning support; the influence is from commitment, engagement, dedication and vigour of the participants.

### **5.3 Interpretation of Quantitative Results**

#### ***Continuous Professional Development activities***

First, I am going to unpack results on the types of CPD activities that participants have reported in the questionnaire. The results from the questionnaires show that teachers reported attending formal activities only. Of the total number of activities reported, the majority were workshops; only a few meetings or other courses were reported. First, it is worth noting that formal activities are characterised by regular workshops with experts to impart knowledge to the teachers and involve pre-set goals (Vangrieken *et al.*, 2017). This may not seem unusual because workshops are a commonly found type of activity used for Continuous Professional Development (Garet, Porter, Desimone, Birman, & Yoon, 2001). They allowed participants to access expert knowledge in a highly structured way. Slightly less structured meetings were less predominant in the data. This result could indicate that teachers felt that they gained more development in workshops hence it was attended and reported more, and it is the workshop knowledge (*professional competence*) that could translate into instructional quality in the classroom.

Teachers are professionally developed through attending different types of CPD activities, and they do not have a fixed number that they are required to attend. A closer look at the topics of these highly formalised, structured engagement with experts reveals that seven different content topics were reported. The most mentioned workshop content was a CASME activity workshop followed by the Foundation Phase mathematics concepts and the Integration of subjects and other workshops (for details, please refer to figure 10 above). CASME is a non-profit education development agency that works in partnership with the department. It aims to improve the quality of mathematics and science education (CASME, 2014-2015). CASME does this through the professional development of teachers. It seems CASME is the most-liked and relevant as participants may have acquired adequate knowledge on Mathematics (*CK*) and

how to teach the subject (*PCK*) to help in the instructional quality (*cognitive activation and individual learning support*) of Foundation Phase Mathematics.

### ***Frequency and Time***

Most of the teachers (n=12) attended CPD activities that took hours, not minutes as the comparison was based on hours and minutes. These activities being hours were categorised into once-off and continuous. The most attended activities were continuous activities, and this suggests that teachers found these more meaningful despite them taking their time. As indicated by Philipp and Kunter (2013), some empirical research shows that the workload of teachers in terms of working hours is high and that some studies note that teachers view additional tasks as demanding. Despite this evidence, participants attended these CPD activities that took several hours and were scheduled continuously. This may be because of how the frequency and time spent on activities helps them with classroom Foundation Phase Mathematics instruction through the knowledge gained from these particular activities (*PCK*).

Overall, the CPD activities done in these workshops may be the ones that translate into the instructional quality of Foundation Phase Mathematics in the classroom. Participants do predominantly report attending formal activities on topics that mainly relate to CASME, Foundation Phase Mathematics concept and integration of subjects workshops that are attended continuously and take hours. As I have argued, this may be related to how these CPD activities translate into instructional quality of Foundation Phase Mathematics in the classroom such activities have, however, allowed participants to engage with expert knowledge on these topics in a highly structured way. Next, I will focus on how attending these activities and being exposed to this expert knowledge contributes to the instructional quality of their lessons.

### ***The extent of Cognitive Activation and Individual Learning Support in Foundation Phase Mathematics lessons***

The literature on the CPD of teachers shows the link between CPD activities and Instructional quality to improve teachers' knowledge and instruction (Akiba & Liang, 2016). This is especially relevant in Mathematics instruction (Jacob, Hill & Corey, 2017). For indicators of instructional quality, I chose cognitive activation and individual learning support. This is aligned with the view of Kunter and Voss (2013) as they reveal the structures of high quality of instruction. However, the authors mention the third aspect of instructional quality, i.e. classroom management. I chose not to focus on this dimension because, since the initial work by Kounin (1970), several studies have focused on classroom management (Praetorius *et al.*,

2014). My aim is not to add to this vast body of research on classroom management. In the following two sections, I interpret the results of both dimensions included in this study.

### ***Cognitive activation***

Cognitive activation in the context of this study refers to cognitive activities that help learners develop new insight and understanding that is related to their former knowledge (Kunter *et al.*, 2008). Teachers have to choose such activities and teach them to learners. The participants of this study reported on average that their lessons are moderately cognitively activating. This indicating moderate levels of this dimension. Taking the relevance of this dimension of instructional quality into consideration, it seems that such moderate levels of cognitive activation in Mathematics lessons in the Foundation Phase are not sufficient. Cognitive activation in Foundation Phase Mathematics is crucial, and it promotes reasoning. Wriston (2015) argues why a strong Foundation Mathematics is important. Mathematics skills learned at the primary level forms a foundation for the mastering of a higher level of Mathematics skills, and this plays a tremendous role in their career paths. Although the descriptive results show a moderate response, the results of this study show that CPD activities that are attended by the participants show a strong influence on cognitively activating learners during Foundation Phase Mathematics instruction.

The next step of the analyses dealt with inferential statistics to identify links between CPD activities and instructional quality. The correlation between Continuous Professional Development activities attended by the teachers and cognitive activation in the classroom was strong ( $r=.56, p<.05$ ). It suggests that teachers engage in CPD activities that help them prepare cognitively activating lessons.

The result is encouraging because teachers who attend more workshops engage more in cognitive activation. Thus, it highlights the role of CPD activities for instructional quality or Mathematics lessons at the Foundation Phase. The participants in this study have been engaged in 53 activities or more over continuous activities, suggesting that attending more CPD activities that are continuous plays an essential role in Foundation Phase Mathematics classrooms. Most of the attended activities were workshops, i.e. highly formal activities. Knowing that CPD activities for in-service teachers have different types of learning opportunities, from informal to formal activities (Collin, Van der Heijden & Lewis, 2012) it may seem promising to also look into the role of informal activities and how they play a role in cognitively activating lessons.

The correlation may have been strong between CPD activities and cognitive activation. Apart from analysing the links between CPD activities and cognitive activation, I also looked into correlations between other variables (i.e., academic success) and cognitive activation, especially the negative correlation between academic success and cognitive activation ( $r=-.68$ ,  $p<.05$ ). It suggests that when teachers focus on academic success more than the instructional quality of the subject, cognitive activation in the classroom is lower. It seems that teachers are less likely to cognitively activate learners in the Foundation Phase Mathematics if they focus on academic success, indicating that teachers may need to attend more CPD activities and possibly include informal activities that will help them cognitively activate learners in the classroom.

There are theoretical implications in these results because seeing that when teachers attend CPD activities, they engage more in cognitive activation, which has to do with the construction of knowledge about prior knowledge. Teachers provide this opportunity to learners after attending CPD activities that teachers themselves have gained knowledge to add on existing knowledge. It points to constructivism as it is viewed as learning that happens when new information is constructed based on an individual's existing structure of knowledge, understanding and skills (Pritchard, 2009). Not leaving out the professional competence of teachers that gives way to the ability to carry out appropriate tasks where teaching and learning is concerned (Hunt, 2011). Being able to activate learners cognitively has to do with choosing appropriate tasks. Individual learning support also falls under instructional quality, and I will now interpret results on how CPD activities translate into instructional quality through the provision of individual learning support. Next, I look at the extent of individual learning support in Foundation Phase Mathematics lessons.

### ***Individual Learning Support***

Individual learning support was also correlated with certain variables to explore how CPD is translated into the instructional quality of Foundation Phase mathematics. There was no significant relationship between the CPD activities (*number of activities, time, content and type*) and individual learning support. This result is striking since I expected that CPD activities would influence the provision of individual learning support by teachers using the knowledge gained. Literature had indicated that efforts to improve mathematics instruction rely on the CPD activities of teachers (Jacob, Hill & Corey, 2017). However, results on the individual learning support dimension did not show a significant relationship. Next, I interpret results on

the relationship between individual learning support and variables that relate to teachers' views on CPD activities and instructional quality.

Engagement (i.e., dedication, vigour, absorption), and commitment were assessed as well as self-regulation resources (social support, meaning of work) and were paired with individual learning support and showed significant relationships. The results presented indicate that the correlations between some of these variables (i.e., dedication, vigour, absorption) and individual learning support were large, suggesting that translation of CPD activities to individual learning support does is not only dependent on CPD activities but also on the teachers' engagement (i.e., dedication, vigour, absorption), and commitment. Especially the link between dedication and vigour seems relatively large. The more dedicated and vigorous they are, the more likely it is that they will offer individual learning support to the learners. Self-regulation resources also play a role, in the particular meaning of work which had a strong relationship with individual learning support. The way participants find meaning in their work promotes individual learning support in the mathematics classroom. As research indicates that CPD helps teachers review, renew and extend their commitment as change agents (Murphy & de Paor, 2017). It seems that after having engaged in CPD activities, this change is ignited and teachers can be more interactive with learners in the classroom.

Individual learning support is the level to which a teacher considers individual learner's understanding difficulties and encourages learners to engage in challenging tasks while assisting in correcting misconceptions (Warwas & Helm, 2018). From the results reported here, this seems to be the case in the participants' classrooms when teaching Foundation Phase Mathematics. This finding also links to the theory of scaffolding. Delen, Liew and Wilson (2014) view instructional scaffolding as a term for describing the relationship of interaction between learners and teachers. This interaction happens through individual learning support after teachers have gained the necessary knowledge (*competence*). CPD activities translate into instructional quality in Foundation Phase Mathematics through the types of activities chosen, frequency of CPD activities, their content and the views of it.

In summary, I have presented results for the quantitative part of my research to answer research questions one and two of my study. The results show that the teachers attended formal activities, and these formal activities were workshops. The content that was commonly covered was that of the CASME, Integration of subject and Foundation Phase Mathematics concepts

workshops, Foundation Phase. The time spent mostly was hours and were predominantly continuous. Results were correlated to find out how CPD activities translate into instructional quality of Foundation Phase mathematics, focusing on cognitive activation and individual learning support. For research question one, the results showed the types of CPD activities, frequency of attendance and content of the CPD activities.

For research question two, a negative correlation between academic success and cognitive activation was found, indicating that if teachers focus on academic success, they are less likely to activate learners cognitively. A strong relationship was found between CPD activities and cognitive activation. There was no significance found between CPD activities directly and individual learning support. However, some aspects were made variables that showed a significant relationship and a positive correlation with individual learner support. These are dedication, vigour, absorption (i.e. engagement) and commitment as well as the self-regulation resources meaning of work and social support. This suggests that these play a role in individual learning support instruction. Although there was no significant relationship between CPD activities and individual learner support, one might assume that it can be moderated by the teachers' engagement (dedication, vigour, absorption) and commitment as well as the self-regulation resources (meaning of work, social support). A teacher who attended CPD activities might be more likely to provide individual learner support when experiencing high levels of engagement and commitment or high levels of self-regulation resources.

To further explore the relationship of Continuous Professional Development activities with teachers' instructional quality in Foundation Phase Mathematics, a third question was formulated. It helped me explore how CPD activities translate into cognitive activation and individual learning support through analysing the qualitative results of this study.

#### **5.4 Presentation of Qualitative Results**

This part presents the findings of qualitative data that was generated in semi-structured interviews to acquire a deeper understanding of the types of activities participants engaged in and why they chose to engage in these activities. This part of the data generation focused on answering research question three. At first, I had to find out the types of CPD activities, the topics addressed in these activities, the time spent on the activities and the frequency of attendance. After finding out the types of activities, I separated them into formal and informal using the distinction used in the literature review (Collin, Van der Heijden & Lewis, 2012). Secondly, I wanted to know more about what was covered in the CPD activities, how the

mentioned CPD activities were delivered, and how they differed. Also, the reason for attending the CPD activities and the perceived usefulness of the activities. Next, I focused on what teachers do to teach mathematics in the classroom, how they describe how CPD activities influence their mathematics instruction while considering cognitive activation and individual learner support. Lastly, I will mention some indications of possible improvement in learners and difficulties experienced after incorporating knowledge gained. I will conclude the qualitative data presentation section by interpreting the qualitative results.

#### **5.4.1 Continuous Professional Development Activities Attended by Teachers**

After analysing the qualitative data generated from the semi-structured interviews with the participants, the types of activities that were attended by the participants were mainly workshops: CAPS, Jika iMfundo, Centre for the Advancement of Science Education (CASME) workshop, Inclusive, Departmental and Management. Most of the activities that were attended by the teachers were workshops. I was able to understand the differences between these activities when the participants elaborated on what is done in these activities. With this elaboration, I was able to group formal and informal activities that the teachers attended. The formal activities that were mentioned by the teachers; were the Curriculum Assessment Policy Statement (CAPS) activity, Jika iMfundo, Centre for the Advancement of Science and Mathematics Education (CASME) and a management workshop. Each activity meant something to the teachers. Below I will present these activities according to the type of activity, time spent, frequency and other activities organised by colleagues within the school.

##### ***Formal Activities***

##### ***Curriculum Assessment Policy Statements Activity (CAPS)***

This PD activity seems to be an activity that was attended once, and it did not seem common amongst the participants, as it was only mentioned by one participant and attended once. Not much time was dedicated to the session. Participant EL14SE mentioned that

*Eh...It was an hour, yes.*

As this was only mentioned by one participant and had no further elaboration on it, it had no relevance in further exploration in this study. I present this because it is part of the activities that are attended for CPD. However, this has no relevance to Mathematics instruction. The teacher attended it because it was part of the school's year plan for the teaching of subjects.

### ***Jika iMfundo***

Jika iMfundo is an activity that falls under the Department of Education (DoE). It was commonly mentioned by participants: three mentioned that they attended this activity. They attended it to get information on the different Foundation Phase subjects for the year, and not much information was shared about it. They mostly spoke about the time and frequency of the activity. It was attended once a year for one day at the beginning of the year and time spent on Jika iMfundo sessions varied from two to five hours.

GE25AP stated that *Jika iMfundo was roughly 3 hours for one day*. DU18JU mentioned that *I attended Jika iMfundo once a year and It was about 4-5 hours*. However, participant RO10JU indicated something different; *For Jika iMfundo, it was for two days and it is where you are introduced to the whole year's work*.

This suggests that it does not have a standardized duration of attendance and that it was for the basis of administration of the subjects to be taught for the year.

### ***Centre for the Advancement of Science and Mathematics Education (CASME)***

CASME is a workshop activity that was commonly attended by five participants out of the six that I interviewed. It mostly covered Foundation Phase mathematics concepts. This workshop aims to introduce the new term's work and go through the work, and doing practical examples with the teachers. There are five mathematics concepts in the Foundation Phase which are number operations and relationships, patterns, data handling, space and shape and measurement. The mathematics concepts that were touched on during the sessions are number operations and relationships, patterns, data handling as well as space and shape.

LT31OC mentioned that

*"I attended a CASME workshop which was on Foundation Phase mathematics Grade 1-3"*.

LT31OC mentioned that:

*"On the CASME workshop, we always try to cover all the maths topics which are; space and shape, patterns, number operations and relationships and data handling. However, we sometimes focused on the one that teachers mostly ask questions and the facilitator will answer which leads our focus."*

GE25AP also mentioned that

*“With the CASME maths workshops which occurs like I have said every single term, we normally zoom into numbers operations and relationship and pattern, data handling and space and shape which we are going to be teaching during our term so we are shown different skills on how to teach children.”*

It seems that what was intended by this workshop was fulfilled as teachers mentioned the same concepts that are meant to be covered by this workshop. Also, giving teachers a chance to choose focus shows that this workshop was beneficial to teachers.

The amount of time spent on the *CASME* sessions also varied between four to five hours. LT13OC had a different range of time as she expressed that the sessions she attended on *CASME* took 3 hours and RO10JU was not sure as she said, *For the CASME workshop, we spent an hour or more for each session.*

### ***Departmental workshop***

The departmental workshop was mentioned by only one participant (LT31OC), which states that the workshop was attended once a year, and it covered mathematics concepts. It took about 3 hours. It was not only about mathematics concepts as LT31OC highlighted that

*“on the department one, we covered what is required from us as primary mathematics teachers and the assessment guidelines. We were also reminded to not exclude struggling learners.”*

Touching on what is expected by primary mathematics teachers is pivotal because it helps teachers with how to plan for their lessons. Planning for a lesson plays a part in instruction because teachers know what to present to achieve what is required in instructional quality. These lessons are planned using knowledge gained in other CPD activities.

