Teachers' Experiences and Understanding of Continuous Professional Development (CPD) in Uganda

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DECLARATION

I hereby declare that this thesis has not been, and will not be, submitted in whole or in part to another university for the award of any other degree.

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ABSTRACT

Globally, and in particular in Sub-Saharan Africa countries, there is a concerted focus on teacher continuous professional development to enhance quality in education. However, Uganda has limited research about how continuous professional development aligns to classroom practices. This research examines the contribution of continuous professional development to teachers' classroom practices, addressing this main question: "What are teachers' understanding and use of the continuous professional development training that they have attended in Uganda?" The study addresses two research sub-questions. The first research question is, "What are teachers' understanding of the benefits and drawbacks of the training they have attended?" The second research question is, "How do teachers use their CPD training in their Grade 6 mathematics classrooms?" The study uses an interpretive research approach comprising a case study of nine teachers in Uganda, with in-depth interviews of the teachers as the primary data collection tool. The data were transcribed, coded and analysed using critical discourse analysis. The findings of research question 1 indicate that continuous professional development training benefits teachers by improving classroom lesson preparation, equipping teachers with pedagogical content knowledge and assessment practices as well as supporting teacher-teacher collaboration. The drawbacks of the training, however, included a weak training policy framework, limited opportunities for professional development, limited career progression and inadequate school instructional support.

Furthermore, the findings suggest that adequate teacher participation in continuous professional development beneficially affects classroom practices. The central aspect of teacher professional development is the relevance of training, the content and focus of such training as well as adequate participation. The study concludes with implications for policy and practice in continuous professional development, and its re-design of provision, training modalities and opportunities. The study contributes to a new understanding of how teachers' continuous professional development in Uganda influences change in classroom practices. It adds to the knowledge of the efficacy of continuous professional development and the effect of such provision as key to teacher professional knowledge and practice.

ACKNOWLEDGEMENTS

ABBREVIATIONS

CAS	Critical assessment study
CCP	Child-centred pedagogy
CCT	Centre for Coordinating Tutor
CPD	Continuous professional development
EFA	Education For All
FGD	Focus group discussion
GDP	Gross domestic product
H	High
INGO	International non-governmental organisation
ITP	Initial teacher preparation
L	Low
LCP	Learner-centred pedagogy
LG	Local government
M	Medium
MOES	Ministry of Education and Sports
NAPE	National Assessment for Progress in Education
NTCM	National Teaching Committee for Mathematics
PTTC	Primary Teachers Training College
SACMEQ	Southern and Eastern Consortium for Monitoring Education Quality
SSA	Sub-Saharan Africa
TDMS	Teacher Development Management System
TIET	Teacher Instruction Education and Training
TISSA	Teacher Initiative in Sub-Saharan Africa
UBOS	Uganda Bureau of Statistics
UNESCO	United Nations Education, Scientific and Cultural Organization

CHAPTER 1 : INTRODUCTION

This chapter introduces this research on teachers' experiences and understanding of continuous professional development in Uganda into five sections. The first section is the background of the thesis illustrating the evolution of the study. The second section describes the rationale and the motivation for the choice of the topic on teachers' CPD training and mathematics classroom practices in primary schools in Uganda. The third and fourth parts of the chapter respond to the two main research questions and the structure of the thesis, respectively. Finally, this chapter concludes by outlining the structure of the thesis.

1.1 Background of thesis

Globally, policymakers, education practitioners and academics appreciate the critical role of the teacher in quality of education (UNESCO, 2018). The focus on quality in education in Sub-Saharan African (SSA) countries has gained momentum, in particular targeting strategies to address teacher quantity and quality (UNESCO, 2010). In most SSA countries, education reforms address retention, equity and quality in education, including building competencies for teacher change in classroom practices. The vision of several global commitments is continuous teacher re-training as stipulated in Target 4c of the education 2030 agenda (UNESCO, 2014; UNESCO, 2015). Harland and Kinder (1997) note that CPD is about the specificity in training outcomes and associations of teacher change in classroom practices. This means that education systems must call for teachers' professional development as it contributes to teachers' abilities in classroom practices.

Notwithstanding, when considering the effectiveness of CPD, context and learning environment settings are essential. Notably, since the 1990s, developing countries witnessed a surge in enrolment, constraining quality in education with overcrowded classrooms and inadequate school resources. Consequently, Zuze and Leibbrandt (2010) and others have urged governments to invest substantial resources in teaching and learning materials, mass teacher recruitment and classroom capacities. However, the education sector expenditure consists of an enormous teacher wage bill, constraining the allocation in operations and development expenditure (UNESCO, 2014; MOES, 2013; Ngware et al., 2010). In most

instances, despite budgetary increases, SSA countries continue to face challenges in teacher quantity and quality.

In Uganda, policymakers with concerns about school effectiveness attributed this to the state of teacher quality. The weakness in quality education was reflected in the low performance in mathematics in primary education, as reported in the national assessment report (NAPE, 2012). The reasons for weak pupil performance included inadequate teacher pedagogical skills, deficiency in learner reading skills and inadequacy in curriculum implementation. In the annual review of education performance, policymakers sought reforms in teacher education including re-training of teachers (MOES, 2013). According to Guskey and Huberman (1995), the dynamism in the teaching profession requires that teachers enhance their instructional ability, given that effective teaching involves complex behaviour such as communication, reflection and refinement of knowledge and skills.

This research intends to illuminate a deeper understanding of how CPD contributes to the quality of instructional practices in primary education in Uganda, as ensuring quality in teaching and learning calls for effective continuous professional development for teachers. This thesis background articulates the significance of the teacher and CPD in sustaining quality in education. The next discussion on rationale and motivation explains the choice of the CPD research paradigm.

1.2 Rationale and motivation for undertaking the study

The rationale and motivation of the study originate from the concerns on teacher effectiveness in Uganda from policymakers and practitioners. In the course of my technical advisory role with the Ministry of Education and Sports, Uganda, two necessary action points were eminent: first, a teacher policy review, and second, the harmonization of teacher education with an emphasis on teacher professional development (MOE, 2014). The teacher is a key factor in the production of quality education and hence, as a researcher, I became interested in the associations between CPD and teachers' classroom practices (Harland and Kinder, 1997).

In the extensive literature of my doctorate on the critical assessment study (CAS) of the CPD initiatives in Sub-Saharan Africa and in particular, the case of Uganda, I outlined the limited literature on continuous professional development and classroom practices, especially in mathematics (Obiero and Ezati, 2018). A similar argument from Najjumba and Marshal (2013) also highlights the dearth of literature, particularly on knowledge and skills transfer of teachers in classroom practices. The study methodology fits with the areas of further research on the associations between CPD processes and effects on teacher practices identified by Harland and Kinder (1997). The essence of this research is to gain a deeper understanding of the teachers' lived experiences of CPD training and their classroom practices in primary schools of Uganda.

A further look at other studies also identify low achievement in mathematics, fragmented CPD training, and weak pedagogical practices, all of which relate to the professional dilemma of teachers in Uganda (Pontefract and Hardman, 2005; Akyeampong et al., 2006). In particular, the 2012 Uganda national assessment results indicated that learners performed poorly in several topics of the mathematics curriculum. For example, learners face problems in rounding off numbers, dividing fractions by fractions, applying fractions, finding least common multiples and square roots, drawing bar charts, drawing parallel lines and accurately measuring angles. Worse still, the assessment report indicated a learning crisis, with about 70% of Grade 6 learners obtaining below the 50% mark in numeracy (NAPE, 2012). Many concerns in low performance in mathematics have been attributed to weak pedagogical practices.

Stakeholder forums reveal frustration in efforts to address quality in education. Policymakers seek answers to the concerns of low performance despite investments in teacher education (MOES, 2013). The strategic point is a clear need for proof of effectiveness in the re-training of teachers and the extent that CPD transforms pedagogy in classroom practices. In my capacity as Project Coordinator of Capacity Development of EFA of teachers in Uganda, I have the unique opportunity to contribute to teacher education research. That means developing inquiry on how CPD training addresses the concerns of weakness in teachers'

pedagogical skills, as indicated in the outcome of the national assessment report (NAPE, 2012).

This study intends to consider CPD training benefits and drawbacks as well as the use of CPD in classroom practices with the goal of understanding how CPD might address teacher effectiveness in classroom practices to achieve improved learning outcomes of students. Achieving this meant interrogating teachers on their perceptions of their CPD training and how the training leads to changes in their classroom practices. My motivation was to seek insight into teachers' understanding of lived CPD training experiences and their application in classroom practices. The ultimate goal is to discover if teachers' CPD training contributes to enhanced educational quality in primary schools (MOES, 2011; Hardman et al., 2011).

1.3 Overview of study

In this study, the specific research pertains to teachers' CPD lived experiences and how they contribute to the teaching and learning of mathematics in primary schools in Uganda. During my doctoral studies, I analysed pupil performance in mathematics and classroom delivery using the national assessment data. The missing link in the analysis, though, was the contribution of CPD in transforming teacher change in classroom practices (Onsomu, Obiero and Nzomo, 2005). The challenges that confront teachers in the teaching of mathematics call for in-depth research of teachers' CPD learning paradigms. Most important is how CPD contributes to teachers' curriculum delivery in classroom practices for improved learning. Bridging this research gap requires a qualitative study into teachers' CPD and classroom practices.

1.3.1 Study methodology

This research, conducted in 2015, makes use of an interpretative case study approach involving nine primary schools purposely sampled from two districts in Uganda. The study participants in the case study comprise five teachers from a rural district and four teachers from an urban district drawn from a national assessment study framework on Grade 6 mathematics in 2011. In addition, in-depth interviews were conducted with nine headteachers

and two education officials, and focus group discussions took place with Grade 6 pupils from the nine primary schools.

The focus concerned the teachers' CPD lived experiences in the three years preceding the study and the transfer of knowledge and skills into mathematics classroom practices. The teacher narratives allowed me to explore, reflect on and determine the contribution of CPD training in teacher quality in instructional practices.

1.3.2 Research questions

The focus of the study research questions is the contribution of teachers' continuous professional development (CPD) and the application on the training into classroom practices. Therefore, the overarching research question for the study is as follows:

What are teachers' understanding and use of continuous professional development (CPD) training that they have attended in Uganda?

The main research question illuminates teachers' understanding and use of the CPD lived experiences in three years preceding the study. In exploring teacher understanding and use of CPD, the study is seeking to assess the change in pedagogical decisions. The study is anchored on the performance of Grade 6 pupils in mathematics, as reported in the national assessment (NAPE, 2011). The research paradigm is in teacher understanding and use of CPD in Grade 6 mathematics classroom practices in primary schools in Uganda. In exploring the teachers' understanding and use of CPD in classroom practices, this thesis investigates two research questions.

The first research question is on the teachers' CPD training attended, as follows:

Research Question 1: What are the teachers' understanding of the benefits and drawbacks of the continuous professional development (CPD) training they have attended?

This question examines teachers' perspectives on the benefits and drawbacks of the CPD training attended. In exploring the CPD benefits, the study outlines the extent that the professional training meets teachers' individual or collective expectations for quality teaching and learning. The question explores the forms, design and content of the CPD attended in the three years preceding the study. The results indicate the teachers' perceive of the knowledge and skills acquired as a CPD benefit for addressing specific gaps in instructional practices.

The second aspect of the research question concerns the drawbacks of the CPD attended. The teachers narrate their perspective of challenges in the provision of professional development concerning modalities, content and the extent it failed to meet their training expectations. This then brings into focus a follow-up research question.

The second research question explores the teachers' use of CPD training in classroom practices:

Research Question 2: How do the teachers use their continuous professional development (CPD) training in their Grade 6 mathematics classrooms?

The second research question seeks to consider the transfer of teachers' acquired knowledge and skills from CPD training into Grade 6 mathematics classroom practices. Observing Grade 6 pupils' mathematics lessons and post-interviews of teachers proved useful in assessing the application from CPD training in Grade 6 mathematics classrooms. The focus of the use of CPD training in classroom practices is on teacher preparation and initial delivery, application of pedagogical content knowledge and use of assessment practices. The study investigates the relevance of CPD training in addressing weak areas of teaching and learning of Grade 6 mathematics curriculums. The findings outline the challenges teachers face in teacher preparation and initial delivery, pedagogical content knowledge and assessment practices, especially when learners suffer from low numeracy (and literacy) foundation skills. Moreover, the study illuminates stark differences in teachers' levels of CPD participation,

exploring how this influences the quality of instructional practices in Grade 6 mathematics classroom practices.

The research questions support the enquiry into the contribution of CPD in the quality of teachers' instructional practices in primary schools of Uganda. The findings for CPD benefits illustrate acquisition of skills and knowledge for teacher preparation and initial delivery, knowledge and skills in pedagogical content knowledge and assessment practices, and the promotion of teacher-teacher collaboration. The findings pertaining to CPD drawbacks demonstrate weak policy framework, limited CPD opportunities, limited career progression and inadequate school instructional support. Teachers with high CPD participation, however, are likely to demonstrate more quality in instructional practices. Finally, the findings on the use of CPD training in classroom practices illuminate several conclusions: implications for policy and practice and recommendations on CPD review and re-design, including innovations and monitoring mechanism.

1.4 Structure of thesis

The thesis is comprised of eight chapters. The first three chapters set the stage for the research context of the thesis.

Chapter 1, *Introduction*, covers the background to the thesis, rationale of the study and research questions.

Chapter 2, *Context of the study*, explains the background information of Uganda, national assessment of learning, curriculum policies, challenges of primary education and the framework of teacher professional development in Uganda.

Chapter 3, *Literature Review*, provides a review of literature on the definition of CPD, effective CPD, learning goals and models of CPD, training outcomes, motivation and incentives of teachers' CPD opportunities, and lastly, the conceptual framework of the study.

Chapter 4, *Methodology*, covers the methodological perspective, research design, sampling procedures, research instruments, data collection, data analysis, discussions of trustworthiness, ethical considerations and limitations of the study.

Chapter 5, *Contextualization of case study schools*, demonstrates the context of the case study schools, describing the learning environment of the schools and giving indication of the classroom setting of the teachers.

Chapter 6, *Teachers CPD benefits and drawbacks*, elaborates on the results and reviews of research question 1.

Chapter 7, *Teachers use of CPD training in classroom practices*, is about findings and discussion of research question 2.

Chapter 8, *Conclusion*, summarises the findings of research question 1 of the benefits and drawbacks of teachers' CPD and research question 2 on the use of CPD in classroom practices. This final chapter also presents the implications for policy and practice, areas for further research, the contribution of the study to knowledge, and closing reflections of my research journey.