### ***Management Workshop***

The management workshop was mentioned by one participant (GE25AP) who described that it took three hours and happened only once. It does not seem relevant where my study is concerned. Below, I will talk about informal activities that teachers engaged in which seemed relevant to this study.

## **Informal Activities**

Apart from the activities mentioned above which are characterised as formal activities summarising learning activities that are systematic/standardised in terms of time, space, goals, and support. Other activities were indicated by the teachers, i.e., PLCs and informal subject meetings. These activities were informal activities organised by teachers within the school. In the quantitative part of the study, teachers did not mention any informal activities. Yet, in the qualitative part of the study, teachers mentioned informal activities.

### ***Professional Learning Communities***

PLCs are an informal PD activity that occurs within school settings. Earlier studies on informal learning defined it as learning that happens in the workplace without systematic support is absent which does not follow a curriculum and is not limited to specific environments (Richter, Kunter, Klusmann, Lüdtke & Baumert, 2014). This is what teachers had to say about PLCs:

LT31OC mentioned: *Yes, we have subject meetings which are PLCs where we talk about the challenges of the subject as well as solutions. We also talk about assessment details for the term like the number of tasks and activities needed for the term as well as how we can cover work not completed according to the curriculum.*

RO10JU also indicated that: *Uhhh actually, the other activities were organized by the PLCs, also by the subject teachers; we organize activities as subject meetings to help each other in terms of our teaching.*

LT31OC further mentioned that; *PLCs happen twice a term.*

It seems that the aim of this activity is development amongst peers within the school relevant for Foundation Phase Mathematics. It entails helping with providing instruction in the classroom as it was mentioned that it is to help each other with their teaching. Although these sessions are not restricted, they do have standardized attendance.

### ***Subject meetings***

Other than PLCs, informal subject meetings were also attended by the participants. These meetings were for updates on the mathematics subject, assessment task details.

LT31OC indicated that: *Other than that, we sometimes gather for a brief on how far we are and informally talk about the subject and how to teach some topics.*

RO10JU: *In our small area of Umlazi we have organized neighbouring schools to gather at a certain time to help us, help each other, empower each other in terms of these topics, these mathematics topics which are number operations and relationships, patterns, space and shape and data handling.*

GE25AP noted that: *normally in our school, we have activities that are, for example; In the Foundation Phase we have a HOD and an HOD for the Intermediate phase so we normally have Phase meetings with respective HODs where we go back and teach other, Maybe those who weren't able to attend the workshops we inform them, we give them feedback on what we learnt. Furthermore, there are also other meetings where if there is a teacher who would like to introduce something or introduce how to tackle a mathematics question.*

It seemed that these meetings are important because they touch on development in the subject of concern and act as information dissemination to help teachers that did not get a chance to attend CPD activities. Looking at the types of activities attended is not adequate to help in answering how teachers consider cognitive activation and individual learning support as part of instructional quality during teaching mathematics. It seemed pivotal to understand what is done during CPD activities that may assist with the above mentioned.

#### **5.4.2. How the mentioned CPD activities were delivered and how they differed.**

In the activities mentioned above, participants elaborated on what the content they engaged in during the sessions and the mode of delivery. The way these activities were presented differed, in one of the activities, they did practical examples in groups and other sessions, practical examples were done by the facilitator. They also mentioned the reasons why they attended these activities and their experiences as well as their attitudes and beliefs towards the activities.

##### ***Group Practical Examples***

EL14SE had indicated that she attended Jika iMfundo and CAPS and she said:

*“during the activity, they put us in groups and then they give us one of the activities to do as a group”.*

This activity was content specific as they touched on the patterns concept. They did it in a way that they would do it, class.

EL14SE added: *it was patterns but, in our group, we use colours and then we use counters with colours that we put as a pattern.* Participant RO10JU attended a Jika iMfundo workshop

as well and she had a similar view to EL14SE where Jika iMfundo is concerned. She said; *for the Jika iMfundo session, we are split into groups although there is one facilitator we split into groups and given topics, for example, one group is given number operations and relationships, the other is given patterns the other is given data handling.* This gives them an idea of how to conduct a lesson on this topic when they are back in school and received different strategies for tackling an activity from the different teachers.

### ***Facilitator Practical Examples***

In some of the CPD activities that were attended by the participants, they were led by one facilitator that did practical examples to show teachers how to tackle certain topics in the classrooms as well as what they can use as resources. Facilitators do this because of the expertise they have and the aim to impart what they know to the teachers for their benefit as well as the learner. Facilitators may be seen as knowledgeable peers or adults that Vygotsky (1896-1934) spoke of when he mentioned the ZPD. Also, workshops are flexible and encourage active learning.

GE25AP attended the CASME, Inclusive education and Jika iMfundo workshops and were conducted differently in the sense that the practical activities were done by the facilitator and not the teacher. *“There are actually different facilitators but they are just the ones who are just there by the board that they are showing us may be examples, how to tackle questions, then we are just there to observe what is being taught.”*

Teachers were not hands-on as in the activities where group practical activities were done. However, one teacher felt empowered. RO10JU denoted that; *for the CASME workshop, we are there to be empowered by just one facilitator. For each of the sessions per term, a different facilitator comes in speaking about a different topic.* LT31OC stated that *In CASME we came from different schools and in one session that I remember, we were given an example question paper that we worked on together with the instructor, she did question by the question but as we ran out of time she asked teachers to pick questions they most need help with.* DU18JU had a vague response on how the activities she attended were conducted. However; she mentioned that; *“They were telling us the methods of teaching and learning. Things that you must come with to class to present your lessons, things that will make your lesson interesting like providing charts and using bright colours, use examples, pictures real objects and all those things”* This suggests that these sessions were conducted by the facilitator and the facilitator did the practical examples. Therefore teachers were not as active as they would have been if activities were

conducted in groups. “Having done these activities, there were reasons behind doing them and teachers had different expressions about the reasons for conducting them.

### **5.4.3 Reasons for Engaging in CPD Activities (Attitudes)**

All the teachers in my interview sessions expressed different reasons for attending CPD activities. Below you find an overview of the different motives.

#### ***Fresh Insight from old knowledge***

Amongst the six teachers interviewed, three felt that the activities were redundant as they have attended these activities before. One participant expressed that despite that such workshops might seem redundant; they seem to be potential for revising knowledge and strengthening their implication into the lessons: *I choose to go there because it helps us even though we know it's been years now but once you go there you get something and then you come and practice it in the class* (EL14SE).

Another participant did not foreground redundancy but rather described attending these workshops as gaining **new information** by saying: *“That’s why I find myself going there to engage in such workshops because there’s always **new information** we expecting on dealing with problems and also you find that you learning new things as you go, you might have not observed everything that you had taught the other term or other year but this term they give you a new example on how to tackle a problem.”* (GE25AP).

And in more detail, two participants expressed that they specifically gained new strategies to use in the classroom when teaching Foundation Phase Mathematics to achieve optimal instructional quality. To support this, participant LT31OC mentioned that *“I now include a lot of practical work before we begin an activity. This is one of the strategies learnt in workshops”*. Furthermore, she referred to this as an opportunity to provide **useful knowledge** and said: *“I also was willing to attend so I can provide good knowledge to my learners and be able to attend to their needs using the new strategies gained in workshops, especially with the struggling learners”*.

#### ***Receiving Practical Solutions***

The other reason for engaging in CPD activities was to seek solutions to problems teachers face in class or solutions to solve mathematical problems in the classroom. One participant touched on solution seeking motivation when she expressed that *“the facilitator always gives*

*different examples on how to deal with a problem and finding new ways of getting a solution for an answer” (GE25AP).*

### ***Motivation***

There are also several reasons for engaging in the activities which were based on the personal motivation of the teachers, such as seeing improvement in learner performance. Below I present the motivation of teachers in categories.

### ***Improving Teaching***

The successful implementation of knowledge gained rested on what happens after the implementation. Four of the participants highlighted that they engaged in CPD activities because they were helpful in teaching.

RO10JU answered that *they do help me a lot because there has been an improvement in our teaching in teaching the activities in our foundation phase classrooms and we can also see the improvement in our learner’s performance.* LT31OC mentioned that *it showed us easier methods that learners quickly understand when being taught with and it was exciting as we had different methods of solving one sum.* Furthermore, *“too much, yes it’s helpful because even if there are those who do not understand quickly, once you use these activities as a play and if I am using objects they quickly understand”*

(EL14SE). DU18JU also mentioned something about improving teaching, *“I wanted to improve myself, my teaching skills and to know more about foundation Phase because I am not a qualified Foundation Phase teacher, I did intermediate Phase so I specialized in EMS but I am teaching Foundation in the school. I wanted to have that knowledge of the Foundation Phase and the different methods of how to teach young children.”*

It seems that teaching motivation was a highly rated reason for engaging in CPD activities because teachers noticed learner improvement. Some teachers felt that engaging in CPD activities was based on personal motivation.

*“Once you use these activities as a play and if I am using objects they quickly understand”* (EL14SE) and *“Foundation phase classrooms and we can also see the improvement in our learner’s performance”* (RO10JU).

### ***Personal Motivation***

Two of the participants had personal reasons for attending CPD activities. For example, DU18JU said: *I wanted to improve myself, my teaching skills and to know more about Foundation Phase because I am not a qualified Foundation Phase teacher, I did intermediate Phase so I specialized in EMS.* This participant expressed both teaching and personal motivation. Also, LT31OC stated that *I also was willing to attend.* Teachers had teaching and personal motivation for engaging in the CPD activities where motivation is concerned, however, it seems that teaching motivation was the more expressed reason.

### ***School Culture and Departmental Requirement***

Two teachers mentioned that they engaged in CPD activities because it was a school culture to do so. For example, RO10JU said that

*The reason why I chose to engage in these particular activities is that I was appointed by the school as you know that in the foundation phase we are split into Grade 1, 2 and 3 but for these two workshops which is CASME and Jika iMfundo, one teacher was selected to go and get empowered get some empowerment so that the teacher can come back and empower all the other teachers.*

LT31OC also mentioned that *it was a school requirement together with the department as teachers need to be developed every time because times are changing. We need to keep up with the times.*

The reasons for school culture and departmental requirement does not disregard that the engagement in CPD activities is helpful.

#### **5.4.4. Perceived Usefulness of the CPD Activities (Beliefs)**

In addition to describing which CPD activities participants engaged in and what their motives were for engaging in these activities, I will now outline how useful participants found these activities for their lessons. Cognitive activation and individual learning were included as dimensions of instructional quality. Thus, the usefulness of the CPD activities was weighed according to these dimensions and how these dimensions come to play in classroom practice.

## **The Usefulness of CPD Activities during Lessons**

The following three aspects are presented which allow for the evaluation of the usefulness of CPD activities for providing cognitively activating lessons: Lessons become more adaptive, incorporation of diverse views and incorporation of practical activities.

### ***Lessons became more adaptive***

In the interviews participants were requested to elaborate on their experiences concerning the usefulness of the CPD activities for the quality of their lessons, one of the teachers (GE25AP) explained that it was “eye-opening”. What the participant meant was that the content of the workshop allowed teachers to create lessons for learners to gain greater insight. She first explained that during the workshops, they are grouped in different grades of the Foundation Phase. This group paved the way for cognitive activation as she said:

*You might be just a grade one teacher who is going to be teaching this topic in a certain way but you also are given a view on how the next grade would pick up from where you taught the learner and build from that knowledge and introduce them to the other grade.*

This is cognitively activating because the learner builds on the previous grade’s knowledge when the learner gets to the next grade.

### ***Incorporation of Diverse Views***

The activities were not a loss as the teachers felt they were worthwhile and participant GE25AP highlighted that you are *obviously learning something new and there are always different perspectives because we are a group of teachers from different schools.*

Learning something new for the benefit of relating it to previous knowledge is cognitively activating and making engaging in CPD activities useful.

### ***Incorporation of Practical Activities***

Three teachers felt that the activities were useful cognitively in the classroom because learners learnt something new by adding practical examples to lessons.

LT31OC denoted *they are very very! Useful because learners can relate and practicals spark their interest.* What was learnt was seen at the change of perspective in learners or them being able to identify what was learnt in the classroom in real life as EL14SE highlighted that

*Yeah, It is useful because like as I said, patterns it is useful to them to see how are things go in patterns. Even when they are looking at the charts, they show me and say “mam this is the pattern” can you see mam this is a pattern.* This indicates what was mentioned by Vygotsky (1896) as individual learning that occurs after learners have been adequately supported (*scaffolding*).

The participants attended formal and informal CPD activities. The reasons for attending the CPD activities varied: practical solutions, improve teaching and personal motivation. The activities were found useful as lessons became more adaptive and enabled the incorporation of diverse views and practical activities. The participants made use of the new knowledge in the classroom for the instruction of Foundation Phase Mathematics. Below I present how the teachers made use of the knowledge taking into consideration cognitive activation and individual learner support.

#### **5.4.5. Using the knowledge gained in the classroom**

Teachers use what they have learned specifically from CPD activities to teach mathematics by using the activities as guidelines or using similar activities, as an introductory example and a teaching method. Teachers acquire skills to teach mathematics which is what may be viewed as professional competence. The COACTIV model (Baumert & Kunter, 2006) is about professional competence. The CPD activities that teachers engage in inform competence. Liakopoulou (2011) views professional competence in terms of the work carried out by a teacher. The way that the work is done is determined by acquired knowledge. After CPD activities, teachers acquire knowledge and go back and teach. It is through teaching that we can see how CPD can translate into instructional quality and how cognitive activation and individual learner support is considered.

##### ***Guideline and Similar Activity***

Four teachers used the knowledge gained in the classroom as a guideline. For example, *“We use Jika iMfundo as a guideline for most cases and then you find that some topics that were taught in CASME workshop correlate with Jika iMfundo in terms of the day’s work”*(GE25AP).

Participant DU18JU had an elaborate answer to how she uses the knowledge gained:

*I use them as a guideline, I start with an activity, I introduce the activity first, I put it on the board, I explain, and I ask questions. The time you keep on asking questions to see whether the learners are following by the show of hands and you see that they are trying to answer. Sometimes you see that you ask a question and nobody will raise a hand so it means that they*

*do not understand what you are saying so you keep on providing more examples referring to the activity that is on the board as a guideline.*

Teachers believed that using the activities as a guideline is using similar activities to those that were done during CPD activity sessions, and they refer to handouts that they received at the workshops. *“I use similar activities in examples like when I prepare my charts, I do activities that we did in the workshop because they give us handouts as well”* (DU18JU). However, using similar activities as a guideline may require teachers to take into consideration the context it is being administered in because the activities may require resources that were used at the workshops which the school may not have.

### ***School Context***

A school context can be functional or dysfunctional, i.e. it is functional in a way that it has resources and dysfunctional in a way that it lacks resources. Facilitators provide teachers with alternatives that they use in case a school lack resources to conduct lessons that promote cognitive activation and individual learning support. RO10JU states that: *The workshops have taught us and instilled in us the guidelines in which we should take in terms of the group we are having.*

### ***Introductory Example***

Three of the six teachers used what has been learnt as an introduction to a lesson that is based on a topic learned. One teacher explicitly stated how the activities are used as an introduction. *“I for a certain topic for example space and shape, the thing that I would do is like the cutting out of the shapes would be like an introduction and then when the introduction is done probably the learners would be asked to identify the different shapes and then describe it maybe. Then go on to teaching them about those shapes that they have cut out for better understanding”* (RO10JU). Cognitive activation is evident because the teacher aims to ignite understanding in learners by using activities as an introductory example.

### ***Teaching Method***

Some teachers used what was learners as a teaching method which differed from how they taught before attending CPD activities.

*I put it on the board, I explain then I ask questions the time you keep on asking questions to see whether the learners are following by the show of hands. Sometimes you see that you ask a question and nobody will raise a hand so it means that they do not understand what you are telling them so you keep on providing more examples referring to the activity that is on the board.*

Teachers had new strategies for teaching Foundation Phase Mathematics after attending CPD activities. This can be viewed as new strategies for the instructional quality of Foundation Phase mathematics. The CPD activities were used guidelines, or similar activities from the CPD sessions were done, it was used to accommodate school context, as introduction examples when teaching a lesson with a topic that is the same as the one done during CPD activities and as a teaching method. However is it pivotal to view specifically how cognitive activation and individual learner support was considered during the instruction of the subject as a way of meeting the objective of the study.

#### **5.4.5.1 Consideration of Instructional Quality.**

One teacher felt that using CPD activities to teach mathematics did not bring any change. However, four teachers mentioned the change. The change mentioned by the four participants relates to the professional knowledge teachers gain from CPD to teach Foundation Phase mathematics

*Uhh nothing changed, nothing much changed. Jika iMfundo is that it's too much paperwork but practically it is the same as the old one. However, after these courses sometimes you come with new things that you can see that will help them. (EL14SE)*

Teacher GE25AP is one of the four that felt that there is a change in the way that they teach after having acquired skills from CPD activities, to teach mathematics. It makes it easier to teach and what she learned is suitable

*I think I taught in an old fashion way where you just seemed like a lecture to the kids. Now with workshops, they make you more adaptable in terms of you knowing your surroundings, you know what you can use, you know what ways are much more suitable for your class*

One teacher expressed that she used what she learned positively and helped her change her teaching strategy (*instruction*).

*I use these activities to guide the other teachers in teaching mathematics as well as guiding myself. Although the textbooks are there to guide us but going out for workshops guides us more in terms of how we approach a certain lesson, what kind of materials do we need in our classroom. It helped me a lot in terms of having more worksheets, more visible classroom worksheets and charts that learners can see because most learners learn best when they can see and of course I use demonstrations as well to help them. (DU18JU).*

One teacher used about 60% of what she learned, and two expressed that they use all of what they learned. CO08JU stated that she uses all that she learned when she is teaching because it helped her change her teaching strategy. (*Instruction*)

*I use all of it; it also depends on the topic I am going to teach. It also depends on the level of understanding of the learners and me regarding the topic. I used to teach without involving the learners and did less practical work. The reason is that before I was rushing to complete the syllabus, whereas now, I realize that it is about the learners' understanding of the work and involving them make the work move faster.*

After incorporating what teachers learned, all of them noticed an improvement. However, some did express that this improvement did not come from all the learners as some still struggle with some of the work given to them. Although some learners still struggle, cognitive activation is considered.

#### **5.4.6. Considering Cognitive Activation**

The knowledge gained by the teachers in CPD activities enables them to teach Foundation Phase mathematics in a way that learners gained new insight through cognitive activation. Kunter *et al.* (2008) mention that through cognitive activation, learners develop new insight and understanding that is related to their prior knowledge. Three teachers felt that using the knowledge gained in CPD activities activates good understanding. This understanding can be viewed as cognitive activation when analysing the responses of the participants.

Cognitive activation was first expressed through a method that is used to teach mathematics. One of the common ways of cognitively activating learners mentioned by three teachers was that they used more practical examples. Participant EL14SE expressed that: *we use practical first and then I give them the work to do but first, I use it practically if I'm teaching anything*

*in mathematics. Also, by asking them questions, by asking them to come to demonstrate what I'm going to teach after I have told them.*

Also, teacher RO10JU explicitly said:

*I do use practical activities but not all the time. Some of the practical activities that I use are having objects that are shapes or whereby learners must identify those shapes and then move on to tackling any given activity based on these shapes. Then with numbers operations and relationships where we deal with counting and numbers, I do ask learners to collect maybe lids, drink lids that you get from Coca-Cola bottles, so they use that for counting and I do sometimes use them, themselves to count and they see that we are taking five learners and minus three learners so how many are left so I also do that.*

*Additionally, what I have mentioned is that I explain the work to them, and I give them examples. After giving them examples, I ask questions. So, if I can see that the answers, they are giving me are going in the direction correct direction or the direction that I want them to go to or they are correct. I then see that they do understand the set of work, so I allow them to do it.*

*I involve things that they like, learners like. I involve going to the playground and picking up stones probably for counters. What they like, being outdoor, learners love being outdoor and not just being inside the classroom all the time. So, I sometimes let them go outside and do activities outside the classroom.*

Doing things outside the classroom is still part of cognitively activating learners and doing physical activities may ignite understanding.

DU18JU explained that *I put it on the board, I explain then I ask questions the time you keep on asking questions to see whether the learners are following by the show of hands and you see that they are trying to answer. Sometimes you see that you ask a question and nobody will raise a hand so it means that they do not understand what you are telling them so you have to keep on providing more examples referring to the activity that is on the board as a guideline. Sometimes I give them the expected answer and still carry on with questions in between to activate good understanding.*

Furthermore, DU18JU said

*I will say I take them step by step because they are young, they can't take a lot of things at the same time. As I take them step by step, I introduce the simplest, I teach and provide examples with answers sometimes if I see that they do not know answers, maybe give them the first. I engage them, when I am teaching, I give my examples and I give them a chance to provide their examples.*

In summary, teachers used practical activities, explain and question methods, elicit prior knowledge and took learners step by step to activate learners cognitively. They did this while doing activities being influenced by knowledge gained through engaging in CPD activities. Below I present how individual learning support was considered.

#### **5.4.7. Considering Individual Learning Support**

Individual learning support has to do with teacher and learner interaction. This interaction was identified in aspects that were drawn from the responses of the teachers interviewed. Guideline activities, and using practical examples are what was drawn in terms of using considering individual learner support.

##### ***Guideline activities***

Teachers expressed that they use these activities as a guideline. In the next section on how they used what they gained from CPD activities in the classroom specifically, I will explain more on the guideline. The guideline that is being referred to in this section refers to the individual learning support guideline. Introducing learners where they can participate paves the way for interaction. Therefore, teachers used the knowledge gained as a guideline for introducing lessons that require learners to participate. For example, LT31OC said “. *I mostly use activities learnt at the workshops as an introduction*”. Learner involvement is considered during the introduction because teachers made use of practical activities that learners are given a chance to do.

##### ***Using Practical Examples***

Teachers referred to how they did not place much attention to involving learners in the classroom. Learner involvement through practical activities in the classroom has been raised by engagement in CPD activities and teachers have warmed up to it.

RO10JU raised that

*“before we did not pay much attention to practical tasks but we just taught, we just lectured, or we just taught in words without giving examples and demonstrations”.*

However, through learner involvement learners are now able to understand what is being taught as stated by RO10JU that, *the learners are now able to comprehend what the teacher is teaching them.*

Three teachers elaborated on the strategy they use to provide individual learning support to the learners and RO10JU said: *with the learners that did not understand, I definitely do give them individual support by firstly explaining to the whole class the class activity, demonstrating it and then leaving the class, those who understand to tackle the work and then call individually the ones that did not understand, give them special attention.*

### ***Time***

DU18JU also elaborated on how she provided individual learning support to the learners however, she had a challenge.

*Maybe once a week if I see that this learner is struggling, you may want the learner to stay behind after school then they do those activities, maybe reading, you want to improve the learner’s reading skills. Even on that one, we have difficulties because you find that these learners, travel by transport so you find that the transport will be here on time. If the time is 13:45 for learners to be out of school even if you want to stay behind with the learner, you cannot just keep the learner because the learner takes hired transport.*

Teachers were also interviewed on how often they offered individual learning support to learners and whether they noticed any improvement after offering individual learning support, and would they consider it all the time. All the teachers spoke about how often they offer individual learning support. The duration they spent ranged from a day to three times a week. GE25AP felt that either than the frequency of offering individual learning support, it is a requirement to provide it. She said

*yes, it’s required of us to offer individual support to learners because you find that some learners are way behind others in terms of writing their work, getting their work finished or understanding the work.*

Warwas and Helm (2018) describe individual learning support as the extent to which a teacher is considerate to individual learner's understanding difficulties and encourages learners to engage in demanding tasks while they assist in correcting misconceptions. Learners being able to comprehend what is taught through individual learning support makes it seem clear that learner involvement led to learner improvement.

#### **5.4.8. Influence of CPD activities on instructional quality**

Teachers have different strategies for teaching mathematics in the classroom. Teachers explained their different strategies, and I grouped them according to the theoretical frameworks of this study.

##### **5.4.8.1 Links with Constructivism**

Pritchard (2009) sees constructivism as learning that happens when new information is learned based on an individual's prior structure of knowledge, understanding and skills (professional competence). Acquired skills from CPD activities enable teachers to develop learners Mathematical reasoning skills through cognitive activation and individual learner support.

##### ***Cognitive activation***

Cognitive activation was first expressed through a method that is used to teach mathematics to the learners. One of the common strategies mentioned by the three teachers was that of using practical examples more. Participant EL14SE expressed that:

*we use practical first and then I give them the work to do. But first, I use it practically if I'm teaching anything in mathematics. Also, by asking them questions, by asking them to come to demonstrate what I'm going to teach after I have told them*

In addition, teacher RO10JU explicitly said:

*Additionally, what I have mentioned is that I explain the work to them, and I give them examples. After giving them examples, I ask them questions. So, if I can see that the answers, they are giving me are going in the correct direction or the direction that I want them to go to or they are correct. I then see that they do understand the set of work, so I allow them to do it.*

Furthermore, DU18JU also expressed a strategy that she uses to teach mathematics.

*I will say I take them step by step because they are young, they can't take a lot of things at the same time. As I take them step by step, I introduce the simplest, I teach and provide examples with answers sometimes if I see that they do not know answers, maybe give them the first. I*

*engage them, when I am teaching, I give my examples and I give them a chance to provide their examples.*

This relates to constructivism and scaffolding in particular as a teaching strategy that supports teacher and learner interaction and may result in improvement. As mentioned before Vygotsky (1978) stated that when learners are supported by the teacher as knowledgeable sources of instruction, they improve. However, teachers needed to be competent to be able to execute the above-mentioned teaching strategies. This competency was gained through attending CPD activities and thus draws more to the COAVTIC model. This is the reason why I had to find out how they are using what they have learned in the CPD activities for teaching mathematics.

#### **5.4.9 Improvement after attending CPD activities (Professional Competence and COACTIV model)**

Learners show improvement when they are involved in the classroom. Teachers learning from CPD activities and implementing changes that require them to change old ways of teaching and introduce new ways that spark interaction has assisted learners to improve.

All teachers noticed an improvement after incorporating changes in their teaching after attending CPD activities. The improvement was seen in different ways by the teachers. EL14SE mentioned: *they were able to do the activities*. These are activities they presented after attending the CPD activities.

GE25AP explained that *Learners tend to understand more and relate more to the problems or finding solutions for the questions since now I broke down the questions in a way where it's much more suitable for them to comprehend*. Incorporating knowledge gained helped learners understand and change.

RO10JU highlighted that:

*learners have changed their activities even the way they handle a sum or an activity given to them*. Practical activities also helped in inspiring change in learners and influence the improvement. *“Yes, I notice change a lot and learners are willing to learn. Some are always looking forward to the mathematics lesson because they know they will be active”* (CO08JU) and DU18JU stated that *most of them now can see what is going on*.

One participant had something different to say about the improvement she noticed as she felt that there is an improvement in both her teaching and learner performance. *“Yes, there has been some improvement in my teaching and the learner’s performance”* (LT13OC).

Teachers further expressed that even though they noticed an improvement, different learning abilities hinder improvement.

*“Yes, there is an improvement in some learners. However, a few learners, I can say they are challenged in some way. It is not academically challenged but there is some other kind of challenge that results in the academic challenge. Although we cannot reach out to all learners, yes some learners, we have reached out to them”* (RO10JU).

After incorporating what teachers learned, an improvement was noticed. However, some did express that this improvement did not come from all the learners as some still struggle with some of the work given to them. Different learner abilities seem to be relevant.

#### **5.4.10. Difficulties of transferring information from CPD activities into class**

Although teachers noticed improvement and changes, they experienced some difficulties upon using what they learned from the CPD activities. Difficulties experienced are; different learner abilities, lack of resources and school context, language and reading barrier and unfulfilled promises

##### ***Learner Abilities***

Learners have different learning abilities. Three teachers mentioned that the difficulty they experienced was that of learner abilities.

*Yes, there are some activities whereby as I mentioned we cannot reach out to all learners. I have experienced teaching a learner and that learner not understanding anything which means they need more of a special than a school like ours which is mainstream so we experience a lot of difficulties in terms of that and at the end of the day we are puzzled in terms of how to handle such cases but we do go to these workshops and report such cases.* RO10JU

##### ***Lack of Resources and School Context***

Another difficulty experienced by four teachers is the lack of resources in the school context. Some schools did not have resources that were used in workshops due to the context of the school. Participant GE25AP expressed that:

*The only difficulty would be resources because the resources that might have been used during the workshop might not be available in school, so you need to adapt when you get back to your school and try and find similar resources.*

### ***Language and Reading Barrier***

Learners have a language and reading barrier that comes as a difficulty experienced by teachers when using what has been learned.

LT31OC: *Also, sometimes we have a language barrier as we have to go back and teach in learners' home language and DU18JU: other learners they can't read, they have difficulties.*

### ***Unfulfilled Promises***

Teacher RO10JU mentioned that they are waiting for help about how to tackle issues of barriers and the different learning abilities.

*Right now, we are being promised that something is being done for these learners, but we are not sure when will they get help.*

These results from the interviews relate to research question three. Below, I will interpret these results to explore how CPD activities translate into instructional support (i.e., cognitive activation and individual learning support) in teaching Mathematics at Foundation Phase.

#### **5.4.11. Additional Results on Individual Learning Support**

Teachers were also interviewed on how often they offered individual learning support to learners and whether they noticed any improvement after offering individual learning support, and would they consider it all the time.

### ***Frequency***

All the teachers spoke about how often they offer individual learning support. The duration they spent ranged from a day to three times a week. GE25AP felt that either than the frequency of offering individual learning support, it is a requirement to provide it.

*Yes, it's required of us to offer individual support to learners because you find that some learners are way behind others in terms of writing their work, getting their work finished or understanding the work*

Three teachers elaborated on the strategy they use to provide individual learning support to the learners and RO10JU said: *with the learners that did not understand, I definitely do give them individual support by firstly explaining to the whole class the class activity, demonstrating it*

*and then leaving the class, those who understand to tackle the work and then call individually the ones that did not understand, give them special attention*

DU18JU also elaborated on how she provided individual learning support to the learners however, she had a challenge.

*Maybe once a week if I see that this learner is struggling, you may want the learner to stay behind after school then they do those activities, maybe reading, you want to improve the learner's reading skills. Even on that one, we have difficulties because you find that these learners, travel by transport so you find that the transport will be here on time. If the time is 13:45 for learners to be out of school even if you want to stay behind with the learner, you cannot just keep the learner because the learner takes transport.*

### ***Improvement After Individual Learning Support.***

One teacher felt there is an improvement; one stated that it works, and the others spoke of the different learning abilities that hinder improvement.

*Yes, there is an improvement in some learners. However, a few learners, I can say they are challenged in some way it's not academically challenged but there is some other kind of challenge that results in the academic challenge. Although we cannot reach out to all learners, yes some learners, we have reached out to them.*

RO10JU

After presenting the results from the semi-structured interviews to answer research question three, I will now interpret these results in terms of what question three aimed to explore which is; how cognitive activation and individual learning support is considered as part of instructional quality during teaching Foundation Phase Mathematics.

### **5.5 Interpretation of Qualitative Findings**

In the previous section, I have presented results on research question three that falls under the qualitative part of the research. In this section, I will interpret the results by first looking at the CPD activities that teachers engaged in. Second, I will look at the instructional quality of Foundation Phase Mathematics. I will then focus on how the dimensions are considered (*cognitive activation and individual learning support*) linking it to the theoretical framework embodied in the study. It will help me answer research question three.