1.5 Summary of the chapter

This chapter establishes the background of the thesis, reiterating the global and regional commitment to continuous professional development (CPD) for teachers. The rationale and motivation for undertaking the study include the limited existing literature and the hopeful opportunity to expand knowledge of teachers' CPD and its effectiveness in classroom practices in Uganda. The main research question focuses on teachers' understanding and use of the CPD attended, divided into two sub-questions: the first one concerns the perceived benefits and drawbacks of CPD training attended, and the second concerns the use of CPD training for teachers in classroom practices. It concludes with an overview of the structure of the thesis.

The next chapter describes the context of CPD provision in Uganda.

CHAPTER 2 : CONTEXT

This chapter describes the context of the research of teachers' understanding of continuous professional development (CPD) in Uganda, beginning with geographical, demographic and socio-economic information, followed by a look at the Ugandan education system on the education structure and learning performance in primary education. The other section discusses teacher education and management, providing details of initial teacher preparation and teacher deployment, a continuous professional development framework and then curriculum reform and policy challenges. The chapter concludes with a summary of the discussions.

2.1 Geographical, demographic and socio-economic information

This section discusses the social setting of the research participants in Uganda by describing the geographical location and administrative units. It also describes the demographic characteristics and socio-economic status of the country.

2.1.1 Geographical location, culture and administration

Uganda is a landlocked country located in East Africa bordering Kenya to the east, South Sudan to the north, the Democratic Republic of Congo to the west, Rwanda to the south-west and lastly Tanzania to the south. Uganda holds a significant portion of Lake Victoria, a freshwater basin shared with Kenya and Tanzania. Uganda has thirteen regions: Acholi, Ankole, Buganda, Bukedi, Bunyoro, Busoga, Elgon, Karamoja, Kigezi, Lango, Teso, Toro and West Nile. Uganda is 93,065 square miles of land with a primarily equatorial climate (UBOS, 2016; MOES, 2016).

The country encompasses diverse cultures with 53 languages spoken by specific populations in various regions or districts. However, English is the official language across all the districts and a medium of instruction in the education system. The local languages are retained for intercultural heritage and to promote cohesion in the democratic and developmental participation of the citizens.

Based on the colonial framework, the Local Government Act of 1997 empowers administration at the district level, and as of 2018, there were 115 districts. The provision of universal primary education management comes from the district level, with the school grants disbursed through the district administration from the central government.

2.1.2 Demographic characteristics

The demographic characteristics explain the magnitude and structure of the population, illustrating the extent of the demographic dividend of the country. Uganda conducts a population census data every ten years with the most recent population census in 2014 reporting a total population of 34.6 million persons. The country recorded an average annual inter-census growth rate of 3.0%. This 2014 population census data revealed a young and rapidly growing population, with those below 15 years of age constituting more than half of the total population (UBOS, 2016).

A more in-depth analysis of the data shows over half of the labour force is under the age of 30, youth aged 15 to 24 years constitute 23.8% and youth aged 18 to 30 years constitute 24.4%. In addition, the majority of households (75%) reside in rural areas. The data also reveals an increasing rural to urban migration (UBOS, 2016).

2.1.3 Socio-economic status

Uganda as a developing country relies mainly on agriculture production for most of its revenue. In 2013, Uganda discovered oil reserves but is still in the process of extracting for commercial gain. The oil discovery is intended to boost government revenues and improve the development of the critical sectors that include infrastructure, health and education.

Uganda's economy over the past decade achieved steady growth in real gross domestic product (GDP) of more than 5% a year (UBOS, 2018). However, public spending on education grew at an average rate of 0.7% per year. The share of total government education expenditure declined from 27% in 2003/04 to reach a low of 19% in 2010/11 (UNESCO,

2014). The decline in education expenditure is of serious concern, given the increasing school-age population and the impact of these increasing numbers on the provision of quality education.

2.2. Historical perspectives of Uganda education system

This section describes how the Ugandan education system has evolved from the colonial era to the post-colonial period in terms of management, access and quality. Also discussed is the present structure and management of the education system.

2.2.1 Colonial and post-colonial era education

Education in Uganda was first established by missionaries in the 1880s during the colonial days under the British Government. Christian and Catholic missionaries introduced European schooling as part of their evangelizing efforts (Omatseye and Omaseye, 2008). Tiberondwa (1975) explains that missionaries introduced formal education not only for religious purposes but also for employment in clerical and other junior occupations in the colonial government. In addition, the British Colonial government established the first secondary school for Africans in 1924. As of 1950, 50 out of 53 secondary schools were for the Africans.

Uganda gained independence in 1962 and immediately re-invigorated the education system under the slogans, "The creation of African identity" and "The development of African personality". Though there was overhaul of the education system, the British syllabus was still prominent until 1974 in measuring student progress in primary and secondary education. Then, in 1975, the Ugandan government implemented a host of changes in the education system, including the implementation of a national curriculum and use of school materials published locally. While enrolment increased steadily, urban centres faced shortages in primary school facilities.

A reform of primary education and professional development was subsequently initiated in 1993, with reforms of teacher education, primary school curriculum, pupil examination system, textbooks and reading materials and the national assessment framework. In 1997, the

government initiated universal primary education (UPE). UPE implementation introduced policy on abolition of tuition and minimal conditions for instruction through teacher training and curriculum upgrading (Byamugisha and Nishimura, 2015). The noble goal of UPE was to assure government commitment in meeting the Education For All (EFA) goals for the improvement of access, equity and quality in education.

2.2.2 Education structure and management

The education structure of Uganda follows the 7-4-2-3 system commencing at primary, then secondary, tertiary and ending with university education. Although not compulsory, admission for pre-primary education for school-age children of three to five years is for two years. Primary schooling is from Grade 1 to Grade 7, after which pupils sit for a national examination at the end of the primary cycle.

Secondary education is in two cycles: ordinary level (O-level) for four years and two years at the advanced level (A-level), with national examinations held at the end of each level. The tertiary education sector takes between two to three years for middle-level colleges for diverse courses including the TVET, Business and Primary Teacher Education at certificate and diploma qualification. University education takes a minimum of three years for various professional and general courses. Secondary education teachers train in universities, graduating with a Bachelor of Education qualification (MOES, 2014) or Bachelor of Arts or Science degree with Education.

The Ministry of Education and Sports (MoES), responsible for education, is mandated to manage policy and control the maintaining of standards through control of teacher education, curriculum and examinations. There are several departments and agencies with specific mandates in primary, secondary and higher education. For example, the Department of Teacher Instructor in Education and Training (TIET) is responsible for teacher education. Education management for the primary level that involves universal primary education is a decentralised function of the local government (LG) in Uganda (MOES, 2016).

2.3 Primary education and learner performance

Since the implementation of universal primary education (UPE), there has been steady increase in access. Concerted efforts were made to improve the participation levels during the Education For All (EFA) period. According to the UIS (2019), primary school enrolment rose from 2013 to 2018. Compared to the school-going population, it translates to a gross enrolment rate (GER) of 112.0% in 2013, and 102.7% in 2018. In absolute terms, access has increased and more children are accessing education at the right of age of school entry due to universal primary education.

Uganda sets national examinations at the end of Grade 7 and conducts national assessments at Grades 3 and 6 for literacy and numeracy. Over the years, there has been a significant increase in the number of primary graduates. For example, the number of P7 candidates rose from 365,891 in 2002 to 533,376 in 2012, a significant increase of 31.7%.

Figure 2.1 indicates performance at P6 with the achievement lower than compared to that attained at P3. In 2002, the pupils who reached the desired competency were at 20.5% rising to 41.4% in 2007. In 2008, the desired competency in numeracy reached the halfway mark at 53.5% and improved slightly to 54.9% in 2012 except for 45.6% in 2011.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	20.5	26.8	33.0	30.5	41.4	53.5	53.3	54.8	45.6	54.9
Male	25.7	32.4	39.0	34.4	45.9	58.8	58.7	57.9	49.6	58.0
Female	15.3	21.2	27.0	26.7	37.2	48.4	48.1	52.1	41.7	52.1
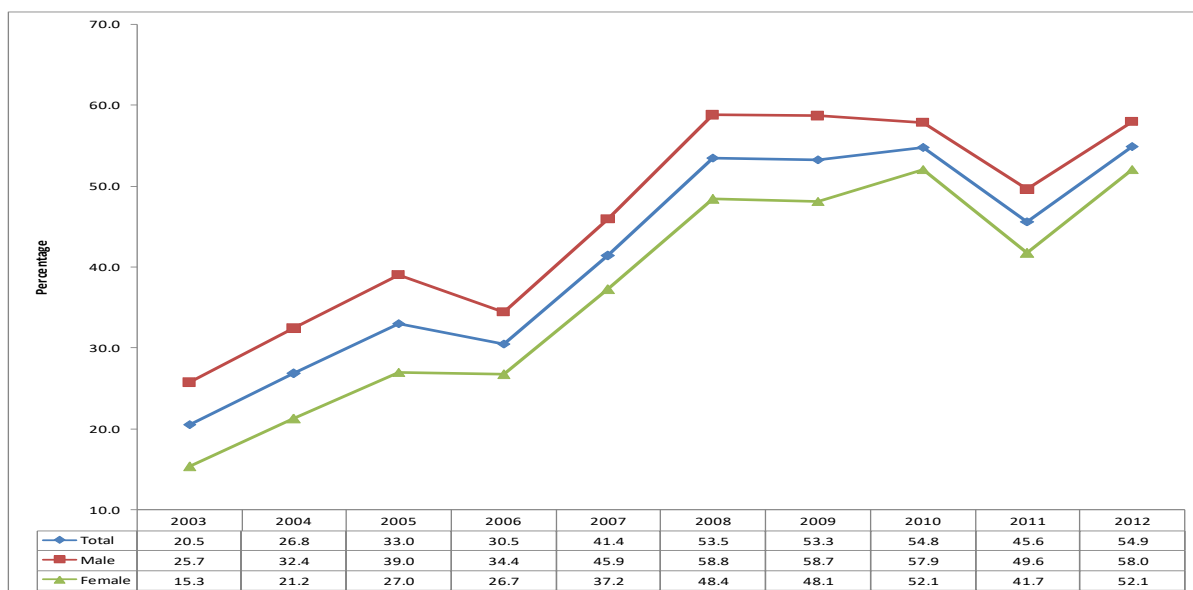
Figure 2.1: Numeracy rate: % of pupils reaching a defined level of competency at P6
(Source: EMIS, Ministry of Education and Sports, 2012)

The achievement in numeracy performance is to ensure that nearly all learners achieve the defined level of competency at Grade 6. Therefore, more opportunities are necessary for teachers to access CPD that supports teacher quality. Studies reveal that poor quality of pupil learning outcomes strongly correlate with poor quality of teaching for pupil learning and achievements in Uganda and Kenya (Pontefract and Hardman, 2005; Akyeampong et al., 2006). The challenges in poor quality teaching are partly due to weaknesses in teachers' pedagogical skills and classroom practices.

2.4 Teacher education and management

This section describes teacher education and management of initial teacher preparation (ITP) and continuous professional development (CPD) in Uganda. The initial teacher preparation, referred to as pre-service training, is offered in training institutions to prepare teachers to teach in primary schools. Continuous professional development is also referred to as in-service training, but provided to qualified and unqualified teachers.

2.4.1 Initial teacher preparation and teacher deployment

Teacher trainees admitted to primary training colleges (PTC) take a 2-year pre-service training, graduating with a Grade III Teacher Certificate. Primary school teachers can pursue further education in universities to obtain either a diploma or a degree level qualification. The government increased admission to initial teacher preparations to meet the increasing demand for qualified teachers (O'Sullivan, 2006). However, the main challenge is that ITPs have low initial entry qualifications, particularly affecting grades in the subject content of mathematics. In addition, pre-service teachers graduate without sufficient skills for teaching. The teacher policy allows teachers to get a study leave with pay for in-service training and subsequently attain higher professional qualifications (MOES, 2011). According to the scheme of service, teachers are expected to develop their careers through various mechanisms, including upgrading their qualifications, undertaking refresher courses, conducting research, and attending workshops and seminars. However, as the opportunities for continuous professional development are limited, teachers must participate of their own

initiative. As a result, admission to core PTC for CPD courses declined from 2,895 in 2008/09 to 1,856 in 2010/11 and an even lower 1,200 in 2011/12 (MOES, 2014).

The minimum qualification for recruitment of a primary school teacher is a Grade III Certificate, with prospective teachers making a formal application through schools and regional education offices. A study conducted by UNESCO (2014) indicates that demand for teachers for primary schools has escalated due to the increase in the school-age population. Table 2.1 shows that the number of teachers deployed in primary schools increased from 150,135 in 2006 to 172,403 in 2010, followed by a slight decline in 2011 to 169, 503 and then rise to 181,232 teachers in 2012 (MOES, 2013).

As of 2012, 12% of Ugandan teachers were unqualified, with the majority being from private education institutions. Data reveal that over the years, the number of qualified teachers has improved, with the proportion of untrained teachers in public schools declining from 28% in 1999 to 3.6% in 2011 (MOES, 2014).

Table 2.1: Number of teachers and qualification, by school type, 2006-12

Number and Percent

Primary	2006	2007	2008	2009	2010	2011	2012
Number of teachers	150,135	152,135	159,516	168,376	172,403	169,503	181,232
Share of Unqualified	18.0%	13.3%	11.6%	14.3%	12.7%		
Pupil Enrolment	7,362,938	7,537,971	7,963,969	8,297,780	8,374,648	8,098,177	8,337,069
Pupil Teacher Ratio(PTR)	48: 1	50:1	50:1	49:1	49:1	48:1	45:1

(Source: EMIS fact and sheet, 2012)

This recent decade witnessed increased access in primary education; hence, the higher demand for teachers. However, the number of teachers recruited compared to student enrolment is still inadequate, resulting in a high pupil-teacher ratio (UNESCO, 2014), standing at a national average of 45:1 in 2012. Disparities indicate schools with an even higher PTR (as high as 78:1). In addition to the high pupil-teacher ratio, training adequate teachers for special education requires attention (Arbeiter and Hartley, 2002).

In 2014, the Ministry of Education and Sports and UNESCO released a report entitled *Teacher Issues in Uganda: A shared vision for an effective teacher policy* in which

policymakers were urged to review the teacher policy for competency in teacher professionalism, addressing issues of school effectiveness and teacher motivation.

2.4.2 Continuous professional development framework

The administration of CPD falls within the Teacher Development Management System (TDMS) at the national, district and school levels. Centres for Coordinating Tutors (CCTs) conduct their supervision support responsibilities within and report to a specific core PTC. Primary schools are in cluster centres under the jurisdiction of a CCT, rendering coordination of CPD activities manageable within the TDMS structure (MOES, 2011).

The CPD framework in primary schools is in line with the teacher code of conduct. The Education Service Notice 2012 provides details of the professional conduct of the teachers, requiring that "*a teacher shall take advantage of all professional development opportunities and use modern and accepted methods of teaching*". Further re-training is required to enhance teachers' classroom practices (GOU, 2012).

The modalities of CPD can be a workshop (residential or non-residential) at the national level, cluster centres and schools. Moreover, the CCTs conducted individual teacher support supervision in the schools documented in lesson supervision sheets (MOES, 2018) which detail information on the availability of documents such as schemes of work and lesson plans. It also includes enquiry on the lesson delivery process in classroom management and seeks to identify good practices. Focus is frequently on developing generic teaching skills or introducing new curricula (Pryor et al., 2012). The training is conducted primarily via a cascade model for the school-based professional development, with members of the Centre for Coordinating Tutors (CCTs) as trainers (Hardman et al., 2011).

However, the TDMS framework is not well coordinated, lacks synergies with the various actors and is not adequately resourced (Pryor et al., 2012). According to Hardman et al. (2011), the CCTs lack adequate technical capacity to teachers' professional development as they only receive short-term onsite and refresher skills training.

Notwithstanding all the challenge mentioned, the intention of this study is to understand how teachers' CPD training in Uganda influences changes in classroom practices (Garet et al., 2001). The next section elaborates on the curriculum and policy challenges.

2.5 Curriculum reform and policy challenges

This section narrates the curriculum and policy challenges describing curriculum reform, thematic curriculum and policy challenges.

2.5.1 Curriculum reform

Over the years, the debate on curriculum issues followed the surge in enrolment and constraints in school resources since the 1997 declaration of universal primary education (UPE). The main concern was low quality in education provision depicted by the severe repetition rate, high dropout rate and low student performance. In addition, the education system lacked qualified teachers, and suffered with teacher absenteeism and lack of lesson planning, calling for curriculum reform to rectify the weakness in the education system.

Uganda initiated curriculum reform in 2000, seeking views on areas to address in the 2000 primary education curriculum. The objective of thematic curriculum was to improve quality in education and increase student achievement in literacy, numeracy and life skills. In 2007, a thematic curriculum was rolled out in phases from lower primary (Grades P1 to P3) to upper primary (P4 to P7), and completed in 2012 (Altinyelken, 2009). Penny et al. (2008) highlight teacher education programmes as one area of focus in Ugandan governmental education reforms for improving the quality of primary education. The target of the reform was to allow for substantial access to quality opportunities for students and teachers through an expanded capacity of the 23 core primary teacher training colleges.

The curriculum reforms address quality in teaching and learning for better learning outcomes. However, according to Anamuah-Mensah, Banks, Moon, and Wolfenden (2012), teacher

preparation was inadequate in meeting the large-scale needs of the 21st century. In particular, more efforts are required to revamp teacher education including the introduction of school-based training modes. Practitioners call for introduction of teacher policy that emphasises continuous professional development, including integrating research practices and technology (MOES, 2012). The teacher education reforms were to train all teachers and integrate continuous re-training of serving teachers in primary schools. This study considers this development as critical to understanding the contribution of CPD to the quality of teaching and learning.

2.5.2 Thematic curriculum

The new thematic curriculum values continuous assessment in primary schools to ensure quality in learning. The main principles of the thematic curriculum are evident in three areas: rapid developments of literacy, numeracy and life skills at lower primary; the treatment of holistic concepts with meaning and relevance to the learner; and presentation of learning experiences in languages in which learners are proficient (Altinyelken, 2009).

In deploying the first principle of the rapid development of literacy, numeracy and life skills, the aim was to secure stronger foundational skills of learners by ensuring that the teaching of various subjects allowed enrichment in knowledge and skills. To this end, it calls for improvement of the subject content knowledge of the teacher, for example, in the learning of mathematics. The second principle of treatment of holistic concepts with meaning and relevance to the learner considers the application of pedagogical content knowledge. The new thematic curriculum requires that teaching and learning incorporate child-centred approaches. The last principle is the presentation of learning experiences in languages in which learners are proficient to recognise the diversity of culture and language across the multiple regions in Uganda. The intention is for lower grade teachers and learners to make use of mother tongue as the language of instruction so as best to support the early cognitive development of the learners.

This study considers classroom assessment as a means of tracking learner performance. As such, the new thematic curriculum emphasises continuous assessment. The teacher is required to conduct a learner assessment in daily lessons. The assessment is both diagnostic and remedial to facilitate feedback and corrective action (Altinyelken, 2009). Effective implementation of the thematic curriculum allows learners to interact with each other, learn by doing, and benefit from exposure to different methods and materials during a lesson. In this way, learners improve their understanding, skills and competencies in any given subject.

2.5.3 Policy challenges in curriculum implementation

In this study, the research identifies three policy challenges in curriculum implementation relevant to teachers and CPD in Uganda: implementation of the thematic curriculum; qualification of teachers during initial teacher preparation; and alignment of CPD to the thematic curriculum.

The first policy challenges arose when policymakers concentrated on the process of policy formulation at the expense of implementation of the new thematic curriculum. The framework of the implementation of the new curriculum was not holistic in the planning process. Successful implementation of the curriculum required ownership of the entire process from school to the community. In this case, leadership roles of headteachers of primary schools were critical for the effective implementation of the new thematic curriculum. The teachers needed to be prepared to ensure devotion and commitment to the new ideas infiltrating classroom practices. This means taking into consideration their background, subject matter knowledge, motivation, commitment to teaching and attitude (Altinyelken, 2009). Furthermore, the learning environment and parental involvement with students and student learning are crucial for successful implementation of the new thematic curriculum.

The second policy challenge was the qualification of teachers from the initial teacher preparation of the primary teachers' training curriculum designed by Kyambogo University, covering all primary school grades and subjects. However, there are concerns of a lack of alignment between the primary teachers' training curriculum and the new thematic

curriculum. There is an indication, as well, that the initial teacher preparation did not meet the teaching standards, as illustrated by the poor teaching practices (NAPE, 2012). Some of the teaching and learning issues highlighted in a UNESCO report include lack of emphasis on new subjects with content not always related to the primary curriculum; and curriculum focus on content at the expense of pedagogy and good classroom practice (MOES, 2013). To address these concerns and bridge the gaps, in 2011 the Ugandan government initiated an education reform of the primary teacher education (PTE) certificate programme. A revised curriculum focused on improving teaching methods and introduced teacher specialisation, whereby teachers were trained to teach either lower or upper primary and maintained supervised school practices. However, the institutions still faced a shortage of adequately trained teacher educators to implement the PTE curriculum (Kyeyune et al., 2011). Along the same lines, the process of implementation of the new curriculum in schools was doubtful among the teachers who were, once again, sceptical of the impact. Altinyelken (2010) notes that teachers were enthusiastic of the new thematic curriculum but raised concern on the appropriateness of the initiative, given the structural realities of Ugandan classrooms; therefore, the necessity for a streamlined implementation process was acknowledged.

The third and last policy challenge was the alignment of the CPD framework to the thematic curriculum. The concerns were that the CPD framework would not integrated with the implementation of the new thematic curriculum. The thematic curriculum policy involved engaging with the policymakers and practitioners; however, enforcement was not mainstreamed in the planning process. The large-scale training of teachers to equip them with skills for teaching the new thematic curriculum was worryingly brief and lacking in continuity. This fits with research outcomes that CPD initiatives in Uganda are short-term, fragmented, poorly planned and devoid of evidence for how to actually improve classroom practices (Pryor et al., 2012).

The need for effective CPD is critical to ensure that the professional needs of teachers are met (Moon et al., 2006). A study by Wolfenden, Auckloo, Buckler and Cullen (2017) shows that demands in situated learning of thematic curriculum can benefit from open educational resources (OER), suggesting that CPD should encourage self-learning among teachers in the

use of open resources and training should be learner-centred aligned to the competence-based thematic curriculum. The curriculum reform was to allow teachers to promote a comprehensive and quality education. Therefore, CPD is to improve teachers' knowledge and competencies so as to promote lifelong professional growth.

2.6 Summary

The chapter describes the context of the study. Uganda is located in East Africa with a population of 34.3 million in of 2014. It has a 7:4:3:2 education system which means seven years of primary education. Uganda experienced steady growth in real GDP of over 5%. There are challenges in the performance in primary mathematics, with only 54.9% of Grade 6 pupils achieving the desired competency in 2012. The national assessment reports link the poor performance to teachers' weak pedagogical skills.

The teacher education framework includes initial teacher preparation and continuous professional development for pre-service and in-service training, respectively. All serving teachers are required to undergo regular re-training conducted at national, sub-national and school level under the Teacher Development Management System (TDMS). The country faced severe curriculum and policy challenges that led to curriculum reform initiated in 2000 that in turn led to the implementation of the thematic curriculum in primary education. However, the roll out of the thematic curriculum faced challenges due to inadequate capacity and facilitation. Given the poor performance in numeracy, this research sought to examine teachers' CPD experiences and how that their training impacted their classroom practices.

The next chapter reviews the literature surrounding CPD provision and its contribution to teacher changes in classroom practices.

CHAPTER 3 : LITERATURE REVIEW

This chapter analyses the literature on teachers' professional development and its influence in classroom practices. The reviewed literature underscores the underlying experiential process of teachers' acquisition of knowledge and skills in professional development opportunities. Section 3.1 introduces the definition of continuous professional development (CPD) and its core features. This is followed by section 3.2, reviewing effective CPD in the areas of policies and strategies of CPD, and CPD practices in Sub-Saharan Africa. Section 3.3 expounds on effective CPD for teachers of primary mathematics by considering the relevance in quality of teaching mathematics, pedagogical content knowledge and assessment practices. Section 3.4 describes the effects of CPD on teacher collaboration and motivation. Finally, section 3.5 outlines the conceptual framework of the study and section 3.6, a summary of the chapter.

3.1 Continuous professional development

3.1.1 Definition of continuous professional development

Exploring the definition of continuous professional development (CPD) is necessary to guide the approach of this study's enquiry of teachers' professional training. Discussing the first two CPD definitions of Hoyle and Megarry (2006) and Day (1999) highlights similarities and differences. Then, a third definition of CPD elaborates on how CPD is contextualised in the Ugandan education system.

The first CPD definition considered is from Hoyle and Megarry (2006) who state, *"Professional development is the process by which teachers acquire the knowledge and skills essential to good professional practice at each stage of a teaching career"* (p. 25). The definition of Hoyle and Megarry depicts teachers' acquisition of knowledge and skills as a benefit of CPD. The critical point is that training enables teachers to acquire knowledge and skills as an excellent professional practice. Teachers' gains in knowledge and skills result in competencies required for effective classroom practices (NTCM, 2010). However, the definition provided by Hoyle and Megarry (2006) has a constraint for CPD benefits, as it does not argue for continuous professional training, but only training offered at different stages of a teaching career.

Conversely, the second definition, from Day (1999), brings out a more comprehensive understanding of a continuous learning experience. Day (1999, p. 4) states,

> *Professional development consists of all-natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school, which contribute, through these, to the quality of education in the classroom. It is the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purpose of teaching; and by which they acquire and develop the knowledge, skills, and emotional intelligence essential to good professional thinking, planning critically, and practice with children, young people, and colleagues throughout each phase of their teaching lives.*

Day's definition is broader, more comprehensive and embraces holistic teacher professional development in day-to-day teaching. The description recognises diversity in teachers' actual settings as individual and collective actions, with clarity in personal learning objectives. It calls for the engagement of the teachers in a 'community of practice' in the form of sharing of classroom practices. It provides clarity on teachers' changes in classroom practices anticipated as a result of participation in CPD. Finally, it demonstrates that an education system should embody a comprehensive CPD framework to realise teacher effectiveness.

In considering the third definition, the education policymakers in Uganda have outlined what entails CPD as follows (MOES, 2018):

> *CDP refers to maintaining and improving the knowledge, skills, values and competencies of staff. According to the Teacher CPD framework: 'teacher CPDs include among others: formal educational programmes, short courses (face-to-face or online) or experiential (presenting at or attending conferences; seminars or workshops; supervised practice for skills development; conducting research; developing policies, protocols or guidelines; acting as a mentor teacher; and participating in committees'.*

This MOES (2018) definition recognises continuous re-training to equip teachers with knowledge, skills, values and competencies. It also recognises teacher collaboration as integral to a 'community of practice', and in particular, the use of mentor teachers and teacher associations in terms of committees. Moreover, the definition contextualises the forms and design of CPD through formal and informal approaches of CPD models (Kennedy, 2014; Day, 1999) while acknowledging the community of practice in teacher professional development.

In this study, the CPD definitions of Hoyle and Megarry (2016), Day (1999) and MOES (2018) allow a broader perspective of factors with regard to benefits and drawbacks in teacher re-

training. Gray (2005) claims that CPD equips individual teachers with professional skills and knowledge beyond the initial teacher training. The ultimate aim is CPD that results in teacher change and facilitates teacher-teacher collaboration for knowledge and skills transfer in classroom practices. The next discussion reviews the core features of CPD and explores how these relate to teacher professional practice.

3.1.2 Features of continuous professional development

According to Desimone (2009), the core features of CPD are content focus, active learning, coherence, duration and collective participation. Figure 3.1 illustrates the CPD core features and how teacher involvement results in an increase of knowledge and skills. The benefits are in the form of change in classroom instruction and improved student learning.
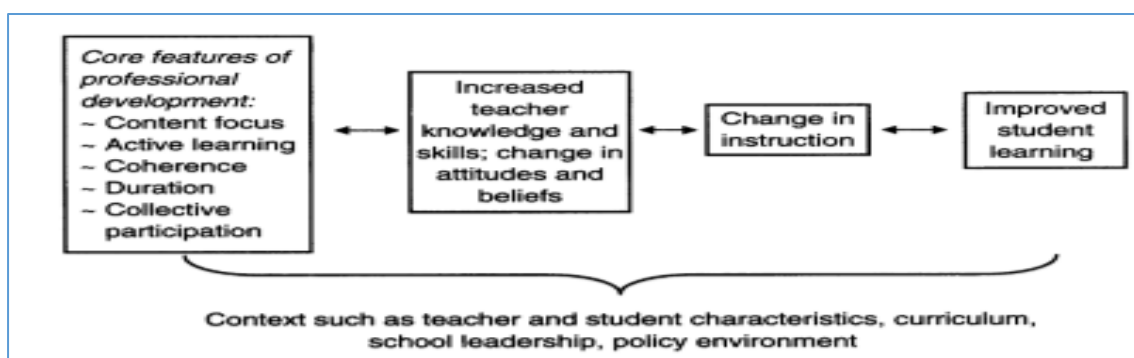
Figure 3.1: CPD core features and teacher change in classroom practices
(Source: Adopted from Desimone, 2009)

The *content focus* in CPD training is about subject content knowledge. Training conducted can integrate subject matter knowledge such as mathematics and science to improve on knowledge and skill CPD. In Uganda, learners in primary education have challenges in numeracy and literacy, so the target through CPD is to enhance classroom practices (NAPE, 2012). According to Lave and Wenger (1990), professional development is to assure that a teacher gains knowledge and skills for effective teaching and learning.