### ***A Critical Discussion of CPD Activities Attended by Teachers***

CPD for in-service teachers consists of different types of learning opportunities, from formal to informal activities (Collin, Van der Heijden & Lewi, 2012). In the qualitative part of my study participants reported formal and informal activities. Formal learning is learning activities that are systematic in terms of time, space, goals, and support (Kyndt, Gijbels, Grosemans & Donche, 2016). In line with this definition, the formal activities that were attended by the teachers are CAPS activity, Jika iMfundo, CASME, departmental workshops and a management workshop. On the other hand, informal learning is characterised by a low degree of planning and organising in terms of learning context, learning support, learning time, and learning objectives (Kyndt, Gijbels, Grosemans & Donche, 2016). In the results, I found that only two informal activities were attended by the teachers (PLCs and informal subject meetings) which was mentioned during interviews and I could not find any in the questionnaires. To address question one of the study in-depth with qualitative results, the results indicate that teachers engaged in formal activities the most and CASME was the common activity amongst the teachers as it was mentioned five times. It was followed by Jika iMfundo which was attended by three teachers. It is pivotal to know what was done specifically in these CPD activities.

Understanding what is done in these activities may help in understanding what they are about and how it develops teachers. In the above-mentioned activities, participants elaborated on what they did during the sessions. They also mentioned the reasons for what was done as well as their feelings towards it. Teachers engaged in CPD activities for different reasons. Results in my study show that teachers engaged in CPD activities because they gained fresh insight from new knowledge, they received practical solutions, for improving teaching and personal motivation and school culture as well as departmental requirement. These reasons influence how they used what they acquired for optimal instructional quality.

### ***Instructional Quality of Foundation Phase Mathematics***

Teachers can provide instructional quality of Foundation Phase Mathematics after engaging in CPD activities. Instructional quality can be viewed as “creating challenging and adaptive learning situations, as well as carefully guiding students through the learning process” (Kunter, Tsai, Klusmann, Brunner, Krauss and Baumert, 2008, p. 470). Teachers may use this as a measure in considering cognitive activation and individual learning support. However, the

results do show that teachers consider the dimensions mentioned above as part of the instructional quality of Foundation Phase Mathematics.

### ***How Cognitive Activation is considered***

When teachers engage in CPD activities, they gain new knowledge that they use during Mathematics' instruction. The COACTIV model suggests teachers need to be competent to carry out the requirement of the profession (Baumert & Kunter, 2006). Having gained knowledge from the CPD activities, acquire an aspect of professional competence which is professional knowledge. The usage of the knowledge gained is what may guide the instructional quality of Foundation Phase Mathematics. In this study, Foundation Phase Mathematics teachers expressed various ways of using the knowledge gained during CPD activities. They used the knowledge gained as a guideline, and they used similar activities that were done in workshops, they used it considering the school context, as an introductory example, and as a practical activity that translates into instructional quality (cognitive activation). These strategies supported learners' understanding.

The way primary mathematics is taught can be cognitively activating to the learners. Keeping in mind that cognitive activation was defined as cognitive activities that enable learners to develop new insight and understanding that is related to their former knowledge, (Kunter *et al.*, 2008). Constructivism is evident here as Pritchard (2009) views constructivism as learning that happens when new information is learned based on an individual's prior structure of knowledge, understanding and skills. It seems that participants aimed to cognitively activate learners by choosing appropriate tasks in the classroom that were influenced by appropriate knowledge gained during CPD activities. In a study by Polly, Neale and Pugalee (2013), it was revealed that teachers that participated in development projects created more Mathematically rich activities that were influenced by strategies learned in the projects. Creating appropriate tasks link to COACTIV theoretical frame touching on professional competence where knowledge (PCK) is concerned. It seems to be the reason why teachers chose to use activities as a guideline or used similar activities to incorporate strategies learned in CPD activities for cognitive activation.

Teachers used what was learned considering the school context for the benefit of the learner through the process of insightful learning (Baumert & Kunter, 2006). Guskey (2002) stated that teacher Professional Development is a process and activities that improve the knowledge, skills and attitudes of teachers to improve how learners perform. This improved knowledge is

seen in the new teaching methods used by teachers and included more practical activities. It seems that teachers further cognitively activated learners by using what was taught to them as a teaching method that differed from how they taught before attending CPD activities. PCK is observed as the knowledge acquired in CPD activities that enhances the PCK of the teachers which is used for teaching the subject before getting into the subject knowledge. As in early research, Shulman (1987) viewed PCK as a critical combination of content and pedagogy for teachers and their particular form of professional understanding.

Overall, participants in the semi-structured interviews listed several ways which aim at cognitively activating their learners. However, results show that teachers predominantly aim to include practical examples to make lessons engaging and cognitively activating for learners after having attended CPD activities.

#### ***How Individual Learner Support is considered (Constructivism and scaffolding).***

Learners may need individual learning support after being taught a Mathematics lesson. Warwas and Helm (2018) describe individual learning support as the extent to which a teacher is considerate to individual learner's understanding difficulties and encourages learners to engage in challenging tasks while they assist in correcting misconceptions. Teachers considered individual learning support through time spent and different strategies used. All the teachers spoke about how often they offer individual learning support. It ranged from a day to a week considering the context and level of understanding of the learner. The reason for this was that some learners struggle with completing the work. Therefore they need individual learning support and time to comprehend and complete what was done in the classroom.

The way it was provided is that teachers teach the whole class first and leave those that understand to tackle the work (*strategy*). The focus is then shifted to those who did not understand (*scaffolding*). If a period is short, learners are required to stay behind after school or come early in the morning. The way that individual learning support is considered by the teachers after attending CPD activities seemed useful and improved learners' performance

#### ***Influence on Learners***

Considering cognitive activation and individual learner support after engaging in CPD activities showed improvement in learners. Four teachers agreed that there is improvement mostly in cognitive activation. However, one teacher highlighted that not all learners might

comprehend the new methods or what was learnt; therefore, individual learning support is highly considered.

This indicates what was mentioned by Vygotsky as individual learning that occurs after learners have been adequately supported (scaffolding, REF)). This paved the way for improvement. Scaffolding helps teachers to develop learners' Mathematical reasoning skills through cognitive activation and individual learner support. Wood (1976) denoted that scaffolding is a process that makes the learner be able to solve tackle a challenge or do a task that a learner would not be able to achieve without being assisted. In this process, the teacher makes decisions on what type of tasks to use, when to support and the help that is necessary (Wood, 2001). A pattern is seen in analyzing how teachers consider cognitive activation by using what they have learned in CPD activities.

#### **5.5.4 Summary of Chapter**

The presentation of results help with interpreting what has been found, and it provides answers to the three research questions of this study. In this chapter, I have presented quantitative results for questions one and two of the research questions. After presenting the results, I then interpreted the results. The results indicate that from the questionnaire answers, teachers attended formal activities only. These activities were workshops and the common content of the workshop was CASME activities, Foundation Phase Mathematics concepts and integration of subjects. Question two which aimed at finding out how CPD activities translate into instruction quality of Foundation Phase mathematics looking at cognitive activation and individual learner support required Pearson correlation and the significant levels found that there is a relationship between the variables correlated. The content, type and frequency spent on CPD activities translated into cognitive activation. The translation of CPD activities into individual learner support was not direct but indicated that there are aspects that influence the provision of individual learner support. Aspects such as the meaning of work, dedication, commitment, vigour, absorption and social support may be influenced by what is learned in CPD activities.

The qualitative part of the presentation of results addressed research question three, which aimed at finding out how cognitive activation is considered in teaching mathematics. I first looked at the types, mostly attended and the content of the CPD activities. In the qualitative part, I found that teachers attended both formal and informal activities. Formal activities were on CASME, CAPS, Jika iMfundo, departmental and management content. Informal were PLCs

and subject meetings. The results indicated that the activities that were attended the most are CASME and Jika iMfundo. During the session, activities were done as practical activities which is what teachers liked the most and incorporated the most to activate learners cognitively. Reasons for engaging in these CPD activities varied. Focusing on the formal CPD activities, the results show that teachers felt that they gained fresh insight, it was helpful for their teaching, helped in finding solutions in the classroom, and it was a school culture to attend CPD activities and a department requirement. This resulted in how cognitive activation and individual learner support was considered in teaching mathematics and provided a link to the theoretical frames.

Cognitive activation was considered by using what was learned in the CPD activities as a guideline. They also did similar activities that were done in the CPD activities, as well as by considering the school contexts. Sometimes they used the activities learned as lesson introductions or as practical activities during a lesson. This sparked new teaching methods for them as they felt that they now teach differently from how they taught before attending CPD activities. In summary, CPD activities were used to consider cognitive activation through scaffolding learners, and they noticed an improvement in learners. Individual learning support was considered through time spent on helping learners and the strategy that was used. Time spent varies from 1 day to 3 times a week. Teachers used different strategies to ensure they provide individual learning support such as; asking the learners that need help to stay after school for extra lessons or first give the entire classwork to do and then focus on those that need support individually. Lastly, teachers expressed that they noticed improvement and individual learning support works. The CPD activities help them know what to do and how to do it. These were the findings concerning the relationship of CPD activities and instructional quality of Foundation Phase Mathematics teachers. In the following chapter, I will discuss the findings in integration, highlight the challenges expressed by teachers, state my recommendations and conclude my study.

## CHAPTER SIX

### DISCUSSION (INTEGRATION) OF FINDINGS, STUDY LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

#### **6.1 Introduction**

In the previous chapter, I have presented quantitative and qualitative findings and interpreted the results. In this chapter, I will discuss findings to answer the three research questions of this study. I will integrate results as this is a mixed-method study and discuss the findings. This study aimed to explore the relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching Mathematics. This was done at two schools in the Umlazi district. I will integrate findings looking at the types of CPD activities engage in (*content and time*), how CPD activities translate into instructional quality (*cognitive activation and individual learning support*) of the Foundation Phase Mathematics and how cognitive activation and individual learning support are considered when teaching Mathematics. I will present my recommendations and then conclude the study.

#### **6.2. Integration of Qualitative and Quantitative Results**

A mixed-method study approach with a sequential design in which participants were invited to respond to a questionnaire in a first step, followed by semi-structured interviews with selected participants. This forms a great strength of the study and allows me to triangulate information from both parts of the study. In the following, I will now integrate the results from both parts of my study to further address my Research Questions.

##### ***Integration of Results on CPD Activities***

Quantitative data showed that participants only attended formal CPD activities. In the interpretation of this finding, I assumed that this might have been the case because participants might have given these activities greater emphasis over informal activities. This assumption seems to be aligned with results from the semi-structured interviews, in which participants indeed mentioned engaging in both formal and informal activities, however, greater emphasis was still on formal activities. Participants indicated that engaging in informal activities (PLCs and subject meetings) was also important, LT31OC mentioned: *Yes, we have subject meetings which are PLCs where we talk about the challenges of the subject as well as solutions.* Not

much was expressed about them concerning this study as these focus more on administration and assessment matters of a subject. However, they are relevant as PLCs add value and they have been placed as an added value (Vangrieken, Meredith, Packer & Kyndt, 2017). Teachers go back to the classroom and implement what has been learned in workshops as results do show that there is a relationship between the types of CPD activities and Cognitive activation. The formal CPD activities that were attended by teachers were workshops. These workshops were CASME, Foundation Phase Mathematics concepts, integration of subjects and Jika iMfundo. CASME was the predominant workshop. CASME is a non-profit organization that offers professional development for teachers in science and mathematics. Teachers may have chosen to attend these particular activities due to frequency and time spent on them or what was offered by them as well as the relevance it has on Foundation Phase Mathematics

### ***Frequency and Time***

The predominant CASME workshops were attended four times in a year (continuous) and they took from 1-4 hours per session. It seems that teachers preferred to attend continuous activities (see figure 9) as once-off activities did not allow them to follow up and some teachers felt that they were redundant, *I choose to go there because it helps us even though we know it's been years now but once you go there you get something and then you come and practice it in the class* (EL14SE). The informal activities attended by teachers were PLC's and subject meetings which occur within the school settings. Not much was expressed about them concerning this study as these focus more on administration and assessment matters of a subject. However, they are relevant as mentioned above. It is important to also draw on reasons for attending these activities.

### ***Reasons for Engaging in CPD Activities***

In the qualitative results, teachers engage in CPD activities for different reasons. The results pointed out that teachers find these activities useful during mathematics instruction. Teachers gain fresh insight from existing knowledge, receive practical solutions, improving teaching, personal motivation and school culture with the departmental requirement. Although they had positive reasons for their engagement, the participants mentioned that improvement in learners is not 100% because learners have different learning abilities. The way that lessons were delivered changed and teachers expressed this during the semi-structured interviews. It can be summarized that the results from the quantitative and qualitative show that the content of CPD

activities, type and frequency spent on CPD activities indeed translate into cognitive activation. This can be further understood when taking into account how this translation took place.

### ***Integration of result on the link between CPD activities and Instructional Quality of Lessons***

In the qualitative interviews, participants described in detail that CPD activities help them in instructional quality after attending them. In the interviews participants elaborated on their experiences regarding the translation of the CPD activities for the quality of their lessons. Participants expressed that they made their lessons more adaptive by teaching lessons that will enable learners to move up the grades with the knowledge gained. The knowledge gained during workshops enabled the participants to incorporate diverse views in classrooms from the different perspectives discovered during CPD activities. Lastly, the incorporation of practical activities which enables teachers to offer individual learning support. As research shows that a large number of Early Childhood Development (ECD) teachers still use what they learned before; teacher-controlled lessons (Barnard & Braund, 2016, p.). It is interesting to know that a shift in ways of conducting lessons is happening after attending CPD activities as teachers now include practical activities in lessons that enable learners to be part of the lesson (*individual learning support*) and also plays a part in cognitive activation by doing practical activities first which touch on what learners know (*constructivism*).

This suggests that this transfer is a complex process. Apart from the transfer of knowledge, it is also highly relevant to consider the motivation, beliefs and self-regulation of teachers (as outlined in the COACTIV Model, Baumert & Kunter, 2013). The quantitative results indeed highlight this, especially for the relationship between individual learning support and variables related to beliefs (the meaning of work, dedication, commitment, vigour, absorption and social support), especially dedication, vigour and meaning of work. This suggests that when designing CPD activities, these factors also need to be taken into consideration. I then had to find out how cognitive activation and individual learning support is considered.

### ***How cognitive activation and individual learning support are considered when teaching mathematics.***

Findings on how cognitive activation and individual learning support was considered are based on question three. The findings show that teachers considered these dimensions by using what was learned in CPD activities as new teaching methods in the classroom. These new methods included using the CPD activities as a guideline, do similar activities or as an introductory example when conducting a lesson. Also, by viewing the school context and preparing lessons

with activities that need resources that can be found in the school or improvise. However, teachers preferred doing practical activities with learners to activate them cognitively. For individual learning support, teachers considered time and strategies used while conducting a lesson.

In summary, teachers mostly used practical activities to cognitively activate learners and considered time and strategy in offering individual learning support. To accommodate learners, it all rested on scaffolding the learners. Teachers felt that the new teaching methods work. Teachers expressed that they noticed an improvement in learners after attending CPD activities. Although there are improvements, there are challenges that were expressed by teachers.

### **6.3 Challenges Expressed by Teachers**

In this section, I present the challenges that teachers faced during the implementation of CPD activities for the benefit of quality instruction. It is generally identified that CPD activities for teachers are relevant for the successful implementation of teaching methods in the classroom (Valdman, Holbrook & Rannikmae, 2012). Research on CPD of teachers has focused on specific themes such: challenges, experiences and perceptions and expectations of teachers or the implementation of the Performance Appraisal System and Integrated Quality Management System (IQMS) (Geldenhuys & Oosthuizen, 2015). The concern is that CPD programs may not have direct and clear links to classroom practice (Gore, Lloyd, Smith, Bowe, Ellis & Lubans, 2017).

The successful implementation of activities learnt during CPD may be weighed through learner achievements. The theory does not seem to match with practice (Korthagen, 2017). Teachers expressed that when they get to class, they are faced with the reality that learners are not the same; therefore, not all learners benefit from them attending CPD activities. DU18JU mentioned that the CPD activities are “*one size fits all*” where learners have different learning abilities. Furthermore, PD programs meet teachers outside their classroom to talk about teaching. Yet, they should alter teacher behaviour in the classroom (Kennedy, 2016). Teachers face the challenge of having to implement what was learned in CPD activities in different school contexts where there may be a lack of resources. Besides lack of resources, the language barrier may be a challenge too.