The CPD core feature of *active learning* involves the observation of expert teaching, followed by interactive feedback and discussion. In Thailand, a study conducted by Brundrett and Lungka (2018) illustrates how professional development with learning activities encourages specific knowledge and skills acquisition. Active learning, context-specific towards meeting teachers' professional training needs, enables a better understanding from each teacher's

perspective of the benefits and drawbacks in classroom practices. In the active teaching and learning approach, teachers brainstorm and review their experiences in classroom practices. Some of the CPD initiatives in Uganda incorporate active learning to promote effective teacher education (MOES, 2018).

The CPD core feature of *coherence* relates training to teacher knowledge and beliefs, as well as policies in the Ugandan education system (Desimone, 2009). Charalambous and Hill (2012) explain that CPD has to align with curriculum materials and quality of instruction. In this study, the importance of CPD relates to improving the learning outcomes in the teaching of mathematics of Grade 6 pupils. In particular, how does CPD address learning opportunity in the teaching of pupils in primary schools of Uganda?

The CPD core feature of *duration* pertains to the sufficiency during the period that teachers attended the professional training. The CPD training varies from short-term to long-term depending on the training goals (Cohen and Hill, 2001). Regular re-training is vital for teacher effectiveness. The sufficiency of the duration of CPD depends on the hours of training in teacher participation and is a factor in teacher quality. In Uganda, for example, short CPD initiatives vary from one day to one month and typically do not involve certification.

The final CPD core feature is *collective participation:* engaging teachers in a community of practice. The research explores teachers' collaborative practices. Loughran (2013), for example, argues for CPD that influences collaborative learning and institutional framework support. According to Lave and Wagner, the aspects of communities of practice among teachers are critical for improving classroom practices (1990). The core primary teacher college incorporates the community of practice in the re-training of teachers (MoE, 2011).

The existing CPD interventions in Uganda support improvements in teaching practices. However, according to Nzarirwehi and Atuhumuze (2019), CPD implementation lacked proper planning. It had limited evaluation to ensure that it met the desired goals in teacher effectiveness and therefore was recommended for a review of teacher training approaches. A well-designed CPD promotes teacher change in instructional practices through increased knowledge, skills and change in attitudes and beliefs for effective classroom practices (Eraut, 1994; Heller, 2017). That means the training incorporates the core features of professional development and informs the required policies and strategies for improving quality teaching

and learning of a subject towards change in instruction as teachers apply newly strengthened competencies to meet learner needs (Blömeke and Delaney, 2012). From the three CPD definitions, a holistic picture emerges entailing the contribution of teachers' professional development in classroom practices. The next review expounds on the influence of policies, strategies and implementation of professional development for teacher change in classroom practices.

3.2 Effective continuous professional development

3.2.1 Effective policies and strategies of CPD

Mainstreaming of CPD initiatives is an essential aspect of the policies and strategies of an education system. At the global and national levels, practitioners engage in the development of policies and procedures for implementing CPD that focus on promoting good teacher professional practices (Darling-Hammond, 2000; UNESCO, 2014). Darling-Hammond, Hyler and Gardner (2017) argue structured professional learning results in changes to teacher instructional practices and improvements in student learning outcomes. Effective CPD calls for education practitioners to incorporate learning activities that equip teachers with refinements in knowledge, skills, values and competencies. The policies and strategies should include the five CPD core features of content focus, active learning, coherence, duration and collective participation.

The policies and strategies on CPD that benefit teachers include incorporating the curriculum and pedagogies in areas of discipline such as mathematics. In Uganda, the teacher training policies articulate the provisions in professional development (MOES, 2013). However, the study conducted revealed a deficiency in the implementation of a holistic approach to teacher training policies (UNESCO, 2014).

Another aspect of effective CPD is the extent to which the training integrates active teaching and learning in the use of knowledge and skills in classroom practices. The benefits to teachers include an expansion in knowledge and skills transferable into classroom practices (Gusky, 2000; Whitehouse, 2011). The ultimate goal is to incorporate active teaching and learning that culminates in quality instructional methods (Good, Wiley, and Florez, 2009). In the United Kingdom, a recently developed strategy requires external experts to train and empower teachers

of mathematics by making use of mental numeracy skills to enhance learning outcomes (CfBT, 2012).

Effective CPD involves follow up support in collaborative practices such as peer coaching and mentoring. South Africa has introduced a national policy framework for teacher education that incorporates a national strategy on teacher collaboration. In this policy, the community of practices is part of the new curriculum and teaching practices in schools (Meyer, Abel and Bruckner, 2018, p. 178).

Useful professional development for teachers encourages feedback and reflection on classroom practices. CPD promotes knowledge and skills used in classroom practices. According to Pawson and Tilley (1997), evaluations allow for reconstructing policy interventions as an interplay of contexts, mechanism and outcomes. CPD must be adequate in re-training and equipping teachers to improve their professional practice (Lessing and Witt, 2007).

Finally, according to Avalos (2011), CPD processes involve the professional learning and facilitation of teachers in ways that are diverse in models and duration. CPD models benefit teachers with knowledge and skills to support pupils' conceptual understanding and use of questioning to seek clarity of actions. Kennedy (2005) derived nine categories of CPD models: training, award bearing, deficit, cascade, standards-based, coaching/mentoring, the community of practice, action research and transformative. CPD models can be clustered in three progressive capacities – of transmission, transitional and transformative – as presented in Figure 3.2.

Model of CPD	Purpose of model		
Training	Transmission		
Award-bearing			Increasing capacity for professional autonomy
Deficit			
Cascade			
Standards-based	Transitional		
Coaching/mentoring			
Community of practice			
Action research	Transformative		
Transformative			

Figure 3.2: Figure: spectrum of CPD model
(Source: Kennedy, 2005)

Wilson (1981) insists that a CPD programme should be flexible, enabling student teachers to acquire a range of skills. For example, CPD activities can be formal structured topic-specific workshops or informal skills development (Desimone, 2009; Harland and Kinder, 1997).

Overall, an effective CPD depends on how the policies and strategies enhance the core features of teachers' professional development. The policy initiatives across education systems, while responsive to diverse CPD initiatives, are constrained by cost and effectiveness (UNESCO, 2014). As the ultimate aim of professional development for teachers is to improve learning outcomes (Opfer and Pedder, 2010), the next discussion reviews the literature on effective CPD in Sub-Saharan Africa.

3.2.2 Effective CPD practices in Sub-Saharan Africa

The majority of teachers in Sub-Saharan Africa (SSA) effectively lack voice and are bereft of well-established systems for feeding their skills through policy-making (UNESCO, 2014). Different researchers have various views on the effectiveness of CPD. Akyeampong, Lussier, Pryor and Westbrook, (2013) and Lowe and Prout (2019), for example, report limited effect on the improvement of teacher quality with CPD. Nzarirwehi's (2019) study determined CPD to be useful, primarily when properly planned, implemented and continually evaluated, replete with adequate resources and incentives. These contradictory findings require more exploration of the effects of CPD. This study, then, focuses on CDP benefits and drawbacks from teachers' perspectives. According to UNESCO-IICBA (2016), across the continent, CPD programmes have little investment in continuous professional development for teacher policy reforms or innovations and adaptation to changes in curriculum and assessment policy. Besides, though professional development involves partners, it is without any coordination and management of the content and only targets a limited number of teachers in coverage. However, there are reasonable attempts in a few countries like Ghana to implement policies that upgrade teachers' knowledge of new subject content and assessment practices through in-service courses or refresher programmes.

The challenges facing CPD initiatives in SSA countries, for example in Kenya and Namibia, include inadequate resources, poor delivery and lack of effective strategies to improve teaching standards (Lowe and Prout, 2019). According to Nyambe, Kasanda and Iipinge (2018), Namibia has sound CPD design but faces resistance from teachers' unions due to weak

implementation strategies. The process suffers from inadequate consultation with the stakeholders. However, in Ethiopia, the CPD initiative focused on improving teachers' subject knowledge and skills for handling difficult topical areas (Leu and Price-Rom, 2006). The CPD benefit, in this case, is the acquisition of teaching skills, values and attitudes as well as escalating ability to create a suitable environment for learning (Hart and Teeter, 2002). Besides, a good CPD practice is the institutionalization of evaluation mechanisms for rewarding teacher performance (Ingvarson, Kleinhenz and Wilkinson, 2007).

In Uganda, Wabuke (2016) reports the existence of a Teacher Development and Management System (TDMS). One benefit was that the core primary teacher training colleges (PTTCs) conduct outreach programmes as part of CPD for teachers in primary schools. Tutors from the PTTC engage in supportive re-training of teachers but require adequate resources and incentives (Nzarirwehi, 2019). This practice ensures CPD implementation involves facilitators from training institutions with experienced, practising teachers.

The next discussion, considering teachers' CPD and quality of instructional practices, highlights a detailed understanding of teachers' acquisition of pedagogical content knowledge and assessment practices.

3.3 Effective CPD for teachers of primary mathematics

3.3.1 CPD and relevance in the quality of teaching of mathematics

The benefit of CPD in Sub-Saharan Africa countries, including Uganda, is about quality of instructional practices and equipping learners with 21st-century skills (Clarke and Hollingworth, 2002). For example, in South Africa, the goal in professional development is to improve the quality of teaching mathematics as required in the curriculum. The quality of teaching mathematics calls for teachers to acquire procedural knowledge that is implicit in attaining specific competencies of the cognitive domain categories (Ndlovu, 2013). That means the teaching and learning process ought to equip learners with knowledge and skills relevant to the individual learner and life application. The goal is to implement CPD that connects to the needs of both the teachers and the learners. Desimone (2015) argues for CPD that incorporates teachers' classroom reflections; integrates procedural classroom behaviour; enriches learning with rural and urban contexts; and encourages the support of parents and

other leaders. The ultimate outcome of teachers' professional development is quality in the teaching of mathematics.

The overarching goal is that CPD promote quality in classroom activities by contributing to teacher change and better student learning outcomes (Clarke and Hollingworth, 2002), with teacher changes primarily in technical competencies of pedagogical content knowledge (Shulman, 1987; Baumert and Kunter, 2006). However, there are concerns about the ability of teachers to integrate knowledge around subject content, teaching strategies and collaborative learning. The main concern is to what extent teachers have the required mathematical proficiency for quality instructional practices. In particular, teachers have to interpret learners' written work, analyse their reasoning, and respond to the different methods pupils might use in solving a problem (NRC, 2001). In the case of Uganda, the results of the national assessment indicate challenges in the quality of teaching (MOE, 2013).

In essence, a teacher has to engage in classroom activities that create opportunities to learn. Kyeyune et al. (2011) suggest that teachers in Uganda face challenges in the teaching of learners, with a large majority of teachers showing weak foundational skills in mathematical concepts. Another study by Ndungo and Majuma (2019) argues that a teacher's ability to deliver is a function of that teacher's qualification, experience and commitment. That notwithstanding, the study reported a low level of pupil achievement in primary mathematics due to teacher commitment to classroom activities. Overall, the education system is obligated to offer relevant CPD that equips teachers with quality in classroom practices. The next discussion elaborates on teachers' pedagogical content knowledge in classroom practices.

3.3.2 Teachers' pedagogical content knowledge in classroom practices

As earlier articulated, teachers acquire pedagogical content knowledge to teach in a particular curriculum. *Pedagogical content knowledge* is defined by Shulman (1986) as "that special amalgam of content and pedagogy that is uniquely the province of professional understanding" (p. 9).

There are three forms of teacher knowledge: subject matter knowledge, pedagogical content knowledge and curriculum knowledge. A teacher's technical competencies in three domains of

pedagogical content knowledge are critical for effective instructional practices. There are three domains: subject content knowledge, knowledge of pedagogy and knowledge of how to teach mathematics (Simone, 1995).

CPD incorporates the necessary professional skills during training. According to Ndlovu's (2018) study conducted in South Africa, "*Many teachers are unfamiliar with learner-centred pedagogies espoused in the curriculum. Continuing to teach professional development (CPD) in subject matter knowledge (SMK) and learner-centred pedagogical content knowledge (PCK) is acknowledged to be a viable solution. However, for it to be relevant, CPD must be constantly informed by teacher needs and perceptions of self-efficacy*" (p. 1). The study underscores the need for professional development with a focus on a teacher's technical competencies and perceptions of self-efficacy.

Subject content knowledge

Shulman (1986) describes the domain of *subject content knowledge* as the amount of subject matter and organisation of the knowledge in mind. This definition refers to teacher adequacy in subject knowledge of mathematics as vital to meet the desired goals of teaching and learning. Similarly, Amade-Escot (2006) argues that in instructional practices, the relationship is a triangular one of teacher, students and subject knowledge. CPD promotes subject matter to improve teachers' understanding of knowledge and the nature of the transformation in teaching. Most important, as Brousseau (2002) insists, teachers face situations of making meaning of the subject matter gained and assuring better learning outcomes. Teacher subject content knowledge is incorporated in CPD training to achieve better learner understanding of the subject (Darling-Hammond and Bransford, 2005; Schoenfeld, 2005).

Teacher subject matter knowledge is twofold; the first involves understanding mathematical facts and concepts; and the second is the knowledge of mathematical procedures (Fennema and Franke, 1992; Haylock, 1998). CPD can improve teachers' knowledge of math facts and concepts, as mathematical facts and concepts are important to build each learner's foundation of mathematics. Learners with weak foundational skills lack the required knowledge to build on mathematics concepts and facts. This calls for effective teachers who have the qualities, mindset and behaviour to close this knowledge gap in learners with weak foundation skills (Akyeampong et al., 2018).

In terms of knowledge of mathematical procedures, this involves supporting learners' procedural fluency in solving mathematical problems. The goal of CPD is to equip the teachers with steps to perform mathematical procedures accurately. During the training, the emphasis is to engage learners with examples of life application in mathematics and provide guiding decisions and interpretations in problem solving. Studies from Kenya and Uganda reveal that some teachers are challenged by the content in mathematical procedures (Akyeampong et al., 2013; Bunyi et al., 2013; UNESCO 2012). Some teachers find it difficult to clarify mathematical ideas or solve problems that involve more than routine calculations (NRC, 2001).

CPD integrated with content knowledge increases teacher confidence and commitment in classroom practices. According to Hiebert and Grouws (1999), effective classroom delivery is demonstrated in knowledge, nature and purpose of tasks and activities required to engage pupils. An example is illustrated in Kenya, where a group of trained instructional supervisors equipped teachers with knowledge of mathematical proficiencies (Piper et al., 2016). Just as Grouws and Cebulla (2000) argue, an effective CPD supports teacher change to enhance learners' knowledge and reasoning. In particular, according to Rollnick and Mavhunga (2016), training on subject content as a stimulus of the discourse of pedagogical direction is imperative, with the outcome being teacher confidence in teaching due to a wider breadth and depth of understanding of the subject matter. Therefore, as Ball et al. (2008) state, content knowledge, as presented by the teacher, is how teachers organise classroom content structure.

Knowledge of pedagogy

CPD for teachers infuses training with knowledge of pedagogy. *Knowledge of pedagogy* refers to "the specialised knowledge of teachers in creating and facilitating effective teaching and learning environments for all students, independent of the subject matter" (Guerriero, 2017, p. 5). Training of teachers with knowledge of pedagogy promotes learner-centred pedagogy when incorporating active participation of learners in classroom practices (Shulman, 1986; Buhagiar and Murphy, 2008). Moreover, it involves training the teacher with actions that include encouraging learners to ask questions, active listening to learner responses, and clearly and deliberately answering questions. This teacher action encourages learners to ask questions that enable them to develop a deeper understanding of mathematical facts, concepts and procedures.

Sullivan (2011) agrees, suggesting that teachers need to develop capabilities for identifying and building learner understanding that involve asking and answering questions. In understanding classroom practices, Shulman (1986, p. 8) explores the following questions: "Where do teacher explanations come from? How do the teachers decide what to teach? How do teachers represent, question learners, and deal with problems of learner misunderstanding?" Answers to these and other questions call for CPD training that emphasises active listening to learners' questions, promoting confidence and attentiveness with learner proficiency (Timperley et al., 2010).

Knowledge of how to teach mathematics

CPD that incorporates knowledge for how to teach mathematics will improve teacher quality in classroom practices. The knowledge of how to teach mathematics refers to the pedagogic decisions that teachers use to engage the learners in the learning process. Teachers demonstrate competencies in the use of cognitive and technical procedures to develop learners' critical and high-order skills in mathematics (Cochran-Smith, 2005; Olsen, 2008). The goal of the CPD training is enriched teacher approaches for planning and ensuring delivery of mathematical content. Teachers must develop and evaluate their knowledge about the teaching by explaining, representing and exemplifying mathematics. In addition, teachers need to understand how to use particular resources, equipment and tools to support the learning of mathematics. Most important is that teachers make use of mathematical tasks and activities that promote interactive discussion (ACME, 2016).

The knowledge of how to teach mathematics in classroom practices means that teachers must have the skills to apply their knowledge, including helping learners to meet their learning goals and conducting learning activities to engage learners in substantive mathematical work. However, most professional development initiatives are inadequate in supporting teachers to develop, use and analyse that knowledge in the context of their classrooms (NRC, 2001). The training lacks tools or insufficiently engages teachers in equipping learners to attain higher-order levels of cognitive skills (Oliver and Rechly, 2007; Muijs and Reynolds, 2010).

Hughes and Acedo (2009) argue for professional development that ensures rigorous learning around facts and concepts to improve learners' abilities to solve mathematical problems. It is, they insist, about imparting learners with skills for accurate advancement in solving

mathematical problems. Therefore, CPD training has to assure teacher quality in the knowledge of how to engage in fruitful classroom practices. Effective professional development programmes, supporting teachers' knowledge of how to teach, thereby contribute to changes in instructional practices that bring significant gains in learner outcome.

After exploring the knowledge of how to teach, the next discussion focuses on the application of assessment practices in mathematics to monitor pupils' learning achievement in the classroom.

3.3.3 Teachers' classroom assessment practices in mathematics

CPD of teachers should incorporate training on classroom assessment practices. Assessment practices refer to a range of techniques to evaluate students' learning progression. Black and Wiliam (1998) define *formative assessment* as that which teachers use in the classroom to determine the extent of student mastery in a lesson. Classroom assessment involves the gathering of information on learners' strategies, understandings, attitudes, and prior knowledge and skills. During the teaching of mathematics, for example, assessment allows the teachers to understand what the learners know, not only to monitor student performance but to regulate their own teaching ability for conveying the content thoroughly and meaningfully. This includes the engagement of learners' prior learning to determine any gaps and use of written and verbal skills to analyse the information presented (NRC, 2001). Black and Wiliam (2006) argue that formative assessment provides evidence to teachers on what teaching tasks to adapt to meet learner needs. Teachers make use of a variety of forms of assessment to improve student learning. While a 'test' is the most common form of classroom assessment, teachers also make use of journals, observations, questioning and self-assessment. An assessment allows teachers to examine students' mathematical thinking, with feedback that clarifies *how* to best address learner needs (Suurtamm, Koch and Arden, 2010).

Some countries such as Sudan and Ghana have guidelines in place that stipulate mechanisms for developing skills and expertise in classroom assessment (Bethel, 2016). However, in both countries, the application of these guidelines is weak and lacks sufficient tools and resources in monitoring. Conversely, a study conducted in South Africa of Grade 4 indicates the CPD training of teachers integrates assessment practices, contributing to better learning outcomes (Umugiraneza, Bansilal and North, 2017). The success of the CPD training in quality of

instructional practices has attributed to the use of teacher-led instructional methods and formal assessments. In Ghana, while the implementation of 'assessment for learning' was ambitious and required distinct and context-specific approaches to classroom practices (Oduro and Hudson, 2015), the CPD training lacked innovative assessment practices that incorporated school leadership support.

Lessing and Wit (2007) explain that training of teachers in assessment equips them with skills for identifying pupil's thinking and building on areas of pupil weakness. It also supports teachers for change in classroom delivery that invokes confidence. Incorporating classroom assessment in CPD training encourages teachers to reflect on ways of tracking learning outcomes and identify the strength and weakness of learners in mathematics (Haylock, 1998; Fiona, 2014). Teacher can then modify the lesson planning and classroom tasks to match learner needs. Formative assessment involves the engagement of learners in a small group activity, individual activity or pupil presentation. Small groups bring pupils together to exchange the tasks and demonstrate their understanding of mathematical ideas with each other, an engagement of learners that enriches their logical thinking in mathematical problems (Pfannkuch, 2011).

Finally, an effective CPD integrates pedagogical content knowledge and assessment practices to equip teachers with technical competencies in classroom practices. The subsequent section presents a detailed account of the importance of teacher collaboration in CPD training.

3.4 Effects of CPD on teacher collaboration and motivation

3.4.1 CPD and collaborative teacher practices

Teacher collaboration in CPD design promotes a community of practice amongst teachers for sharing of best practices to enhance quality teaching and learning. Wenger (1998) argues that having a community of practice provides a situated learning context that allows a teacher to gain competence and ensure their experience of engagement. In particular, a community of practice is embedded within an activity, setting and culture (Laver and Wenger, 1990), usually unintentionally rather than deliberately.

The current experience is that a community of practice is extremely beneficial, bringing together experts to support teachers and promote sharing of classroom practices experiences. For example, in South Africa, one study indicates that professional development of teachers that incorporates a community of practice supports learning as experience, learning as doing, learning as becoming, learning as belonging and learning as 'mastery' (Graven, 2002). A similar argument espoused by Chaitanya and Brodie (2017) illustrates that the professional learning community should demonstrate teacher change in classroom practices. However, in this study, some teachers only made modest shifts in classroom practices while others maintained sustained transformation in their teaching. The learning activities in the professional learning community involved teachers' conversations about learners' errors and needs, allowing teachers to reflect on redesigning lessons to meet learner needs. Finally, a community of practice generates ideas and understanding of the differences in teacher classroom experiences.

There are three forms of teacher collaboration in a community of practice: peer-to-peer, mentorship and teacher associations. The peer-to-peer is about peer coaching and sharing of best practices. In peer-to-peer, Hughes and Acedo (2017) explain, teachers collaborate by creating a safe, respectful and challenging learning environment. Primary teachers in South Africa have benefited from peer coaching conducted as professional development in school premises. They engaged peer coaching through centralised training and classroom visits that involved observing teaching, providing feedback and demonstrating corrective actions (OECD, 2010).

Mentorship, slightly different, refers to activities that involve two teachers; one is a mentor and another, a mentee. Their relationship requires training and practice through actively listening, conducting observations and solving problems (Manca and Ranieri, 2017). Furthermore, note Griffiths, Thompson and Hryniewicz (2010), structured supervision and research mentoring aims at providing the best support to a teacher educator at all stages of a teaching career. In addition, it promotes positive aspects of individual and collective mentoring practices. In Uganda, the professional development support in mentorship targets newly recruited teachers. Tutors from the national technical colleges within the outreach programme conduct mentorship for the teachers deployed in schools within their jurisdiction. This involves induction training for new teachers, pedagogical support in lesson plans and team teaching (MOES, 2016). However good the intentions, these mentorship activities are not adequate to support teachers across the entire country and are limited to new teachers.

Another aspect to enhance collaborative practices is in the use of open educational resource (OER) materials, especially in research practices. In particular, Wolfenden et al. (2017) encourage deep engagement with OER for professional dialogue and collaboration that leads to productive teacher identities and transformation of the community's field of practice. In essence, CPD infused with collaborative practices contributes to sharing of experiences for vital change in classroom practices. The next discussion expounds on the aspects of CPD and teacher motivation.

3.4.2 CPD and teacher motivation

CPD that incorporates teacher motivation can influence instructional practice. According to Martin and Dowson (2009), *motivation* is a set of inner-related beliefs and emotions that influence and direct behaviour. Motivation is multifaceted: it can be intrinsic and extrinsic as well as rational and emotional. Extrinsic motivation refers to participating in an activity as a means to an end, while intrinsic motivation, or self-motivation, is the willingness to participate in an event for its own sake (Porter et al., 2003; Schunk et al., 2008). This implies that teacher motivation is associated with positive or negative feelings in commitment and attraction to remain in the teaching profession (Dörnyei and Ushioda, 2011; Sinclair, 2008). Clearly, when CPD supports motivation, it promotes teacher quality in classroom practices.

Most Sub-Saharan African countries contend with low motivation of the teacher workforce that is visibly evident in high teacher absenteeism and attrition. The causes of low teacher motivation include low pay and severe working conditions (Bennell and Akyeampong, 2007; Bennell, 2004). Lack of teacher motivation is a dilemma in huge CPD investments in Rwanda, as illustrated in low teacher commitment to quality instructional preparation (Muvunyi, 2016). The lack of transfer of CPD acquired knowledge and skill by teachers in classroom practices is also a serious concern. To address this concern, Heystek and Terhoven (2015) argue, motivation is a critical factor in teacher professional development.

In Uganda, as the World Bank (2012) states, teacher motivation is low, attributed to the insufficient and scattered reforms in the teacher policies. Notably, South Africa introduced teacher motivation strategies in CPD opportunities that included attracting professional rewards, financial incentives and accountability measures (Vegas and Umansky, 2005).

Intrinsic motivation is stirred through recognition, working conditions and linking CPD qualifications in career progression. At the same time, teacher quality of instructional practices relate to access of training and incentives. Some motivations for professional development include salary increases, promotions and reduction in teaching time. However, where participation is compulsory, teachers may focus more on fulfilling requirements than on taking advantage of opportunities for professional development.

The reviewed literature on CPD and teacher motivation concludes the aspect of understanding the benefits and gaps in teacher professional development. The next discussion outlines the conceptual framework of the study on the perspectives of the contribution of CPD in teacher quality in classroom practices.

3.5 Conceptual framework of the study

The conceptual framework outlines the contribution of CPD in the quality of teachers' classroom practices. The reviewed literature informs the areas of consideration in the findings of research questions 1 and 2. Research question 1 asks, "What are the teachers' understandings of benefits and drawback of CPD attended". Applying the model builds on teachers' understanding of the knowledge and skills acquired in CPD training attended. Similarly, the literature reviewed outlines how to address research question 2: "How do teachers make use of CPD training in teaching Grade 6 mathematics pupils?" In particular, teacher transfer of the knowledge and skills acquired in CPD training into classroom practices is demonstrated. Figure 3.3 illustrates the conceptual framework of a transformative CPD and teacher change in classroom practices.
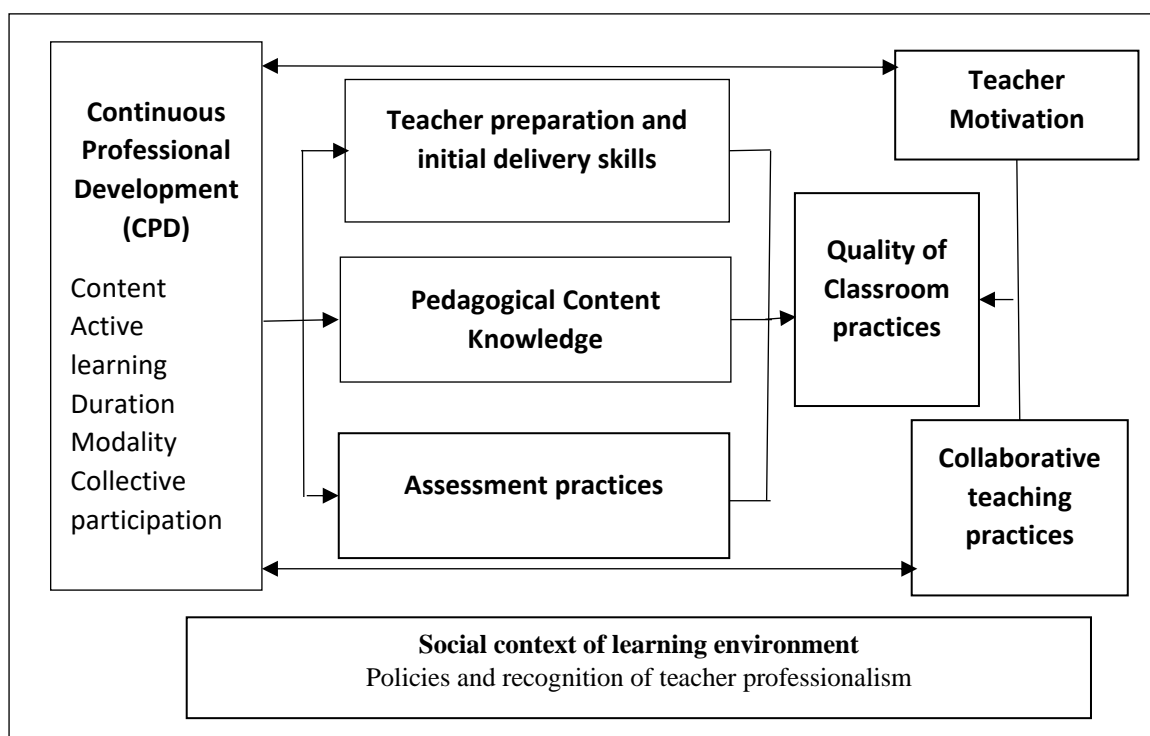
Figure 3.3: Conceptual framework of a transformative CPD for teacher change in classroom practices

A transformative CPD has critical features that include content, active learning, duration, modality and collective participation (Desimone, 2009). According to Schmidt (2010), CPD form and design are about the meaningful action and reflection of the instructional practices. CPD with a variety of activities stimulates teachers to adopt innovative teaching strategies. As Steffe and Wiegel (1992, p. 17) argue, teachers end up with harmonised instructional methods to support learners with the required knowledge and skills. Teachers gain in teaching and learning approaches that fit learner needs (Cobb and Yackel, 1998). For best results, teachers' perspectives of professional training need to inform the required CPD training. The duration of the teacher CPD participation allows profound lived experiences that assure adequate acquisition of knowledge and skills.