In South African schools, teachers in the Foundation Phase have to teach learners in their mother tongue. This may be challenging as CPD activities are mostly conducted in English.

Banda (2018) denoted that the mother tongue in black township schools is seen as a reason for poor education. The sites of this research study were township schools where Foundation Phase learners are taught in isiZulu (mother tongue). Teachers expressed that they face a language barrier as CPD activities are conducted in English. Then they have to go back and teach this to learners in the mother tongue in which translation may be a problem. Apart from the language barrier, teachers face the issue of unfulfilled promises as teacher RO10JU mentioned that they are waiting for help about how to tackle issues of barriers and the different learning abilities. It seems that there is a need for recommendations to ensure smooth translation of CPD activities to instructional qualities and improvement in how the dimensions in question are considered when teaching mathematics.

#### **6.4 Recommendations**

From this study, I have learned that there is a relationship between Continuous Professional Development activities and instructional quality (cognitive activation and individual learning support) in teaching Foundation Phase mathematics. The strength of this relationship involves the type of CPD activities that teachers engage in, the time and frequency of the activities. Apart from this, the knowledge gained in CPD activities gets translated into the instructional quality of Foundation Phase Mathematics. This translation happens through CPD activities for cognitive activation. For individual learning support, it is through teachers' beliefs, strategy and time allocated for offering the support. Teachers' teaching methods change after attending CPD activities, as I discovered that teachers incorporate more practical activities and interact with learners more. This may influence the field by more teachers adopting these new ways of teaching Foundation Phase mathematics as the participants agreed that improvement is evident in learners. Considering this, I present recommendations.

Implementers and facilitators of teacher CPD need to consider the beliefs of teachers and what motivates them. Also, what they would like to engage more in, where instructional quality is concerned by communicating with the teachers. This will assist them in drafting development programs that are considerate of the above. Although it may not be 100% accommodating, it may accommodate a majority of the teachers' needs where CPD is concerned.

The DOE should design CPD activities that are most practical as teachers did express that after implementing practical activities and considering cognitive activation and individual learning

support, they noticed an improvement. DOE should also provide feedback on issues that are raised by teachers during CPD activities.

Having conducted this research and having only the teachers as participants may have limited findings on the improvement that happens in learners after being taught by teachers that have acquired knowledge in CPD activities. This drew more on self-report, and there may be a need to include learners in such studies to get an in-depth report on how the CPD activities play a role in learner improvement.

Other studies should also look into involving other areas and have a larger sample size. This study aimed to explore the relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics, also including learners in future studies. It may also be advisable to add a third data generation method such as observation. This would enable researchers to explore what happens in the classroom as the participants teach. To conclude my study, I will provide a summary of my overall results.

Studies can also compare the effects of the different kinds of activities that teachers engage in to get a deeper understanding of how they translate into instructional quality and where it is based on a particular type of CPD activity.

## **6.5 Conclusion**

The study aimed to explore the relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics. As I argued that mathematics is utilized in everyday occurrence, Foundation Phase Mathematics is crucial for learners to and be able to reason at an early stage. This study focused on the types of CPD activities teachers in two primary schools in the Umlazi district engaged in as well as time and frequency (*research question one*), how CPD activities translate into instructional quality of Foundation Phase Mathematics classrooms (*research question two*) and How cognitive activation and individual learning support are considered about instructional quality in the classroom (*research question three*).

It seems evident that the results point to a strong relationship between CPD activation and instructional quality of Foundation Phase Mathematics. Results pointed to teachers attending mostly formal CPD activities that were workshops and did so continuously for cognitive activation and that teachers' beliefs promoted individual learning support in the classroom.

Results also point to teachers being adaptive in lessons and using mostly practical activities for cognitive activation and considered time for individual learning support. This supports that CPD activities and instructional quality have a relationship as it seems that the knowledge gained influences classroom instruction positively. This has sparked an interest in knowing more about CPD activities and the role it plays in instructional quality for the benefit of my instruction quality in Foundation Phase Mathematics.

When I first introduced the study to the participants, they seemed keen and interested. They saw a need for this study which motivated me more to engage in it. Participants seemed to be very concerned about mathematics education as early as the Foundation Phase. Seeing that research points to shocking results in mathematics performance in South Africa from TIMSS study and concern in Foundation Phase Mathematics. This study seemed relevant.

Teachers can make the most of their CPD activities by ensuring that they use the knowledge gained in CPD activities for the instructional quality of Foundation Phase Mathematics just like the participants used similar activities like those done during CPD activities. More teachers may need to attend CPD activities for the betterment of mathematics teaching from as early as Foundation Phase.

## References

- Abrahams, I., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education*, 30(14), 1945-1969. doi: 10.1080/09500690701749305
- Akiba, M., & LeTendre, G. (2009). *Improving teacher quality: The US teaching force in global context*. New York: Teachers College Press.
- Akiba, M., & Liang, G. (2016). Effects of teacher professional learning activities on student achievement growth. *The journal of educational research*, 109(1), 99-110. doi:10.1080/00220671.2014.92447
- Arcidiacono, C., Procentese, F., & Napoli, I. D. (2009). Qualitative and quantitative research: An ecological approach. *International Journal of Multiple Research Approaches*, 3(2), 163-176. Retrieved from [https://www.researchgate.net/profile/Caterina\\_Arcidiacono/publication/269638620\\_Qualitative\\_and\\_quantitative\\_research\\_An\\_ecological\\_approach/links/5d0f6ae1458515c11cf14a11/Qualitative-and-quantitative-research-An-ecological-approach.pdf](https://www.researchgate.net/profile/Caterina_Arcidiacono/publication/269638620_Qualitative_and_quantitative_research_An_ecological_approach/links/5d0f6ae1458515c11cf14a11/Qualitative-and-quantitative-research-An-ecological-approach.pdf)
- Almalki, S. (2016). Integrating Quantitative and Qualitative Data in Mixed Methods Research-Challenges and Benefits. *Journal of Education and Learning*, 5(3), 288-296. Retrieved from <https://files.eric.ed.gov/fulltext/EJ1110464.pdf>
- Amadi, M. N. (2013). In-Service Training and Professional Development of Teachers in Nigeria: Through Open and Distance Education. *Bulgarian Comparative Education Society*. Retrieved from <https://files.eric.ed.gov/fulltext/ED567172.pdf>
- Arends, F., Winnaar, L. & Mosimege, M. (2017). Teacher classroom practices and Mathematics performance in South African schools: A reflection on TIMSS 2011. *South African Journal of Education*, 37(3), 1-11. doi: 10.15700/saje.v37n3a1362
- Avalos, B. (2011). Teacher professional development in teaching and teacher education over ten years. *Teaching and teacher education*, 27(1), 10-20. doi:10.1016/j.tate.2010.08.007
- Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5(6), 66-70. doi: 10.9790/7388-05616670

- Ball, S. J. (2009). Privatising education, privatising education policy, privatising educational research: Network governance and the 'competition state'. *Journal of education policy*, 24(1), 83-99. doi: 10.1080/02680930802419474
- Ball, L. D., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special?. *Journal of teacher education*, 59(5), 389-407. doi: 10.1177/0022487108324554
- Banda, F. (2018). Translanguaging and English-African language mother tongues as linguistic dispensation in teaching and learning in a black township school in Cape Town. *Current Issues in Language Planning*, 19(2), 198-217. doi: 10.1080/14664208.2017.1353333
- Baumert, J., & Kunter, M. (2013). The COACTIV model of teachers' professional competence. In M. Kunter, J. Baumert, W. Blum, U. Klusmann, S. Krauss & M. Neubrand (Ed.), *Cognitive activation in the mathematics classroom and professional competence of teachers* (pp. 25-48). Springer, Boston, MA.
- Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., *et al.* (2010). Teacher's mathematical knowledge, cognitive activation in the classroom, and student progress. *American Educational Research Journal*, 47(1), 133-180. doi:10.3102.0002831209345157
- Barnard, E. & Braund, M. (2016) Strategies for the implementation of mathematics in Grade R: Teachers' beliefs and practices. *South African Journal of Childhood Education* 6(1), 1-8. Retrieved from [https:// dx.doi.org/10.4102/sajce.v6i1.409](https://dx.doi.org/10.4102/sajce.v6i1.409)
- Beauchamp, C., & Thomas, L. (2009). Understanding teacher identity: An overview of issues in the literature and implications for teacher education. *Cambridge Journal of education*, 39(2), 175-189. doi: 10.1080/03057640902902252
- Bergman, M.M. (2008). *Advances in Mixed Methods Research*. London: SAGE
- Bertram, C. & Christiansen I. (2014). *Understanding research: an introduction to reading*. Pretoria: Van Schaik.
- Bodovski, K., & Farkas, G. (2007). Mathematics growth in early elementary school: The roles of beginning knowledge, student engagement, and instruction. *The Elementary School Journal*, 108(2), 115-130. Retrieved from [https://www.jstor.org/stable/10.1086/525550?seq=1#metadata\\_info\\_tab\\_contents](https://www.jstor.org/stable/10.1086/525550?seq=1#metadata_info_tab_contents)
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. Educational researcher. *Educational Researcher*, 33(8), 3-15. Retrieved from <https://www.jstor.org/stable/pdf/3699979.pdf>

- Botha, E. M. (2012). Turning the tide: creating Professional Learning Communities (PLC) to improve teaching practice and learning in South African public schools. *Africa Education Review*, 9(2), 395-411. doi: 10.1080/18146627.2012.722405
- Brighouse, H. (2008). Educational equality and varieties of school choice. *School choice policies and outcomes: Empirical and philosophical perspectives*, 41-59. Retrieved from <http://sk.sagepub.com/reference/encyclopedia-of-education-theory-and-philosophy/n299.i1.xml>
- Bru, E., Stephens, P., & Torsheim, T. (2002). Students' perceptions of class management and reports of their own misbehaviour. *Journal of School Psychology*, 40(4), 287-307. doi: 10.1016/S0022-4405(02)00104-8
- Bruns, J., Eichen, L. & Gasteiger, H. (2017). Mathematics-Related Competence of Early Childhood Teachers Visiting a Continuous Professional Development Course: An Intervention Study. *Mathematics Teacher Education and Development*. 19(3), 76-93.
- Caena, F. (2011). Literature review Quality in Teachers' continuing professional development. *Education and Training*, 20(20), 2-20. Retrieved from [https://www.researchgate.net/profile/Francesca-Caena-2/publication/344906256\\_Literature\\_review\\_Quality\\_in\\_Teachers'\\_continuing\\_professional\\_development/links/5f988be5a6fdccfd7b84aa8c/Literature-review-Quality-in-Teachers-continuing-professional-development.pdf](https://www.researchgate.net/profile/Francesca-Caena-2/publication/344906256_Literature_review_Quality_in_Teachers'_continuing_professional_development/links/5f988be5a6fdccfd7b84aa8c/Literature-review-Quality-in-Teachers-continuing-professional-development.pdf)
- Cochran, K. F., DeRuiter, J. A., & King, R. A. (1993). Pedagogical content knowing: An integrative model for teacher preparation. *Journal of Teacher Education*, 44(4), 263-272. Retrieved from <https://files.eric.ed.gov/fulltext/ED340683.pdf>
- Coetzee, D. (2001). South African education and the ideology of patriarchy. *South African Journal of education*, 21(4), 300-304. Retrieved from <https://www.ajol.info/index.php/saje/article/viewFile/24919/20531>
- Cole, P. (2012). Linking effective professional learning with effective teaching practice. *Australian Institute for Teaching and School Leadership, Melbourne*. 1-26. Retrieved from [https://ptrconsulting.com.au/wp-content/uploads/2018/03/linking\\_effective\\_professional\\_learning\\_with\\_effective\\_teaching\\_practice\\_-\\_cole.pdf](https://ptrconsulting.com.au/wp-content/uploads/2018/03/linking_effective_professional_learning_with_effective_teaching_practice_-_cole.pdf)
- Collin, K., Van der Heijden, B., & Lewis, P. (2012). Continuing professional development. *International journal of training and development*, 16(3), 155-163. doi: 10.1111/j.1468-2419.2012.00410.x

- Creswell, J.W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. London: Sage.
- Creswell, J. W. (2015). *30 essential skills for the qualitative researcher*. California: Sage Publications.
- Creswell, J.W & Plano Clark, V.L. (2007). *Designing and Conducting Mixed Method Research*. London, United Kingdom: Sage Publication, Inc.
- Day, C. (1999). Professional development and reflective practice purposes, processes and partnerships. *Pedagogy, Culture & Society*, 7(2), 221-233. Retrieved from <https://doi.org/10.1080/14681366.1999.11090864>
- Decristan, J., Kunter, M., Fauth, B., Buttner, G., Hardy, I & Hertel, S. (2016). What role does instructional quality play for elementary school children's science competence? *Journal for Educational Research Online*, 8(1), 66-89.
- Delen, E., Liew, J., & Willson, V. (2014). Effects of interactivity and instructional scaffolding on learning: Self-regulation in online video-based environments. *Computers & Education*, 78, 312-320. Retrieved from <http://dx.doi.org/10.1016/j.compedu.2014.06.018>
- De Vries, S., Jansen, E. P., & van de Grift, W. J. (2013). Profiling teachers' continuing professional development and the relation with their beliefs about learning and teaching. *Teaching and Teacher Education*, 33, 78-89. doi:10.1016.2013.02.006
- Doğan, S. & Yurtseven, N. (2017) Professional learning as a predictor for instructional quality: a secondary analysis of TALIS. *School Effectiveness and School Improvement*, 29(1), 64-90. doi: 10.1080/09243453.2017.1383274
- DuFour, R., & Eaker, R. (1998). Professional learning communities. *Bloomington, IN National Educational Service*, 4(2), 1-20. Retrieved from <https://www.ctf-fce.ca/Publication-Library/PD2004-Volume4-2-bil.pdf>
- Evans, L. (2014). Leadership for professional development and learning: enhancing our understanding of how teachers develop. *Cambridge Journal of Education*, 44(2), 179-198. doi: 10.1080/0305764X.2013.860083
- Flick, U. (2006). *An Introduction to qualitative research (3rd ed.)*. London: Sage.
- Flick, U. (Ed.). (2018). *An introduction to qualitative research*. London: Sage Publications Limited.
- Forde, C., McMahan, M., McPhee, A. D., & Patrick, F. (2006). *Professional development, reflection and enquiry*. London: Sage.

- Fouka, G., & Mantzorou, M. (2011). What are the major ethical issues in conducting research? Is there a conflict between the research ethics and the nature of nursing?. *Health science journal*, 5(1), 3-14. Retrieved from <http://www.hsj.gr/>
- Fraser, C., Kennedy, A., Reid, L., & Mckinney, S. (2007). Teachers' continuing professional development: Contested concepts, understandings and models. *Journal of in-service education*, 33(2), 153-169. doi: 10.1080/13674580701292913
- Frempong, G., Reddy, V., & Mackay, K. (2013). Improving teaching and learning through the South African Annual National Assessment: Challenges, possibilities and solutions.
- Fullan, M., & Hargreaves, A. (2002). The teacher as a person. In *Teaching and learning in the primary school*. In A. Pollard & J. Bourne (Eds.), *Teaching and Learning in the Primary School* (pp.77-82). London: Routledge.
- 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. Retrieved from <https://www.jstor.org/stable/pdf/3202507.pdf>
- Geldenhuis, J.L. & Oosthuizen, L.C. (2015). Challenges influencing teachers' involvement in continuous professional development: A South African perspective. *Teaching and Teacher Education*, 51, 203-212. doi: 10.1016/j.tate.2015.06.010
- Gess-Newsome, J., Taylor, J. A., Carlson, J., Gardner, A. L., Wilson, C. D., & Stuhlsatz, M. A. (2019). Teacher pedagogical content knowledge, practice, and student achievement. *International Journal of Science Education*, 41(7), 944-963. doi: 10.1080/09500693.2016.1265158
- Gitomer, D. H. (2019). Evaluating instructional quality. *School Effectiveness and School Improvement*, 30(1), 68-78. doi: 10.1080/09243453.2018.1539016
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *Qualitative Report*, 8, 597-606. Retrieved July 2, 2009, from <http://www.nova.edu/ssss/QR/QR8-4/golafshani.pdf>
- Gore, J., Lloyd, A., Smith, M., Bowea, J., Ellisa, H. & Luban D. (2017). Effects of professional development on the quality of teaching: Results from a randomised controlled trial of Quality Teaching Rounds. *Teaching and Teacher Education*, 68, 99-113. doi: 10.1016/j.tate.2017.08.007
- Govender, S. (2018). South African teachers' perspectives on support received in implementing curriculum changes. *South African Journal of Education*, 38(1).

Retrieved from file:///C:/Users/211517220/Downloads/182902-465764-1-SM%20(1).pdf

- Graff, J.C. (2013). *Research in Evidence Based Practice: An Integrative Approach to Research. Administration and Practice.*
- Grosse, C., Kluczniok, K., & Rossbach, H. G. (2019). Instructional quality in school entrance phase and its influence on students' vocabulary development: empirical findings from the German longitudinal study BiKS. *Early Child Development and Care, 189(9)*, 1561-1574. doi: 10.1080/03004430.2017.1398150
- Gulston, K. (2010). *The challenges experienced by educators in primary schools regarding continuous professional development (dissertation).* University of Pretoria, Pretoria.
- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and teaching, 8(3)*, 381-391. doi: 10.1080/135406002100000512
- Guskey, T. R. (2003). What makes professional development effective? *Phi Delta Kappan, 84(10)*, 748-750. Retrieved from <http://www.artsintegrationpd.org/wp-content/uploads/2017/07/What-makes-effective-PD-Guskey.pdf>
- Guskey, T. R. (2009). Closing the knowledge gap on effective professional development. *Educational Horizons, 87(4)*, 224-233. Retrieved from <https://www.jstor.org/stable/42923773>
- Hagvall Svensson, O., Lundqvist, M., & Williams Middleton, K. (2017). Transformative, Transactional and Transmissive Modes of Teaching in Action-based Entrepreneurial Education. In *ECSB Entrepreneurship Education (3E) Conference, May 10-12 Cork Ireland* (pp. 1-15). Retrieved from [http://publications.lib.chalmers.se/records/fulltext/248686/local\\_248686.pdf](http://publications.lib.chalmers.se/records/fulltext/248686/local_248686.pdf)
- Hall, J. N. (2013). Pragmatism, evidence, and mixed methods evaluation. *New Directions for Evaluation, 2013(138)*, 15-26. doi:10.1002/ev.20054
- Hallinger, P. (2003). Leading educational change: Reflections on the practice of instructional and transformational leadership. *Cambridge Journal of education, 33(3)*, 329-352. doi: 10.1080/0305764032000122005
- Hancock, B. O., & Ockleford, E. E. & Windridge, K. (2009). *An introduction to qualitative research.* Nottingham: The NIHR RDS for the East Midlands
- Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for research in mathematics education, 372-400.* Retrieved from <https://www.jstor.org/stable/pdf/40539304.pdf>

- Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., & Ball, D. L. (2008). Mathematical knowledge for teaching and the mathematical quality of instruction: An exploratory study. *Cognition and instruction*, 26(4), 430-511. doi:10.1080/07370000802177235
- Hoekstra, A., Beijaard, D., Brekelmans, M., & Korthagen, F. (2007). Experienced teachers' informal learning from classroom teaching. *Teachers and Teaching: theory and practice*, 13(2), 191-208. doi: 10.1080/13540600601152546
- Holzberger, D., Philipp, A., & Kunter, M. (2013). How teachers' self-efficacy is related to instructional quality: A longitudinal analysis. *Journal of Educational Psychology*, 105(3), 774. doi:10.1037/a0032198
- Hoyle, E. 1980. De-professionalization in education. *World yearbook of education 1980: The professional development of teachers*. New York: Routledge.
- Hunt, M. (2011). UK teachers' and learners' experiences of CLIL resulting from the EU-funded project ECLILT. *Latin American Journal of Content & Language Integrated Learning*, 4(1), 27-39. Retrieved from <http://journals.sfu.ca/laclil/index.php/LACLIL/article/view/54>
- Integrated Quality Management System Collective Agreement 8 of 2003. ELRC. 2-14. Retrieved from <https://www.elrc.org.za/sites/default/files/documents/Collective%20Agreement%208%20of%202003.pdf>
- Ivankova, N. V., & Creswell, J. W. (2009). Mixed methods. *Qualitative research in applied linguistics: A practical introduction*, 23, 135-161. Retrieved from [https://vulms.vu.edu.pk/Courses/ENG518/Downloads/\[Juanita\\_Heigham,\\_Robert\\_Crocker\]\\_Qualitative\\_Resea\(BookFi\).pdf#page=152](https://vulms.vu.edu.pk/Courses/ENG518/Downloads/[Juanita_Heigham,_Robert_Crocker]_Qualitative_Resea(BookFi).pdf#page=152)
- Jardine, D. W. (2006). *Piaget & education primer*. New York: Peter Lang.
- Jacob, R., Hill, H., & Corey, D. (2017). The impact of a professional development program on teachers' mathematical knowledge for teaching, instruction, and student achievement. *Journal of Research on Educational Effectiveness*, 10(2), 379-407.
- Junker, B. W., Weisberg, Y., Matsumura, L. C., Crosson, A., Wolf, M., Levison, A., & Resnick, L. (2005). *Overview of the instructional quality assessment*. California: Regents of the University of California.
- Kaushik, V., & Walsh, C. A. (2019). Pragmatism as a Research Paradigm and Its Implications for Social Work Research. *Social Sciences*, 8(9), 255. doi:10.3390/socsci8090255

- Kayıkçı, K. (2009). The effect of classroom management skills of elementary school teachers on undesirable discipline behaviour of students. *Procedia-Social and Behavioral Sciences*, 1(1), 1215-1225. doi: 10.1016/j.sbspro.2009.01.218
- Kempton, M. E., & Steyn, G. M. (2015). An investigation of teachers' collaborative learning in a continuous professional development programme in South African special schools. *Journal of Asian and African Studies*, 52(2), 157-171.
- Kennedy, M. M. (1999). (Eds.). Teaching as the learning profession: *Handbook of Policy and practice* (pp. 54–85). San Francisco, CA: Jossey Bass.
- Kennedy, M. M. (2005). Inside teaching: *How classroom life undermines reform*. Cambridge, MA: Harvard University Press.
- Kennedy, A. (2014). Understanding continuing professional development: the need for theory to impact on policy and practice. *Professional development in education*, 40(5), 688-697. doi: 10.1080/19415257.2014.955122
- Kennedy, M. M. (2016). How does professional development improve teaching? *Review of educational research*, 86(4), 945-980. doi: 10.3102/0034654315626800
- Kimathi, F., & Rusznyak, L. (2018). Advancing professional teaching in South Africa: lessons learnt from policy frameworks that have regulated teachers' work. *Education as Change*, 22(3), 1-25. Retrieved from <http://www.scielo.org.za/pdf/eac/v22n3/07.pdf>
- Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Besser, M., Krauss, S., Cheo, M., & Baumert, J. (2015). Content knowledge and pedagogical content knowledge in Taiwanese and German mathematics teachers. *Teaching and Teacher Education*, 46, 115–126. doi: 10.1016/2014.11.004
- Klieme, E., Hartig, J., & Rauch, D. (2008). The concept of competence in educational contexts. In J. Hartig, E. Klieme, & D. Leutner (Eds.), *Assessment of competencies in educational contexts* (pp. 3-22). Göttingen, Germany: Hogrefe & Huber
- Kayıkçı, K. (2009). The effect of classroom management skills of elementary school teachers on undesirable discipline behaviour of students. *Procedia-Social and Behavioral Sciences*, 1(1), 1215-1225. doi:10.1016/j.sbspro.2009.01.218
- Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, 6(5), 26-41. doi: 10.5430/ijhe.v6n5p26
- Korthagen, F. A. (2016). Pedagogy of teacher education. In *International handbook of teacher education*. Singapore: Springer

- Kounin, J. S. (1970). *Discipline and group management in classrooms*. Oxford, England: Holt, Rinehart & Winston.
- Kunter, M., & Baumert, J. (2006). Who is the expert? Construct and criteria validity of student and teacher ratings of instruction. *Learning Environments Research*, 9(3), 231-251. doi: 10.1007/s10984-006-9015-7
- Kunter, M., Klusmann, U., Baumert, J., Richter, D., Voss, T., & Hachfeld, A. (2013). Professional competence of teachers: Effects on instructional quality and student development. *Journal of Educational Psychology*, 105(3), 805-820. doi: 10.1037/a0032583
- Kunter, M., Tsai, Y., Klusmann, U., Brunner, M., Krauss, S. & Baumert, J. (2008). Students and mathematics teachers' perceptions of teacher enthusiasm and instruction. *Learning and Instruction*, 18, 468-482. doi:10.1016.2008.06.008
- Kunter, M., & Voss, T. (2013). The model of instructional quality in COACTIV: A multicriteria analysis. In *Cognitive activation in the mathematics classroom and professional competence of teachers* (pp. 97-124). Springer, Boston, MA.
- Kyndt, E., Gijbels, D., Grosemans, I., & Donche, V. (2016). Teachers' everyday professional development: Mapping informal learning activities, antecedents, and learning outcomes. *Review of educational research*, 86(4), 1111-1150. Retrieved from <http://dx.doi.org/doi:10.3102/0034654315627864>
- Lessing, A., & De Witt, M. (2007). The value of continuous professional development: teachers' perceptions. *South African Journal of Education*, 27(1), 53-67. Retrieved from <https://www.ajol.info/index.php/saje/article/view/25098>
- Liakopoulou, M. (2011). The Professional Competence of Teachers: Which qualities, attitudes, skills and knowledge contribute to a teacher's effectiveness. *International Journal of Humanities and Social Science*, 1(21), 66-78. Retrieved from [https://s3.amazonaws.com/academia.edu.documents/48402276/8.pdf?response-contentdisposition=inline%3B%20filename%3DThe\\_Professional\\_Competence\\_of\\_Teachers.pdf](https://s3.amazonaws.com/academia.edu.documents/48402276/8.pdf?response-contentdisposition=inline%3B%20filename%3DThe_Professional_Competence_of_Teachers.pdf)
- Lieberman, A. (1996). 'Practices that support teacher development: Transforming conceptions of professional learning.' In McLaughlin, M and Oberman, I. (Eds) *Teacher learning: new policies, new practices*. New York: Teachers College Press
- Lom, E., & Sullenger, K. (2011). Informal spaces in collaborations: exploring the edges/boundaries of professional development. *Professional development in education*, 37(1), 55-74. doi: 10.1080/19415257.2010.489811

- Loong, E.Y., Herbet, S., Vale, C., Bragg, A. & Widjaja, W. (2016). Tracking changes in primary teacher's understanding of mathematical reasoning through demonstration lessons. *Mathematics Teacher Education and Development*, 19(1), 5-29. Retrieved from <https://eric.ed.gov/?id=EJ1152733>
- Machaba, M.M. (2013). *Teacher Challenges in the Teaching of Mathematics at Foundation Phase* (PhD, University of South Africa). Retrieved from [http://uir.unisa.ac.za/bitstream/handle/10500/13262/thesis\\_machaba\\_mm.pdf?sequence=1&isAllowed=y](http://uir.unisa.ac.za/bitstream/handle/10500/13262/thesis_machaba_mm.pdf?sequence=1&isAllowed=y)
- Marshall, C., & Rossman, G. B. (2014). *Designing qualitative research*. Singapore: Sage publications
- Martin, N. K., & Baldwin, B. (1993). Validation of an Inventory of Classroom Management Style: Differences between Novice and Experienced Teachers, 1-38. Retrieved from <https://files.eric.ed.gov/fulltext/ED359240.pdf>
- McKim, C. A. (2017). The value of mixed methods research: A mixed methods study. *Journal of Mixed Methods Research*, 11(2), 202-222. doi: 10.1177/1558689815607096
- McCusker, K. & Gunayadin, S. (2015). Research using qualitative, quantitative or mixed Methods and choice based on the research. *Perfusion*, 30, 537-542. doi:10.1177/0267659114559116
- Morgan, D. L. (2014). Pragmatism as a paradigm for social research. *Qualitative inquiry*, 20(8), 1045-1053. doi: 10.1177/1077800413513733
- Mokhele, M.L. (2017). Lesson Study as a Professional Development Model for Improving Teachers' Mathematics Instruction. *Journal of Social Science Humanities*, 2, 049-056.
- Mors, J.M (2015). Critical Analysis of Strategies for determining rigour in qualitative inquiry. *Qualitative Health Research*, (25)9, 1212-1222. doi:10.1177/1049732315588501
- Murphy, T. R., & de Paor, C. (2017). Teachers' CPD and sectoral interests: Opportunities for convergence and divergence. *Teaching and Teacher Education*, 66, 242-249. Retrieved -from <http://dx.doi.org/10.1016/j.tate.2017.04.018>
- Mullis, I.V.S., Martin, M.O. & Fay, P. 2008. TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. Chestnut Hill, MA: TIMSS & PIRLS International Study Centre, Boston College. Retrieved from <https://eric.ed.gov/?id=ED494650>
- National Policy Framework of Teacher Education and Development in South Africa 8 of 2006. South Africa. 1-27. Retrieved from [https://unesdoc.unesco.org/in/documentViewer.xhtml?v=2.1.196&id=p::usmarcdef\\_0](https://unesdoc.unesco.org/in/documentViewer.xhtml?v=2.1.196&id=p::usmarcdef_0)

000149112&file=/in/rest/annotationSVC/DownloadWatermarkedAttachment/attach\_i  
mport\_fab12b6f-799b-42b2-8dfb-  
3bfe820aa0f8%3F\_%3D149112eng.pdf&locale=en&multi=true&ark=/ark:/48223/pf0  
000149112/PDF/149112eng.pdf#%5B%7B%22num%22%3A129%2C%22gen%22%  
3A0%7D%2C%7B%22name%22%3A%22XYZ%22%7D%2C0%2C792%2Cnull%5  
D

- Neisser, U. (1976). General, academic, and artificial intelligence. *The nature of intelligence*, 135, 144. Retrieved from <https://psycnet.apa.org/record/1977-04938-000>
- Nieuwenhuis, J. (2016). Introducing qualitative research. In K. Maree (Ed.), *First steps in research*. Pretoria: Van Schaik Publishers
- Nübling, M., Vomstein, M., Schmidt, S. G., Gregersen, S., Dulon, M., & Nienhaus, A. (2010). Psychosocial work load and stress in the geriatric care. *BMC Public Health*, 10(1), 428. Retrieved from
- O'Hara, M., Carter, C., Dewis, P., Kay, J. & Wainwright, J. (2011). *Successful Dissertations: The Complete guide for education, childhood and early childhood studies students*. London: Continuum International Publishing group.
- Ono, Y., & Ferreira, J. (2010). A case study of continuing teacher professional development through lesson study in South Africa. *South African Journal of Education*, 30(1). Retrieved from <https://www.ajol.info/index.php/saje/article/viewFile/52602/41208>
- Ottmar, E. R., Decker, L. E., Cameron, C. E., Curby, T. W., & Rimm-Kaufman, S. E. (2014). Classroom instructional quality, exposure to mathematics instruction and mathematics achievement in fifth grade. *Learning Environments Research*, 17(2), 243-262. doi: 10.1007/s10984-013-9146-6
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, 42(5), 533-544. doi: 10.1007/s10488-013-0528-y
- Pallant, J. (Ed.). (2011). *SPSS Survival Manual: A step by step guide to data analysis using SPSS*. Australia: Allen & Unwin
- Parise, L. M., & Spillane, J. P. (2010). Teacher learning and instructional change: How formal and on-the-job learning opportunities predict change in elementary school teachers' practice. *The elementary school journal*, 110(3), 323-346. doi 0013-5984/2010.11003.000410.00