The skills and knowledge gained from CPD include the learning goals in teacher preparation and initial delivery, pedagogical content knowledge and assessment practices (Desimone, 2009; Cobb and Yackel, 1998; Steffe and Wiegel, 1992). Teacher quality relates to confidence and commitment to the use of knowledge and skills acquired from diverse CPD opportunities (Borko, 2004). Acceptable teacher preparation includes preparing schemes of work and lesson plans. The initial delivery includes lesson introduction, prior learning, teaching aids and gender perspective in classroom management. The aspect of pedagogical content knowledge covers

subject content knowledge, knowledge of pedagogy and knowledge of *how* to teach mathematics, the practice of teaching itself. Assessment practices consider the approach for providing tasks in solving a problem using whole class, small groups and individual presentation.

Sustaining quality in classroom practices stems from the technical competencies teachers acquire in CPD training. According to Cai et al. (2009), enquiry revolves around how teachers use gains in knowledge and skills for instructing properly and incorporating active engagement to cultivate learner interests. As such, in attaining teacher quality, pupils concomitantly acquire knowledge, develop their thinking and participate in problem-solving and critical thinking (Cobb, 1994; Cai et al., 2009; Piaget, 1973). The observed teacher changes demonstrate the effectiveness of the CPD attended. As Boaler (2001) argues, students do not merely learn from what they hear, but when subject to quality teaching they have opportunities to construct and re-contextualise knowledge.

The influence of CPD in classroom practices also depends on teacher motivation and collaborative teaching practices. Motivation factors endear the teacher to participate in CPD training and renew commitment to change in classroom practices. Collaborative teaching practices allow for the sharing of experiences through peer-to-peer and mentorship activities. Moreover, the social context of learning calls for support from school leadership through a clear school development plan and recognition of teacher professionalism (Bubb & Earkley, 2003; Leithwood, 2007).

Specifically, the conceptual study framework provides the basis for understanding the contribution CPD to the quality of teaching and learning mathematics in primary schools of Uganda. The findings are intended to inform the implications for policy and practice in CPD implementation in Uganda.

3.6 Summary

The literature reviewed demonstrates the relevance and effectiveness of CPD in contributing to the quality of teaching in classroom practices. The definition or CPD articulates the contribution to teacher change in classroom practices. In particular, the CPD definitions

promulgated by Hoyle and Megarry (2006), Day (1999) and MOES (2018) focus on teacher training to improve knowledge, skills and values for transfer in classroom practices. However, Hoyle and Megarry's (2006) definition is deficient compared to Day (1999) and the MOES (2018) in that these others articulate for holistic CPD that is continuous and which incorporates collaborative teaching practices. As illustrated by Desimone (2009), the core features of CPD are its content focus, active learning, coherence, duration and collective participation. Though the CPD initiatives in Uganda have incorporated the core features, they still, however, lack planning and are not holistic in implementation.

For an effective CPD implementation, there must be well thought out policies and strategies benchmarked at the global and national level. In Uganda, the literature reveals weaknesses in the implementation of a holistic approach to teacher training policies. Though the forms and design of CPD initiatives are diverse in Sub-Saharan Africa, they are detrimentally restrained by costs and effectiveness.

So, despite the existence of CPD for teachers, this CPD has only a limited effect on improving teacher quality. CPD investment lacks proper planning and implementation to allow the transfer of acquired knowledge and skills in classroom practices in many Sub- Saharan African countries, including Uganda. In some instances, like in Namibia, teacher unions have resisted CPD initiatives due to weak implementation strategies.

The ultimate goal of professional development is to improve the quality of instructional practices. CPD that uplifts the quality of teaching mathematics must equip teachers with knowledge and skills in pedagogical content knowledge, assessment practices and teacher collaboration. These technical competencies allow teachers to make use of classroom activities that create learning opportunities for pupils of Grade 6 mathematics.

Similarly, for CPD to be effective, policies and implementation strategies must be cognizant of teacher motivation. In Uganda, high teacher absenteeism and poor commitment in the transfer of CPD uptake in classroom practices are evidence of low motivation. Some countries, such as South Africa, introduced teacher motivation strategies in CPD that include attracting professional rewards, financial incentives and accountability measures.

Finally, from the literature review, a conceptual framework was developed that describes a transformative, effective CPD that leads to the transfer of knowledge and skills for quality instructional practices in the teaching of mathematics for Grade 6 pupils. The conceptual

framework illustrates the design of an effective CPD to equip teachers with technical competencies for quality classroom practices.

The next chapter introduces the methodology used in the study.

CHAPTER 4 : METHODOLOGY

This chapter is a narration of the methodology applied in the study. It begins with section 4.1, *Methodological perspective,* explaining the ontology, epistemology and my positionality. Then section 4.2 discusses research design, describing the choice of a qualitative case study. Section 4.3, *Sampling procedures*, explains the sampling of the schools and respondents. Then section 4.4, *Research instruments,* explains the tools developed for interviewing the participants. The next section 4.5 involves data collection procedures on what took place and section 4.6, *Data analysis*, explains the inductive techniques in generating themes and interpretation. Section 4.7 includes a discussion of trustworthiness, describing the reliability, validity and transparency of the case study; and section 4.8 presents ethical considerations in the research. Section 4.9 presents the limitations of the study and finally, section 4.10 presents the summary.

4.1 Methodological perspective

4.1.1 Ontological perspective

The ontological viewpoint is that reality is in the observed phenomena from a social perspective of the nature of being and its existence (Freimuth, 2009; Cohen and Manion, 1989). It is about getting a deeper meaning into how participants feel inside, how they interpret and reflect on their daily, routined experience (Creswell, 1998). As a researcher, I had direct contact with participants that afforded an in-depth, subjective understanding of their lives. This contact led to a deeper understanding of how participants perceive and experience the world from a subjective basis (Cohen and Manion, 1989). I made use of an interpretivist paradigm to unravel the subjective meaning of the participants' realities.

The phenomenon of the study is the teachers' CPD lived experiences. CPD training activities are related to daily teacher routine as replicated in classroom practices. Brown (2005) argues that social interaction defines circumstances that enable or constrain the learning environment; the understanding is that participants assimilate the phenomena of CPD training experiences in their teaching environment.

This study concerns participant reflections on an event and how that event was crucial to the understanding of their beliefs and intentions (Goldkuhl, 2012). According to Hamilton and Pinnegar (2015), each participant's context of human action and interaction is potential for

unpredictability, growth and change. It called for the study to follow an interpretivist approach, as this allows for immersion in a setting and interaction with participants to make meaning of their perceptions of the phenomena.

4.1.2 Epistemological perspective

The study epistemology concerns the belief in the origin and acquisition of knowledge (Hofer, 2004), with epistemology specifically considering teachers' views, values and beliefs, acknowledging that they construct their meaning and in different ways (Denzin and Lincoln, 2005). Keiny (1994) suggests a constructivist theory that allows a researcher to discard the notion that knowledge is a world in itself, independent of the view of an observer. In essence, knowledge becomes a construction of the individual's subjective reality. In this study, the focus of knowledge is how teachers' CPD lived experiences influence classroom practices (Frid, 2000).

The epistemological assumption seeks to answer, "How can we acquire knowledge?" and once acquired, "How does the knowledge transfer occur to other human beings?" (Cohen et al., 2001). The study seeks to ascertain the meaning of how individuals construct reality in social situations (Denzin and Lincoln, 2005). In particular, professional development is learning for change in knowledge, skills and practices. According to Keiny (1994), the gap between intended and actual teaching behaviour brings about a disconnect of what teachers are to do and how they teach. CPD training, then, seeks to minimise the gap in teacher assertiveness in the reflection of knowledge and practice. In reality, teachers construct their practice through an active dialogue with the materials that constitute their field of action.

CPD training of teachers can bring change in knowledge and competencies, contributing to pupil opportunities for learning. CPD reality has no single correct representation for teacher quality in classroom practices. Most important, effective teaching ceases to constitute one objective truth, as its analysis is complex, multi-faceted and multi-dimensional.

The study seeks clarity of emerging issues pertaining to phenomena of teachers' CPD experience by understanding the various ways participants construct meaning (Schensul, 2012). In this case, I do not assume facts as objective truth but focus on the findings and conclusions derived in the study. In addition, I make use of diverse subjective views and tools

to reflect different aspects of the research paradigm. The analysis is inductive with emerging theoretical perspectives and data analysed and interpreted to formulate the underlying implications for policy and practice of CPD.

4.2 Study positionality

My study positionality emerges from years of experience in education research coupled with my passion for understanding quality of teaching and learning. In 2011, I analysed the contribution of government investments in school resources and school effectiveness (Onsomu et al., 2007). Then in 2013, as UNESCO Project coordinator, I was engaged in policy formulation in the harmonisation of teacher education policies and management in capacity building of teachers to achieve Education For All (EFA) in Uganda. This role motivated my choice to conduct a study on teacher professional development in my doctoral studies within the global vision of teacher quality for better learning outcomes (MOES, 2014). From this position, I had direct interaction with the national education officials on the development of teacher education programmes.

I considered myself an "outsider" in my encounter with the teachers who were my primary target in the research. In particular, being an outsider allowed me to gain valuable insight into information from the teachers on their lived CPD training experiences. As an outsider, I earned the trust of the participants, so they had no fear of confiding about the CPD attended. My reflection was critical, as it allowed me to engage in thoughtful appraisal of the nuances of conversation and a way of ameliorating power imbalances in the study with participants (Nakray, Alston and Whittenbury, 2015). As an outsider and Project Coordinator, I considered power imbalance, and in particular, how participant responses could be tilted to seek favour in CPD opportunities. As a researcher, I had to limit participants' individual interests through a participatory approach, pointing out the policy implication of the research in the quality of teaching and learning (Green and Thorogood, 2018). The aspects of power imbalance relate to the in-depth interviews of teachers and focus group discussions of the pupils.

I also recognised that an interview is a social encounter, and as an independent observer, it is possible for me to benefit from the interchangeable role of "insider" and "outsider" (Kerstetter, 2012). In conducting interviews with the education officials, I considered myself an "insider" since I worked with the participants in teacher education programmes. I was conscious of my

positionality with the education officials and took into consideration sensitivity that can resonate in the interviews. In particular, as an independent researcher, I assured participant confidentiality and independence in my research undertaking to minimise my influence.

Dwyer and Buckle (2009) explain that a researcher can occupy the positions of "insider" and "outsider" depending on each specific context. In particular, as "insider" I had the privilege of understanding the phenomena and gained a deeper understanding of the issues related to the research questions. Similarly, insight was achieved with teacher interviews as an "insider" when probing their lived experiences. It was a unique position to be an "insider" and "outsider" in a different context at national and school levels, respectively. This position minimised biases in my understanding of the participants' reflections on CPD training (Langellier, 1994).

Therefore, this paradigm of the methodological perspective of interpretivism allows for the presentation of the next discussion on the research design of the study.

4.3 Research design

The research design is a qualitative case study that sets to generate contextual, nuanced and authentic accounts of respondents' experiences (Schultz and Avital, 2011). A *case study* is defined as an intensive analysis of an individual(s) experience in phenomena, stressing the developmental factors of the environment (Flyvbjerg, 2011). The phenomena in this study are the participants' lived CPD experiences. The use of a case study generates rich data and thick descriptions of human behaviour presented in a physical and social context of intentionality. By contrast, quantitative studies are limited to a thin description of the phenomena of relationships between constructs (Brekhus et al., 2005). A case study, in this instance, allows for a deeper understanding of the teachers' CPD lived experiences.

To ensure generation of in-depth data, I made use of critical discourse analysis in the study. Fairclough (1993) explains that critical discourse analysis systematically explores opaque relationships in discursive practices, events, texts, social and cultural structures, relations and processes. In this qualitative case study, the use of critical discourse analysis enhanced the analysis of written and spoken texts to reveal issues of dominance and equity in a phenomenon. Specifically, I applied a critical discourse analysis approach to discover the meaning of

practices and events using the texts that arose. In particular, the study explores the relationships between discourse and society itself as a factor in securing power and hegemony.

More so, construction and representation of a social world allow a researcher to describe, interpret and explain relationships (Rogers, 2004). In this study, I wanted to explore how teachers experience their CPD and relate them to their classroom practices. Gee (2011) states that generating the meaning of research includes discourse analysis of events. In this case, the lived CPD experiences relate to the teachers' understanding of gains in knowledge and skills, followed by how the teachers' knowledge and skills acquired influence change in classroom practices. Textual analysis of participant narratives explain the nature of the phenomenon that teachers consider as CPD benefits or drawbacks.

As a researcher, I had to reflect on the verbal responses and body actions in observed classroom practices in conjunction with participants' perspectives of how CPD influences the teaching and learning process. Critical discourse analysis aims at making connections of discourse practices with the social practices of the participants. The next section explains the sample and sampling procedures of the study participants.

4.4 Sample and sampling procedures

As a qualitative case study of primary schools, this research made use of a purposive sampling technique using a framework of 1,232 primary schools in 112 districts in Uganda that participated in the 2012 National Assessment for Progress in Education (NAPE). An annual assessment report is published on pupil learning outcomes for Grade 6 numeracy. In the 2012 NAPE report, one outcome determined persistent low achievement in Grade 6 pupils' mathematics and teachers' weak pedagogical skills. In this purposive sampling, the first stage involved the selection of two districts, followed by a selection of specific schools from the two districts that participated in the assessment (Marshall and Rossman, 2011; Creswell, 2003; NAPE, 2012). The criterion for selecting the districts was the location (one rural and one urban) and proximity to my working station when conducting the study (Collingridge and Gantt, 2008).

Stage 2 of the purpose sampling involved the school sample size. A sample size of five to 15 is suitable for a qualitative study of schools selected from two districts, one urban and rural

(Gray, 2005; Miller and Salkind, 2002). There were a total of 18 public and private schools in two districts (Appendix 1). Since government CPD resources were primarily directed at public schools, the sample was drawn from public schools within the two districts identified. Five public schools from the urban district and five public schools from the rural district participated in the 2012 national assessment. Since the study targets teachers as the primary participants and qualitative research can have five to 15 participants, ten teachers of Grade 6 mathematics were selected for the study.

The selection of the study participants was also purposive at national, sub-national and school levels: two education officials responsible for CPD (one national from the department responsible for CPD and one at CCT at cluster level); one headteacher from each primary school sampled; one Grade 6 teacher from each primary school sampled; and six Grade 6 pupils from each of the schools. Since each school has one headteacher, all nine headteachers were selected. In the case of teacher participants, the target was those teaching Grade 6 mathematics. Thus, the sampling of teachers involved one teacher teaching Grade 6 mathematics from each of the selected primary schools; hence, a total of 10 teachers. In addition, from each school, six Grade 6 pupils were selected using simple random sampling from the class register.

The study made use triangulation (Groenewald, 2004), as it included interviews with pupils, headteachers, education officials and managers of CPD initiatives. In total, the study involved nine teachers (one teacher dropped due to sickness), nine headteachers, 54 Grade 6 pupils and two education officials. The next section describes the research instruments that target the three categories of participants.

4.5 Research instruments

As a qualitative case study design, the research instruments adapted were semi-structured interviews with guiding questions. Interview questions that were open-ended, neutral, sensitive and understandable (Britten, 1999) allowed for flexibility in discovery or elaboration of information that is important not only to the participants but also to address the study framework (Appendix 2). The three types of qualitative tools used were in-depth interviews, observation schedules and focus group discussion guides. At the beginning of the study, a document analysis guide was prepared to analyse documents on CPD initiatives to identify areas of focus in the research instruments that target specific participants (Appendix 3).

The in-depth interview guides were open-ended tools designed to capture the teachers' CPD lived experiences in the last three years (Appendix 4). According to Alshenqeeti (2014), interviews are more powerful than questionnaires for eliciting narrative data. Interview methods allow for the investigation of participant views in greater depth. Likewise, as Cohen and Omery (1994) note, an interview is a valuable tool that allows for exploring the construction and negotiation of meaning in a natural setting, broadening the scope of understanding the phenomena under investigation. Each teacher's in-depth interview involved answering the questions on CPD forms, duration, providers, professional training needs and challenges. The questions sought to understand how these teachers used the training in their classroom practices.

Another set of in-depth interview guides targeted headteachers (Appendix 5) and education officials (Appendix 6). The in-depth interviews of headteachers and education officials elicited information on types of CPD training, teacher practices and challenges in the teaching of mathematics. The in-depth interviews provided rich information. The two tools, both open-ended and used to obtain information surrounding CPD, aided in data triangulation with the teacher data and education officials (Appendix 6).

The lesson observation schedule, a semi-structured tool for Grade 6 classroom practices, captured the teaching episodes in the 35 minutes of classroom practices (Appendix 7). Use of an observation tool, according to Cohen, Manion and Morrison (2011), supports compilation of subjective and detailed data. The instrument was developed to enrich understanding of how teachers apply technical competencies in classroom practices. The design was flexible, constructed and reconstructed to meet the research goals. The use of a lesson observation tool contributes to observing and unpacking the sophisticated features of body and language assessment (Rahman, 2016). The information captured from the lesson observations included teaching strategies, teacher-pupil interactions and evaluation practices. At the end of each lesson observation, teachers engaged in post-lesson reflection.

A CPD training observation schedule, another semi-structured tool, was employed to observe and record the training of the teachers (Appendix 8). Using the observational techniques allowed for gathering information on classroom practices on processes and behaviours in a learning environment (Patton, 1990). The form and design of CPD were focused on the learning

goals, were grounded in the content of teaching, were organised around collaborative problem solving and were integrated into a comprehensive change process (ESA, 2012).

Data collection also involved focus group discussions (FGD) as a tool to capture perspectives of pupils (Appendix 9). An FGD guide allows a researcher to select topics of interest using a purposive technique (Schostak, 2005). However, it requires skills in moderation and note taking and is more time consuming (Smithson, 2000). In this study, the FGDs of Grade 6 pupils elicited pupil attitudes to mathematics subjects, topics they liked and what they did not like in mathematics classrooms and homework.

Other in-depth interviews conducted involved two education officials (Appendix 10). The information obtained provided the understanding of the coordination of CPD initiatives and implementation at national, sub-national and cluster levels. It also provided insight into the coordination and implementation of professional activities with other stakeholders.

Based on the research instruments, the next discussion is an explanation of how the data collection occurred.

4.6 Fieldwork

The study was designed to ascertain teachers' CPD lived experiences in the last three years and articulate their understanding of its contribution to the quality of their instructional practices. Permission and approval letters were sought from the Ministry of Education and Sports to visit the schools. The fieldwork comprised face-to-face meetings with the participants at national, sub-national and school levels from June to August 2015. Fieldwork commenced with an appointment with the education officials at the national level followed by district and schools. The Centre of Coordinating Tutors (CCT) coordinated my interview appointments with headteachers from the nine primary schools. Figure 4.2 provides a detailed mapping of the fieldwork.
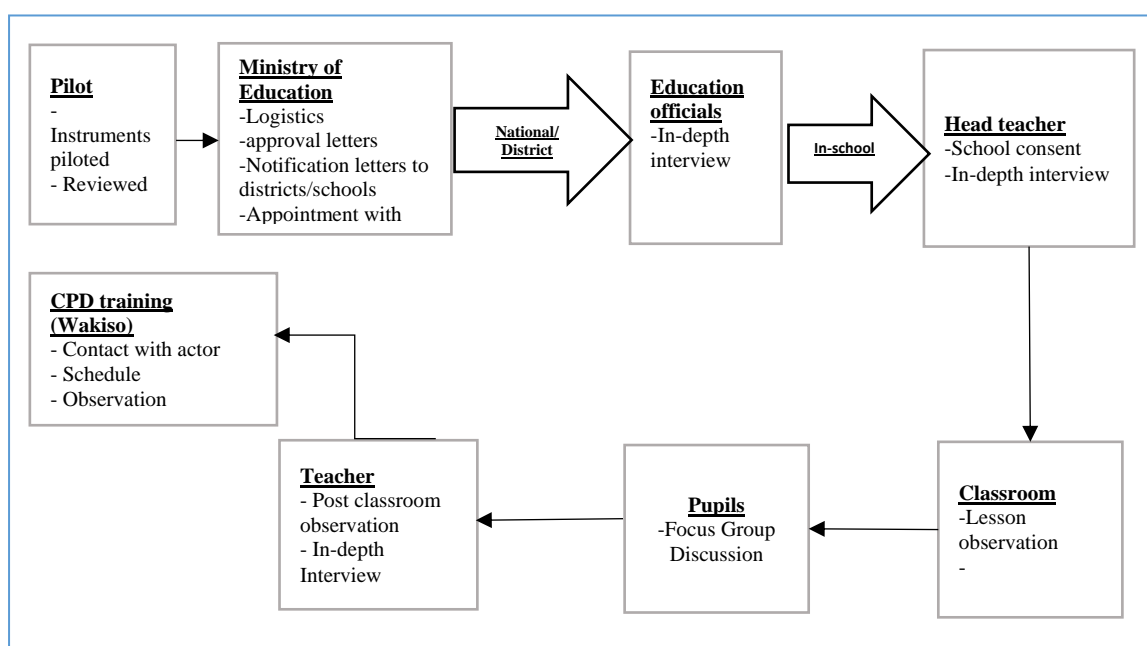
Figure 4.1: Steps taken in data collection at the national, district and school levels

After the data collection instruments were piloted and reviewed, meetings provided a background of the structure of the CPD at all levels of education administration. During the interviews, consent sought from headteachers and teachers, including approval for audio recording.

In school, the headteachers played a crucial role in setting the ground for classroom observations, FGDs with Grade 6 pupils and interviews of the teachers. Consent forms were signed with approval from parents to hold discussions with the Grade 6 pupils. The first to be interviewed was the headteacher who provided critical information on the school development and follow up support for teachers, including CPD opportunities. I obtained the profile of each school's CPD development plan and an explanation of how the school management addressed concerns for quality teaching and learning. Then I conducted the Grade 6 mathematics lesson observation for 35 minutes. The lesson observation included observing the verbal input and body actions of the teachers while audio recording the teaching episodes. Following that, FGDs with Grade 6 pupils revealed their perspectives on the learning of mathematics. Finally, an in-depth interview was conducted with the teacher, starting with post-lesson observation and reflection of their classroom practices as relating to the CPD lived experiences. Then a meeting with one CPD provider culminated in attending a CPD training where I observed and interviewed two participants to hear their learning perspectives. A follow-up was conducted with education officials to reconfirm some aspects of the data gathered from the teachers.

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Overall, the participants provided valuable insights on lessons learnt and challenging situations stemming from their CPD participation.

At the conclusion of the fieldwork, transcribed interviews of nine teachers, nine headteachers, 54 pupils, two education officials and one CPD manager were collated. The notes I had written in a diary contained useful comments observed during the in-depth interviews. The next discussion explains the data analysis techniques.

4.7 Data analysis

Data analysis took place in three consecutive cycles, as presented in Figure 4.3 that depicts the qualitative analysis coding and interpretation processes. Cycle 1 of the analysis procedure is content analysis and transcription. Cycle 2 is the coding of themes from the transcribed interviews. Finally, cycle 3 is mapping of key issues, data interpretation using critical discourse analysis and report writing.

4.7.1 Analysis procedures in cycle 1

The first cycle was a literature review of policy and project documents on curriculum delivery processes, pedagogical practices and CPD initiatives (Holsti, 1969). Transcription of interview notes followed for the teachers, headteachers, pupils, education officials and CPD training interviews. Strauss and Corbin (1998) argue that transcription builds on theoretical sensitivity and brings the researcher closer to the data by allowing review and constant comparison of the interviews.
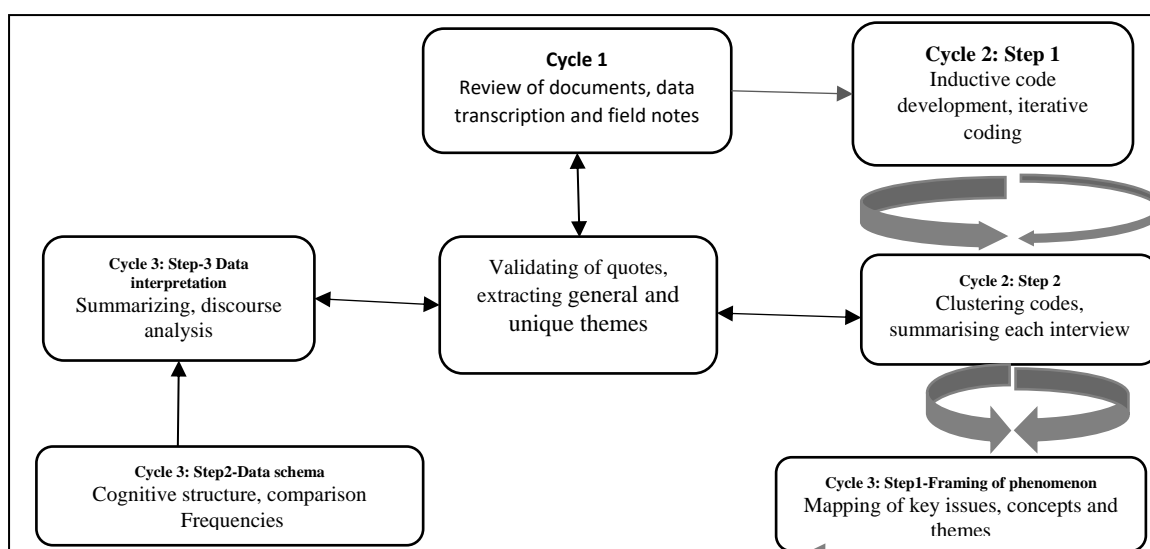
Figure 4.2: Qualitative analysis coding and interpretation process

4.7.2 Analysis procedures in cycle 2

Cycle 2 data analysis involved inductive code development followed by clustering codes and validation of unique themes. In step 1 of inductive code development, I did iterative coding taking into consideration the deliberate and purposeful understanding of the meaning of the phenomenon of teachers' CPD lived experiences. However, as a researcher, I did not have to take a position either for or against the purpose of the data coded. The code is a short phrase that symbolically assigns a summative, salient attribute of the data (Saldaña, 2016). The iterative coding process allowed me to organise data with similar or common meanings involving concepts and data that were relatively simple and direct.

In step 2, code clustering, I clustered the codes prepared in step 1 and summarised each interview. From the interview summary, I derived meanings by looking at the relationship between categories and gathering them to form themes. The process involved a rigorous examination of the list of groups of significance. At this time, I tried to elicit the essence of the meaning of units in a holistic study setting. The process continued with the data until there were no new emerging concepts (Trotter, 2012). The clusters of themes formed were based on identified important topics or significant groups.

4.7.3 Analysis procedures in cycle 3

Cycle 3 had three steps: mapping key issue concepts and themes generated; data schema of the cognitive structure of ideas and themes with the frequency of occurrence; and data interpretation using critical discourse analysis and the final report writing. The first step mapped concepts and issues of an exhaustive description of participant experience of the CPD phenomenon. It involved harnessing the participants' diversity in CPD events and comparing commonalities and differences.

The second step involved constant comparison of the data codes to uncover and explain patterns of variations (Strauss and Corbin, 1998) such as a comparison of data from one interview or theme with data sets that were either similar or different. I examined the data critically by making meaning out of it. In engaging a substantial amount of judgment, I consciously connected with my pre-suppositions to avoid inappropriate subjective opinions.

The third step was data interpretation: triangulation of the teacher data with information from education officials, headteachers, pupils and report writing. The explicit use of discourse analysis in data interpretation informed the CPD benefits and drawbacks, as well as knowledge and skills transfer in Grade 6 mathematics classroom practices. The information from the data analysis informed the findings and policy implications.

4.8 Discussion of trustworthiness

In this study, I engaged in rigorous approaches to ascertain result trustworthiness. According to Cope (2014), *trustworthiness* or *rigour* of a study refers to the degree of confidence in data, interpretation and methods to ensure the quality of a survey. I established protocols and procedures that enhanced the similarities in a different context. To ensure trustworthiness, the study considered approaches that assure credibility, dependability, confirmability and transferability (Lincoln and Guba, 1985).

Credibility calls for the accurate identification and description of participants and sampling methods. The study credibility was assured through precise identification and characterisation of the participants in the sampling methods. A clear sampling procedure documented no bias

when using purposive sampling of the target study area, schools and teachers. As a qualitative study, the protocols and procedures of data collection involved the use of open-ended and semi-structured interviews (Golafshani, 2003; Altheide and Johnson, 1994; Yin, 2006). For comparable responses, the same in-depth interview guides were used to interview the participants of the study. This way, similar responses are assured and trustworthiness and consistency are guaranteed. Therefore, the same procedures, if repeated, would generate similar conclusions (Seale, 1999). Besides, I was the only researcher conducting the interviews and was conscious of the questions asked, which I considered when transcribing the audio recordings.