- Phelps, G., & Schilling, S. (2004). Developing measures of content knowledge for teaching reading. *The Elementary School Journal*, 105(1), 31-48. Retrieved from <https://www.jstor.org/stable/pdf/10.1086/428764.pdf>
- Philipp, A., & Kunter, M. (2013). How do teachers spend their time? A study on teachers' strategies of selection, optimisation, and compensation over their career cycle. *Teaching and teacher education*, 35, 1-12. Retrieved from <https://doi.org/10.1016/j.tate.2013.04.014>
- Polly, D., Neale, H., & Pugalee, D. K. (2013). How does ongoing task-focused mathematics professional development influence elementary school teachers' knowledge, beliefs and enacted pedagogies?. *Early Childhood Education Journal*, 42(1), 1-10. doi: 10.1007/s10643-013-0585-6
- Polly, D., Wang, C., Lambert, R., Martin, C., McGee, J. R., Pugalee, D., & Lehew, A. (2017). Supporting Kindergarten teachers' mathematics instruction and student achievement through a curriculum-based professional development program. *Early Childhood Education Journal*, 45(1), 121-131. doi: 10.1007/s10643-013-0605-6.
- Powell, K. C., & Kalina, C. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, 130(2), 241-250.
- Pritchard, A. (2009). *Ways of Learning*. (2nded.) London: Routledge.
- Praetorius, A. K., & Charalambous, C. Y. (2018). Classroom observation frameworks for studying instructional quality: looking back and looking forward. *ZDM*, 50(3), 535-553. Retrieved from <https://link.springer.com/content/pdf/10.1007%2Fs11858-018-0946-0.pdf>
- Praetorius, A.K., Pauli, C., Reusser, K., Rakoczy, K. & Klieme, E. (2014). One lesson is all you need? Stability of instructional quality across lessons. *Learning and Instruction*, 31, 2-12. Retrieved from: <https://doi.org/10.1016/j.learninstruc.2013.12.0021>
- Richland, L. E., Begolli, K. N., Simms, N., Frausel, R. R., & Lyons, E. A. (2016). Supporting mathematical discussions: the roles of comparison and cognitive load. *Educational Psychology Review*, 29(1), 41-53. doi:10.1007/s10648-016-9382-2
- Richter, D., Kunter, M., Klusmann, U., Lüdtke, O., & Baumert, J. (2014). Professional development across the teaching career: Teachers' uptake of formal and informal learning opportunities. In *Teachers' Professional Development* (pp. 97-121). Brill Sense. Retrieved from [https://doi.org/10.1007/9789462095366\\_008](https://doi.org/10.1007/9789462095366_008)
- SACE. 2005. The state of teacher professionalism in South Africa. *Paper commissioned to the EPU by SACE*. Centurion: ELRC

- Schaap, H., & de Bruijn, E. (2018). Elements affecting the development of professional learning communities in schools. *Learning environments research*, 21(1), 109-134. Retrieved from <https://link.springer.com/article/10.1007%2Fs10984-017-9244-y>
- Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and psychological measurement*, 66(4), 701-716. doi: 10.1177/0013164405282471
- Shirrell, M., Hopkins, M., & Spillane, J. P. (2019). Educational infrastructure, professional learning, and changes in teachers' instructional practices and beliefs. *Professional Development in Education*, 45(4), 599-613. doi: 10.1080/19415257.2018.1452784
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational researcher*, 15(2), 4-14. Retrieved from <https://www.jstor.org/stable/pdf/1175860.pdf>
- Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard educational review*, 57(1), 1-23. Retrieved from <https://www.hepgjournals.org/doi/abs/10.17763/haer.57.1.j463w79r56455411>
- Singh, S. K. (2011). The role of staff development in the professional development of teachers: Implications for in-service training. *South African Journal of Higher Education*, 25(8), 1626-1638. Retrieved from [https://journals.co.za/docserver/fulltext/high/25/8/high\\_v25\\_n8\\_a12.pdf?expires=1566133897&id=id&accname=guest&checksum=1C1C6E1DC0BDBE3E8535C25609804E08](https://journals.co.za/docserver/fulltext/high/25/8/high_v25_n8_a12.pdf?expires=1566133897&id=id&accname=guest&checksum=1C1C6E1DC0BDBE3E8535C25609804E08)
- South African. Department of Basic Education (2011-2014). *Annual Report*. Pretoria: Government Printer.
- South African Department of Basic Education SACE. (2014). *IQMS Personal Growth Plans and Development Needs of Education*. Pretoria: Government Printer
- Spaull, N. (2011). A preliminary analysis of SACMEQ III South Africa. *Stellenbosch: Stellenbosch University*.
- Steinert, Y. (2010). Faculty development: from workshops to communities of practice. *Medical teacher*, 32(5), 425-428. doi:10.3109/01421591003677897
- Steyn, G.M. (2011). Continuing Professional Development in South African Schools: Staff Perceptions and the Role of Principals. *Journal of Social Sciences*, 28(1), 43-53. Retrieved from <https://core.ac.uk/download/pdf/43173852.pdf>
- Sukamolson, S. (2007). Fundamentals of quantitative research. *Language Institute Chulalongkorn University*, 1, 2-3. Retrieved from

- [https://s3.amazonaws.com/academia.edu.documents/32848458/Quantitative\\_research.pdf?response-content](https://s3.amazonaws.com/academia.edu.documents/32848458/Quantitative_research.pdf?response-content)
- Tajudin, N. A. M., Chinnappan, M., & Saad, N. S. (2017, May). Relationship between mathematics teacher subject matter knowledge, pedagogical content knowledge and professional development needs. In *AIP Conference Proceedings* (Vol. 1847, No. 1, p. 030001). AIP Publishing LLC. Retrieved from <https://aip.scitation.org/doi/pdf/10.1063/1.4983878>
- Tashakkori, A., & Creswell, J. W. (2007). The new era of mixed methods. *Journal of Mixed Methods Research* 1 (1), 3-7. doi: 10.1177/2345678906293042
- Thobela, N. Q., & Mtapuri, O. (2014). Teachers' perceptions of the integrated quality management system: lessons from Mpumalanga, South Africa. *South African Journal of Education*, 34(1), 1-14. Retrieved from <http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=d7d39048-521e-46a6-b577-8ba008639302%40sessionmgr4007>
- Thomas, D. (2006). A general inductive approach for analysing qualitative evaluation data. *American Journal of Evaluation*, 27 (2), 23-246. doi: 10.1177/1098214005283748
- Valdman, A., Holbrook, J. & Rannikmäe, M. (2012). Evaluating the teaching impact of a prior, context-based, professional development programme. *Science Education International*, 23(2), 166-185. Retrieved from <https://files.eric.ed.gov/fulltext/EJ975557.pdf>
- Vangrieken, K., Meredith, C., Packer, T., & Kyndt, E. (2017). Teacher communities as a context for professional development: A systematic review. *Teaching and teacher education*, 61, 47-59. Retrieved from <http://dx.doi.org/10.1016/j.tate.2016.10.001>
- Venkat, H., & Spaull, N. (2015). What do we know about primary teachers' mathematical content knowledge in South Africa? An analysis of SACMEQ 2007. *International Journal of Educational Development*, 41, 121-130. Retrieved from <http://dx.doi.org/10.1016/j.ijedudev.2015.02.002>
- Venkatesh, V., Brown, S. A. & Bala, H. (2013). Bridging the Qualitative-Quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems. *MIS Quarterly*, 37(1), 21-54. Retrieved from <http://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=715ce933-8753-4484-97f4-9b78a88fbde7%40pdc-v-sessmgr02>
- Vygotsky, L. (1978). Interaction between learning and development. *Readings on the development of children*, 23(3), 34-41. Retrieved from

- [https://luria.ucsd.edu/tclearninglounge/ROOT/carlos/readings/vygotsky\\_learning\\_and\\_dev.pdf](https://luria.ucsd.edu/tclearninglounge/ROOT/carlos/readings/vygotsky_learning_and_dev.pdf)
- Wabule, A. (2016). Continuous professional development: What role and who benefits? Reflections on teacher development in Uganda. *Africa Education Review*, 13(3-4), 141-156. doi: 10.1080/18146627.2016.1229575
- Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston: Harvard Business Press.
- Warwas, J. & Helm, C. (2018). Professional learning communities among vocational school teachers: Profiles and relations with instructional quality. *Teaching and Teacher Education*, 73, 43-55. Retrieved from <http://www.elsevier.com/locate/tate>
- Watkins, C., & Wagner, P. (2000). *Improving school behaviour*. London: Sage.
- Whitworth, B. A., & Chiu, J. L. (2015). Professional development and teacher change: The missing leadership link. *Journal of Science Teacher Education*, 26(2), 121-137. doi 10.1007/s10972-014-9411-2
- Wood, D. (2001). Scaffolding, contingent tutoring, and computer-supported learning. *International Journal of Artificial Intelligence in Education*, 12(3), 280-293. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.136.2649&rep=rep1&type=pdf>
- Wood, T. (1995). From alternative epistemologies to practice in education: Rethinking what it means to teach and learn. In L.P. Steffe & J. Gale (Eds.), *Constructivism in Education*, (pp.349-358). New York: Routledge.
- Wriston, J.M. (2015). The Importance of a Strong Mathematical Foundation. *Human Research Projects*, 2-38. Retrieved from [http://ideaexchange.uakron.edu/honors\\_research\\_projects/177](http://ideaexchange.uakron.edu/honors_research_projects/177)
- Yilmaz, K. (2008). Constructivism: Its theoretical underpinnings, variations, and implications for classroom instruction. *Educational Horizons*, 86(3), 161-172. Retrieved from <https://www.jstor.org/stable/pdf/42923724.pdf>
- Yin, R.K. (Ed.). (2009). *Case Study Research: Design and Methods*. Thousand Oaks CA: Sage Publications.

## APPENDIX 1

K423 Mgaga Road

Umlazi

4066

January 2019

**To:** The Principal

### REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT YOUR SCHOOL

I am Miss **Nompumelelo Gcinile Nzimande** and I am conducting research as a requirement of the University of KwaZulu-Natal towards a Masters' Degree in the discipline of Teacher Development Studies. My supervisor is Prof. Anja Philipp. The title of the research study is **“The relationship between Foundation Phase teacher’s Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umlazi district”**. I would like to use your school as one of the research sites, and this letter intends to request your permission. The focus of the study is to gain insight into the relationship of continuous professional development activities with the teacher’s instructional quality in Foundation Phase mathematics. *Therefore I would like to request your permission for your school to participate in the study.* Should permission be granted, the methods of collecting data with the stakeholders will be scheduled for dates and times that are convenient to *them*. Care will be taken that *no disruptions* are caused during the sessions. Please also note that participation in this study is *voluntary*, and each participant has the *right to withdraw* from the study *at any time*. Refusal to answer questions and withdrawal from this research will in no way result in any form of discrimination or disadvantage. In addition, you are assured that details of the school and the participant will be kept *confidential* through the use of codes and data will be stored in the university and disposed of after 5 years.

I will use two data collecting tools: questionnaires and semi-structured interviews. Questionnaires can be filled in during teachers’ private time and will be collected by me after one week at the schools. All interviews will be conducted outside of normal school time. The participants will be notified in advance of the exact date and time for the interviews. The data for all interviews will be audio-recorded using a digital device (if participants agree) and then transferred to typed transcriptions for analysis purposes.

All data will be used for my dissertation and academic publications (e.g., research reports, conference presentations and publication in research journals).

#### Data Collection Schedule and Methods

Activity	Estimated Time	Proposed Time Frame	Data Collection Format
Questionnaire	45min	February 2019	Questionnaire
Individual Semi-structure Interview	45min	February 2019	Audio Recording and Transcription

For more information and questions about the study, you may contact the researcher, supervisor or the Research Office on the following details:

<b>Supervisor</b>	<b>Student</b>	<b>Research Office</b>
<p><a href="#">Supervisor: Prof Anja Philipp</a> Tel No.:031 260 3819 Email: <a href="mailto:philippa@ukzn.ac.za">philippa@ukzn.ac.za</a></p>	<p>Student: Miss N.G Nzimande Cell No: 076 1937751 Email:<a href="mailto:211517220@stu.ukzn.ac.za">211517220@stu.ukzn.ac.za</a></p>	<p>Research Office, Westville Campus Govan Mbeki Building Private Bag X5001 Durban 4000 KwaZulu-Natal, South Africa HSSREC Research Office, Tel.: 031 260 4557 E-mail: <a href="mailto:HSSREC@ukzn.ac.za">HSSREC@ukzn.ac.za</a></p>

Thanking you in advance.

---

Miss N.G Nzimande

**INFORMED CONSENT DOCUMENT TO CONDUCT RESEARCH**  
**RESEARCH PARTICIPANT: PRINCIPAL**

**DECLARATION OF CONSENT**

I, ----- (full name of principal) have been informed about the study entitled: **“The relationship between Foundation Phase teacher’s Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umlazi district.”** by \_\_\_\_\_ (full name of student).

I understand the purpose and procedures of the study.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that the participation of my school in this study is entirely voluntary and that I may withdraw my permission at any stage and for any reason. Withdrawal from this research will in no way result in any form of discrimination or disadvantage.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher or the supervisor.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

**HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION**

Research Office, Westville Campus  
Govan Mbeki Building  
Private Bag X 54001  
Durban  
4000  
KwaZulu-Natal, SOUTH AFRICA  
Tel: 27 31 2604557 - Fax: 27 31 2604609  
Email: [HSSREC@ukzn.ac.za](mailto:HSSREC@ukzn.ac.za)

**I hereby provide consent to:**

Audio-recording of interviews	YES / NO
Handing out of questionnaires	YES / NO

\_\_\_\_\_  
**Signature of Principal**

\_\_\_\_\_  
**Date**

**School stamp:**

## APPENDIX 2

### **Informed Consent Document:** **INDIVIDUAL SEMI-STRUCTURED INTERVIEW SCHEDULE**

Title of Study: **The relationship of continuous professional development activities with teacher's instructional quality in Foundation Phase mathematics.**

Dear Research Participant,

My name is **Nompumelelo Gcinile Nzimande** and I am currently studying towards Masters in Education (MEd.) degree at the University of Kwa-Zulu Natal (UKZN). It is required of me to complete a research dissertation by the end of this year. My supervisor for this study is Anja Philipp (School of Education, University of KwaZulu-Natal, [philippa@ukzn.ac.za](mailto:philippa@ukzn.ac.za), 031 2603819).

The main purpose of this interview schedule is to gather information, on the relationship between Continuous Professional Development and Instructional quality in Foundation Phase mathematics

You will not be obligated to answer questions that you feel uncomfortable with or that you are unwilling to respond to, due to personal reasons. For the interview, the recording tools used to collect the information will be a notepad, and with your approval, a digital voice recorder. The interview will be approximately 45 min. long and will focus on three key questions used for the research study addressing the types of activities teachers engage in and how they translate to instructional quality

Please provide me with a personal code so that I can link your questionnaire response to your interview. This code is only known to you.

**Please note** that the information you provide in the study will be kept strictly **confidential**. All names of persons will be substituted with **codes** to protect the person's confidentiality. Your participation is **voluntary** and you are **free to withdraw** from the study at any stage and for any reason. Refusal to answer questions or withdrawal from this research project **will in no way result in any form of discrimination or disadvantage**. All the data that will be collected will be used for my dissertation and academic publications. All recorded data will be kept in a secure storeroom housed in the School of Education and will be disposed of (by incineration) five years after completion of this study. I will inform you about the research findings by presenting the findings to you.

Thank you!

---

Miss NG Nzimande  
(MEd. Student)

**INFORMED CONSENT DOCUMENT TO CONDUCT RESEARCH**

**RESEARCH PARTICIPANT: SENIOR/ MASTER /TEACHER**

**DECLARATION OF CONSENT**

I, \_\_\_\_\_ (full name of participant) have been informed about the study entitled, **The relationship between Foundation Phase teacher’s Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umlazi district.** by Nompumelelo Geinile Nzimande.

I understand the purpose and procedures of the study.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that the participation of my school in this study is entirely voluntary and that I may withdraw at any stage and for any reason. Withdrawal from this research will in no way result in any form of discrimination or disadvantage.

If I have any further questions/concerns or queries related to the study, I understand that I may contact the researcher or the supervisor.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

**HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION**

Research Office, Westville Campus  
Govan Mbeki Building  
Private Bag X 54001  
Durban  
4000  
KwaZulu-Natal, SOUTH AFRICA  
Tel: 27 31 2604557 - Fax: 27 31 2604609  
Email: [HSSREC@ukzn.ac.za](mailto:HSSREC@ukzn.ac.za)

I hereby provide consent to:

Audio-recording of my interview                      YES / NO

**Signature of Participant**

**Date**

\_\_\_\_\_

\_\_\_\_\_

## APPENDIX 3

### SEMI-STRUCTURED INTERVIEW SCHEDULE

**Title of the study: The relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umlazi district**

Please prepare the code in line with the following instruction: the two first letters of the first name of your mother (example: Alicia – AL), your day of birth (example: 13 October – 13), first two letters of your mothers' birth month (example: 07 January – JA). The example code would be AL13JA.

**CODE OF PARTICIPANT:** \_ \_ \_ \_ \_

#### CRITICAL QUESTIONS:

- 1) Which Continuous Professional Development activities do Foundation phase mathematics teachers in two primary schools engage in?
- 2) How do the Continuous Professional Development activities of mathematics teachers translate into instructional quality (cognitive activation, individual learning support) during their teaching?
- 3) How do Foundation phase teachers consider cognitive activation and individual learning support as part of instructional quality during teaching mathematics?

### PROPOSED INTERVIEW QUESTIONS

#### Continuous Professional Development (CPD)

*As you know, professional development is the development of an individuals' professional role and the continuous professional development of educators can be referred to as processes and activities formulated to help improve knowledge, skills and attitude of educators for the interest of the learner and learner achievement.*

**First, I would like to know:**

**\*What type of Continuous Professional Development Activities did you attend in the last year? \*Which topics did you address in these sessions?**

**\*How much time did you spend on these activities?**

**\*How often did you do this?**

**\*Do you engage in activities that are organized by you or other teachers?**

**Probing questions:**

1. Did you attend workshops, seminars or courses or did you engage in other activities?
2. In which concept (Numbers Operations and Relationships, pattern, space and shape, Data handling etc.) were chosen as topics for the activity?
3. Did you spend 45min-1 hour on the activities done or was time allocated per activity?

**Next, I would like to know more about what you did in these CPD activities.**

**Probing questions:**

1. How was the activity held? What did you do during the activity? What was the content and how was it taught?
2. Did you do any practical activities?

**Please also tell me why you chose to engage in these particular activities.**

**Probing questions:**

1. Do you think these activities will help you achieve optimal instructional quality?
2. Were they suggested by the subject advisor or did you pick them out together with other teachers?

**And how useful did you find these activities?**

**Probing questions:**

1. Do they help you with teaching primary mathematics?
2. Could you use what you learned during your teaching?

**I would also like to know how you are using what you learned in your classroom.**

**Probing questions:**

1. Do you do similar activities in the classroom?
2. Do you use the activities that were done during CPD as a guideline?

**Please explain to me what you do to teach mathematics to your learners?**

**Probing questions:**

1. Do you provide the information to your learners?

2. Do you use practical activities? Which ones?
3. How do you engage your learners in class when teaching mathematics.
4. What do you do to get them interested in the topic?

**How did you use what you have learned in your professional development activities for your teaching of mathematics?**

**Probing questions:**

1. How much of the content you have learned could you use in the classroom?
2. Did you change how you teach after these courses? How?
3. If so, what strategy do you use?

**Do you notice any improvement in the learners' after you incorporated these changes?**

**Probing question:**

1. Is there any change in the learners since you use the new method?
2. Has the activity of the learners in class changed since you used the new method?

**And last, please tell me if you have experienced difficulties in using what you have learned in these activities in the classroom?**

**APPENDIX 4**

**QUESTIONNAIRE**

Dear Teacher,

I am currently conducting a study entitled: **The relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umlazi district.**

The purpose of this study is to find out what type of activities Foundation Phase mathematics teachers engage in and how they can use what they have learned to teach mathematics to their learners. In this questionnaire, I will ask you about the types of activities you engaged in and how useful they were for your teaching. This will help shed light on how mathematics teachers can be supported best to teach their learners at the Foundation phase.

I kindly ask you to please take some time to fill in this questionnaire which will take approx. 30 minutes. The results of this study will be analysed within the context of my Masters in Education dissertation conducted at the School of Education at the University of KwaZulu-Natal and for academic publication o conferences or in academic journals and for research reports.

**Of course, your participation is voluntary. Your responses will be treated confidentially and will be analysed in line with academic standards.**

**Please try not to leave out any answers. All your responses are of importance for this study!**

**If you are not quite sure, please choose the answer that seems most appropriate from your experience, there are no "right" or "wrong" answers.**

**Should you have any questions about the study, please contact me or my supervisor:**

Student: Miss Nompumelelo Gcinile Nzimande, 0761937751, gcinile45@gmail.com

Supervisor: Prof Anja Philipp, School of Education, University of KwaZulu-Natal, 031 260 3819, philippa@ukzn.ac.za

**Please provide me with informed consent for your participation in the questionnaire.**

I understand the purpose and procedures of the study.

I can contact the supervisor of this study to ask questions about the study.

I declare that my participation in this study is entirely voluntary and that I may withdraw my permission at any stage and for any reason. Withdrawal from this research will in no way result in any form of discrimination or disadvantage.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

**HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION**

**Research Office, Westville Campus**

**Govan Mbeki Building**

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557 - Fax: 27 31 2604609

Email: [HSSREC@ukzn.ac.za](mailto:HSSREC@ukzn.ac.za)

**Please indicate your consent for participation in the questionnaire study by ticking one of the options below:**

Yes, I agree with the points above and give my informed consent to the study.	<input type="checkbox"/> <sub>1</sub>
No, I do not agree with the points above and do not give my informed consent to the study.	<input type="checkbox"/> <sub>2</sub>

**Only if you ticked “Yes” and gave your consent to participate in the project, we kindly ask you to please fill in the following information and continue to fill in the questionnaire on the next pages.**

In order to keep your responses confidential, it is necessary to generate an individual code. The code will be designed by you and will not allow for any conclusion on your identity. Please prepare the code in line with the following scientifically established instructions:

- 1) first two letters of the first name of your mother (example: Alicia – AL)
  - 2) your day of birth (example: 13 October – 13)
  - 3) first two letters of your mothers’ birth month (example: 07 January – JA).
- The example code would be AL13JA.

**Please write down YOUR personal code:** \_\_\_\_\_

**First, I ask you to fill in some questions on your Professional Development Activities**

*Professional development is the development of an individuals' professional role and specifically, educator continuous professional development can be referred to as processes and activities formulated to help improve knowledge, skills and attitude of educators for the interest of the learner and learner achievement. In the first part of the questionnaire, I would like you to provide some information on your professional development activities **during the last year.***

How many professional development activities were you engaged in in the last year?	
--	--

Please fill in the following for each of the different activities.

<i>Professional Development Activity 1</i>	
What was the content of the activity?	
What type of activity was it (workshop, course etc.)?	
How often did it take place?	
How many hours did you spend on the activity?	

<i>Professional Development Activity 2</i>	
What was the content of the activity?	
What type of activity was it (workshop, course etc.)?	
How often did it take place?	
How many hours did you spend on the activity?	

<i>Professional Development Activity 3</i>	
What was the content of the activity?	
What type of activity was it (workshop, course etc.)?	
How often did it take place?	
How many hours did you spend on the activity?	

<i>Professional Development Activity 4</i>	
What was the content of the activity?	
What type of activity was it (workshop, course etc.)?	
How often did it take place?	
How many hours did you spend on the activity?	

<i>Professional Development Activity 5</i>	
What was the content of the activity?	
What type of activity was it (workshop, course etc.)?	
How often did it take place?	
How many hours did you spend on the activity?	

Please provide us with some information on how you teach mathematics.

Please tick the appropriate box for each statement.

**How often do you do the following in teaching this class?**

	Never	Some lessons	About half of the lesson	Every/Almost every lesson
<b>Cognitive Development</b>				
Relate the lesson to learners' daily lives.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Ask learners to explain their answers.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Ask learners to complete challenging exercises that require them to go beyond the instruction.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Encourage classroom discussions among learners	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Ask learners to decide their own problem-solving procedures.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Encourage learners to express their ideas in class.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Develop Learners' higher-order thinking skills				
<b>Individual Learner Support</b>				
Offer individual learner support?	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Inspire learners to learn mathematics?	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Show learners a variety of problem-solving strategies	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Adapt my teaching to engage learners' interest	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>
Improve the understanding of struggling learners	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>

During an average week, how much time do you spend on the following aspects of your work?	Hours spent on task during an average week
Individual lesson planning	hours
Preparation and correction of tests	hours
Correction of homework and other tests	hours
Documentation of learners' performance	hours
Meetings with learners	hours
Organisation of school projects	hours
Supervision of learners	hours
Organisation of and participation in field trips	hours
Meetings with parents	hours
Individual training, reading of specialist literature	hours
Administrative tasks	hours
Attending school conferences	hours
Professional development activities (which ones?)	hours
Other tasks (which ones?)	hours

Overall, how many hours do you spend on the job during an **average week**:  
 \_\_\_\_\_ hours

**Please also provide some information on your activities at school and your commitment to your school**

Please tick the most appropriate answer.

	To a very small extent	To a small extent	Some what	To a large extent	To a very large extent
Is your work meaningful?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Do you feel that the work you do is important?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Do you feel motivated and involved in your work?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Does your work require you to take the initiative?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Do you have the possibility of learning new things through your work?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Can you use your skills or expertise in your work?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Does your work give you the opportunity to develop your skills?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Do you enjoy telling others about your place of work?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Would you recommend a good friend to apply for a position at your workplace?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Do you feel that your place of work is of great importance to you?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Is your work meaningful?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Do you feel that the work you do is important?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

**Please also provide some information on your engagement as a mathematics teacher and the support from your colleagues.**

Please tick the most appropriate answer.

	Never	Almost Never	Rarely	Someti mes	often	Very often	Always
At my work, I feel bursting with energy.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
At my job, I feel strong and vigorous.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
When I get up in the morning, I feel like going to work.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7

I can continue working for very long periods at a time.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
At my job, I am very resilient, mentally.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
At my work, I always persevere, even when things do not go well.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
I find the work that I do full of meaning and purpose.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
I am enthusiastic about my job.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
My job inspires me.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
I am proud of the work that I do.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
To me, my job is challenging.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
Time flies when I'm working.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
When I am working, I forget everything else around me.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
I feel happy when I am working intensely.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
I am immersed in my work.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
I get carried away when I'm working.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
It is difficult to detach myself from my job.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
How often do you get help and support from your colleagues?	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
How often are your colleagues willing to listen to your problems at work?	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>
How often do your colleagues talk with you about how well you carry out your work?	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>7</sub>

**How would you characterize each of the following within your school?**

	Very High	High	Medium	Low	Very Low
Your understanding of the school's curricular goals.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>
Your degree of success in implementing the school's curriculum.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>
Your expectations for learner achievement.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>
Your ability to inspire learners.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>

*Please also provide some information about your work.*

<b>How many classes did you teach last year?</b>	
<b>How many learners per class did you teach last year?</b>	_____ class 1

	_____ <b>class2</b> _____ <b>class3</b>
<b>In a typical week last year, how much time did you spend teaching mathematics to the learners in class?</b>	_____ <b>Hours per week</b>
<b>On average, how much of your time in a mathematics class did you spend teaching?</b>	_____ <b>%</b>

I would also appreciate it if you could give me some additional information. All responses are treated confidentially.

For how long are you a teacher?	for _____ years
For how long are working at this school?	for _____ years
How old are you	_____ years
I am	
Male	<input type="checkbox"/>
Female	<input type="checkbox"/>
My home language is:	

I teach in the:	
Foundation phase	<input type="checkbox"/> 1
Senior phase (Gr. 7-9)	<input type="checkbox"/> 2
FET (Gr.10-12)	<input type="checkbox"/> 3
	<input type="checkbox"/> 4
	<input type="checkbox"/> 1
	<input type="checkbox"/> 2

My academic qualification(s) is/are:

My professional qualification(s) is/are:

Which subjects were you trained in? Please list them below.	Which subjects are you teaching at the moment? Please list them below.	For how long are you teaching them?
		_____ years
		_____ years
		_____ years
		_____ years
		_____ years

I obtained my qualification(s) from a:

University  
 Technikon  
 College  
 Other: \_\_\_\_\_ (please name the type of institution).

**How big is your school?**


	_____ number of learners _____ number of teachers
--	--

Are you...	
... In the school management?	<input type="checkbox"/> 1
....a Senior Teacher	<input type="checkbox"/> 2
....a Master Teacher	<input type="checkbox"/> 3

**Thank you for your participation!**

## APPENDIX 5

### ETHICAL PERMISSION: UNIVERSITY OF KWAZULU-NATAL and KZN DEPARTMENT OF EDUCATION.



**UNIVERSITY OF  
KWAZULU-NATAL**  
INYUVESI  
YAKWAZULU-NATALI

19 June 2019

**Ms Nompumelelo G Nzimande 211517220**  
School of Education  
Edgewood Campus

Dear Ms Nzimande


Protocol reference number: HSS/0341/019M  
Project Title: The relationship between Foundation Phase teacher's Continuous Professional Development activities and their instructional quality in teaching mathematics at two schools in the Umhlanga District.

**Full Approval – Expedited Application**  
Your application dated 04 April 2019, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 1 year from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully  


.....  
Dr Rosemary Sibanda (Chair)






/px

cc Supervisor: Prof A Philipp  
cc Academic Leader Research: Dr A Pillay  
cc School Administrator: Ms S Jeenarain, Ms M Ngcobo, Ms N Dlamini and Mr SN Mthembu

---

Humanities & Social Sciences Research Ethics Committee  
Dr Rosemary Sibanda (Chair)  
Westville Campus, Govan Mbeki Building  
Postal Address: Private Bag XE4001, Durban 4000  
Telephone: +27 (0) 31 260 3507/83504857 Facsimile: +27 (0) 31 260 4829 Email: [rsibanda@ukzn.ac.za](mailto:rsibanda@ukzn.ac.za) / [stymarr@ukzn.ac.za](mailto:stymarr@ukzn.ac.za) / [info@ukzn.ac.za](mailto:info@ukzn.ac.za)  
Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)

1910 - 2010  
100 YEARS OF ACADEMIC EXCELLENCE

Founding Campuses:  Edgewood  Howard College  Medical School  Pietermaritzburg  Westville



## education

Department:  
Education  
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma

Tel: 033 392 1063

Ref:214/81794

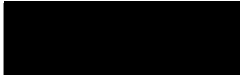
Ms NG Nzimande  
K423 Mgaga Road  
Umlazi  
4031

Dear Ms Nzimande

### PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"THE RELATIONSHIP BETWEEN FOUNDATION PHASE TEACHER'S CONTINUOUS PROFESSIONAL DEVELOPMENT ACTIVITIES AND THEIR INSTRUCTIONAL QUALITY IN TEACHING MATHEMATICS AT TWO SCHOOLS IN THE UMLAZI DISTRICT"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 03 June 2019 to 04 January 2022.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Phindile Duma at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

  
Dr. EV Ndzama  
Head of Department: Education  
Date: 05 June 2019

KWAZULU-NATAL DEPARTMENT OF EDUCATION  
Postal Address: Private Bag X9137 - Pietermaritzburg - 3200 - Republic of South Africa  
Physical Address: 247 Burger Street - Anton Lembede Building - Pietermaritzburg - 3201  
Tel: +27 33 392 1063 - Fax: +27 033 392 1200 - Email: Phindile.Duma@kzndoe.gov.za - Web: www.kzndoe.gov.za  
Facebook: KZNDOE... Twitter: @DOE\_KZN... Instagram: km\_education... Youtube: kzndoe

..Championing Quality Education - Creating and Securing a Brighter Future

APPENDIX 6

TURNITIN CERTIFICATE