In terms of dependability, procedures used in data collection are documented and can apply at different stages of data collection over the duration and in various contexts. Dependability refers to the stability of data over time and under different conditions. In this study, the principles and criteria used to select participants were clearly stated. In addition, the use of common questions ensured consistency of data from teachers with data from headteachers, pupils and education officials (Babbie, 2010).

Study conformability came through accurately representing information that the participants provided as this allowed for accurate data interpretation (Cope, 2014). During data analysis, the use of inductive analysis and comparison generated meaning from the codes and themes that emerged. This allowed for documenting the similarity of ideas obtained from participants' reflections in a transparent manner (Bolger, 1999). Field notes verified the perspectives and understanding of the phenomenon observed. Finally, I relied on participant voice within the enquiry and included quotations in the findings. In this way, the results assure conformability and transferability of the findings to other settings.

The study, therefore, maintained trustworthiness, and in the next section, I describe the ethical considerations of the research.

4.9 Ethical considerations

This research was carried out with ethical procedures and approval sought from the relevant authorities. The Ethical Review Committee of the University of Sussex approved all documents

(Appendix 10). Letters of introduction for the research and consent forms for the respondents were prepared and endorsed. When conducting the interviews, I presented information to the respondents on the benefits of the research. The consent sheet (Appendix 11) contained information on the purpose of the study and the reasons for participation. The participants were informed of the selection method, and it was explained that as the results were general, not attributable to any person, there were no risks in taking part in the study. Moreover, the results would provide evidence for policies and plans for teacher professionalism in Uganda.

Furthermore, informing the participants that the survey was part of my professional doctoral studies at the University of Sussex, I assured participants that on request, they could obtain a copy of the study results. I also discussed the consent verbally, and requested that the consent form be signed, indicating their acceptance. The headteachers secured permission from parents for interviews of pupils and consent forms signed.

To ensure confidentiality, I transcribed the interviews anonymously and had the records secured, in safe custody, archived in a documentation data bank. All the interview narratives, field notes, and audiotapes were confined in safe storage. As a researcher, I was guided by the professional code of conduct and in line with Ugandan legal requirements on the execution of research projects and general research norms. I complied with the principle of voluntary participation and the law of anonymity through omission of participants names in the report. In addition, the participants joined the study voluntarily, without inducement and coercion. Confidentiality was maintained by destroying field notes and audio records at the completion of the project. I gave due diligence to cite all authors of all documents in the research mentioned in the study report.

4.10 Limitations

The study limitation was primarily the restricted time as I was employed full-time in addition to resourcing this comprehensive study. Being employed full-time meant I could only use my leave days and weekends for fieldwork and follow up visits. Though I had a competing interest in time, I made prudent use of available time to maintain stringent research quality.

Another study limitation was that the scope was constrained to the historical perspective of CPD training attended in the previous three years. Therefore, in the argument of Flyvbjerg (2004), the use of qualitative data on teachers' understanding and experience results cannot authenticate generalisability. However, attempts were made to achieve some degree of generalisation by ensuring trustworthiness and the potential for replication in another context of a study of teachers' CPD (Cohen, Manion, and Morrison, 2011).

4.11 Summary

To summarise, the study ontology is interpretivist to obtain a deeper meaning of teachers' lived CPD training experiences as a reality of the phenomenon. The epistemology considered CPD in the context of social constructivism. Researcher positionality was that of an independent researcher who is both an "outsider" and "insider".

The research design was a qualitative case study of teachers from primary schools in Uganda. By using a purposive sampling technique, nine teachers were selected from nine primary schools in one urban district and one rural district in Uganda. Other respondents included two education officials, nine headteachers, and 54 Grade 6 pupils. The research instruments used were in-depth interviews, observation schedules and focus group discussions.

Data collection took place from June to August 2015 and data analysis involved the use of critical discourse analysis. Data analysis was an inductive process of three cycles involving transcription, coding, theme development and data interpretation. Study trustworthiness assured credibility, dependability, conformability and transferability. Ethical considerations included university approval, consent from participants, and confidentiality and anonymity of data and information. Finally, the acknowledged limitations of the study entailed duration, budget and the scope of CPD that teachers covered.

This detailed account of the study methodology sets the stage for the next chapter, elaborating the presentation and discussion of the research setting of the case study schools.

CHAPTER 5 : RESEARCH SETTING OF CASE STUDY SCHOOLS

This chapter explores the research setting of the case study of the schools in Uganda. Section 5.1, *Study practice in the nine primary schools*, explains the events engaged in each school. Section 5.2, *Contextualising the nine case study schools*, describes the context of the schools during the research practice. Section 5.3, *Understanding CPD contribution to teachers' classroom practices in mathematics*, describes the learning goals of the CPD that teachers attended. Finally, section 5.4 summarises the chapter.

5.1 Context of the study area and schools

5.1.1 Socio-demographic information of the selected urban and rural districts

The research was conducted in two districts, one rural and the other urban. The rural district involved five public primary schools while the urban district had four public primary schools. The study targeted primary schools in the two districts that had participated in the 2012 national assessments (NAPE, 2012).

Rural district

While the main economic activity of the rural district is agriculture, it is rapidly becoming urbanised and changing to trade and industry. In 2014, the district had a total population of 2.0 million and a net attendance rate of 81.1% of the 6-12 year old primary school-age population (UBOS, 2017). In this study, the rural district had five public primary schools visited. Only two of the five schools had a secure learning environment with a gated compound. These same two schools had a large school population with a Grade 6 class size of 87 and 130 pupils, respectively. In contrast, three remaining schools had a small class size of 16, 25 and 27 pupils.

Urban district

In the urban district, the main economic activity is trade and industry. The data indicates that in 2014, the urban district had a population of 1.5 million and a net attendance rate of 85.0% of the 6-12 year old primary school-age population (UBOS, 2017). In this study, the urban district had four public primary schools visited, with all schools having a secure learning

environment within a gated compound. Three of the four schools had a large school population with Grade 6 enrolment of 128, 132 and 149. The fourth school had smaller Grade 6 enrolment of 25 pupils.

5.1.2 School visits research events

This research practice involved nine primary schools from two districts in Uganda. Visits were scheduled to each school on one specific day within one month. The visits entailed in-depth interviews with the headteachers and teachers of Grade 6 mathematics and observations of Grade 6 mathematics lessons. The school visit started at 8 am and ended at 12.30 pm. However, in two out of nine schools, the time was rescheduled from 12.30 pm to 4.30 pm. The first interview involved the headteacher and, on average, lasted 40 minutes. The headteacher explained the general school performance, mathematics performance and school CPD plans.

After the headteacher interview, the second task was to conduct a class observation of Grade 6 mathematics. The first step was to obtain the schemes of work and lesson plan. The lesson observation lasted 35 minutes, during which notes were compiled on the teaching episode and the class was audio recorded. The topics prepared and presented in the Grade 6 mathematics lessons in the nine schools varied.

After the class observation, the next activity was to conduct a focus group discussion (FGD). The class register was provided and using random selection, three boys and three girls were selected. The FGD of the Grade 6 pupils took 30 minutes during break time. The pupils were enthusiastic and active in expressing their opinions on the teaching and learning of mathematics.

The final interview with the Grade 6 teacher of mathematics in the nine schools, lasting approximately 45 minutes, commenced after the observation of the mathematics lesson to

allow the teacher time to reflect on the classroom practices. It was followed by an in-depth interview of the teacher's professional learning experiences from the CPDs attended in the last three years. The conversation engaged on CPD opportunities and the teacher's understandings of the benefits and drawbacks. The interview also sought the teacher's reflection on effects of the acquired knowledge and skills in CPD attended on classroom practices. The teacher also explained the areas of strength and weakness in the teaching and learning of mathematics of Grade 6 pupils.

The next discussion elaborates on the contexts of the classroom events and learning environment of the nine case study teachers.

5.2 Contextualising the nine case study teachers

The teachers in this case study on CPD lived experiences are from nine schools that participated in the 2012 National Assessment for Progress in Education (NAPE). According to Husband et al. (2003), the context of a case study provides formidable background information when describing the events in the research. Therefore, the setting of the case study teachers illuminates the characteristics and the events in the classroom. In this section, the vignettes of nine teachers depict the lived CPD experiences and the instructional practices in the teaching and learning of Grade 6 pupils in mathematics.

5.2.1 Teachers from the rural district schools

The selected rural district in this study had five teachers from the targeted five public primary schools. The schools were located in five different cluster centres in the district under a Centre for Coordinating Tutor (CCT). Table 5.1 illustrates the rural district teachers' classroom environments and CPD attended.

Table 5.1: Rural district teachers classroom environment and CPD attended

Teacher	Sex of teacher	Grade 6 enrolment	Pupil textbook ratio	Mathematics lesson observed	Type of CPD attended in the last three years		
					CCT visit	Pedagogy	subject content
Teacher 1	Male	87	1:5	Money	√	√	√
Teacher 2	Female	130	1:8	Construction	√	√	√
Teacher 3	Female	27	1:4	Statistics	√	X	√
Teacher 4	Male	25	1:4	Improper fractions	√	√	X
Teacher 5	Male	16	1:4	Fractions	√	X	X

The study involved three male teachers and two female teachers, with only two of the five teachers having a large class. The CPD professional learning experience was in four CPD modalities: school-based training, cluster-based training, cascade training and higher education institutions training. The nine teachers reported to have received support supervision visits by the Centre for Coordinating Tutor (CCT). The learning goals of the CPD training included teacher preparation and initial delivery skills, pedagogical content knowledge and classroom assessment. Vignettes of the five teachers from the rural district illuminate their CPD lived experiences and observed classroom practices.

Teacher 1

This is an overview of the learning environment, CPD opportunities and observed Grade 6 mathematics lesson for Teacher 1. Teacher 1 is from a school located in a rural district. Teacher 1 taught Grade 6 mathematics class with an enrolment of 87 pupils, as shown in Table 5.1. In the three years preceding the study, the teacher participated in CPD training opportunities with learning goals of pedagogical training skills and subject content. The teacher also benefited from supervisory visits of the Centre of Coordination Tutor (CCT).

In the observed mathematics lesson, Teacher 1 was teaching the topic of 'Money'. The teacher prepared a lesson plan clearly outlining the learning process. However, in the

observed lesson, the element of prior learning was not well articulated. During the teaching, the teaching methods involved a mix of whole class, small group and individual tasks. For small groups, the teacher paired the pupils and assigned the task of discussing their own experience in 'Money and Shopping'. The teacher-student interaction was friendly and built on pupils' responses. The teacher engaged pupils in justifying their answers by developing their critical thinking. It was stimulating with learners actively engaged in solving the problems in small groups. The teacher demonstrated an effective use of learner-centred approach in classroom practices. In addition, in assessment, the learners were engaged in small groups and individual problem-solving tasks. The assessment allowed pupils to apply their understanding of facts and concepts in solving problems using individual tasks. In addition, the teacher identified weak areas in the concepts of money. The pupils received encouraging remarks and stickers for good work.

During the post-lesson discussion, Teacher 1 noted that a gain in knowledge and skills in CPD training led to improvement in classroom practices. However, at the same time, the teacher indicated some learners still struggled with issues of low mathematics literacy and weak foundation skills.

Teacher 2

This is an overview of the learning environment, CPD opportunities and observed Grade 6 mathematics lesson for Teacher 2. Teacher 2 is from a school located in a rural district. Teacher 2 taught a Grade 6 mathematics class with an enrolment of 130 pupils, as shown in Table 5.1. The class lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:8. In the three years preceding the study, the teacher participated in two CPD trainings with learning goals of pedagogical skills and subject content. The training attended equipped the teacher with a learner-centred approach, use of Bloom's taxonomy and explanation for integrating ICT in teaching. The trainings were organised by an NGO and the Ministry of Education. In addition, the Centre of Coordination Tutor (CCT) visited the teacher twice for supervision support.

The lesson observed for the teaching of Grade 6 mathematics was on 'Construction'. The teacher had prepared a lesson plan and during the teaching, introduced the topic. However, there was no prior learning induced for the learners to build upon. The teacher mainly used the chalkboard with a classroom demonstration using a compass, divider and ruler. The teaching of the topic engaged learners in watching the demonstration and reciting in chorus the solutions as presented by the teacher. In ending the lesson, the pupils were given tasks to measure lengths using rulers and dividers. The teacher walked around the class to identify problems and mark solutions.

During the post-lesson discussion, Teacher 2 reported challenges in the CPD training due to limited skills and knowledge gained for effective classroom practices. According to the teacher, most of the pupils had poor attitudes regarding mathematics and therefore, low performance. Some of the learners' weaknesses in the curriculum included fractions and use of numbers in operation of multiplication and division.

Teacher 3

This is an overview on the learning environment, CPD opportunities and observed Grade 6 mathematics lesson for Teacher 3. Teacher 3 is from a rural district school with a Grade 6 class enrolment of 27 pupils, as illustrated in Table 5.1. The teacher attended CPD on pedagogical training skills and subject content. In addition, there were supervisory visits from the Centre of Coordination Tutor (CCT). The school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:4. While the Grade 6 mathematics teacher only participated in a 2-year diploma qualification training, this training had a positive impact in subject content knowledge and pedagogy. Furthermore, there was one Centre of Coordination Tutor (CCT) visit for verification of schemes of work and lesson plans used in classroom practices. There was a concern of inadequate supervisory support from the headteacher and Centre for Coordinating Tutor.

In the observed Grade 6 mathematics class, the teacher followed a well-articulated lesson plan. The topic presented by the teacher during the Grade 6 mathematics lesson was on 'Statistics'. In the observed lesson, the topic of statistics was introduced and prior learning

acknowledged. The teacher used singing as a strategy to capture pupils' attention at the beginning and provided a mental exercise for multiplication. Teacher-pupil interactions were significant in the question and answer sessions: pupils recited the words the teacher wrote on the board and listened to the explanation of the statistical words, their meanings and the formula presented on the board. However, the pupils did not have individual tasks.

During the post lesson discussion, Teacher 3 described the pupils' performance in mathematics as average, with some learners facing challenges attributed to weak foundation skills.

Teacher 4

This overview presents the learning environment, CPD opportunities and observed Grade 6 mathematics lesson for Teacher 4. Teacher 4 is from a rural district school with a Grade 6 class enrolment of 25 pupils, as illustrated in Table 5.1. The school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:4. In the last three years, the Grade 6 mathematics teacher attended only one CPD training about the use of books for teaching and learning. During the same period, the Centre of Coordination Tutor (CCT) visited only once.

The topic presented by the teacher during the Grade 6 mathematics lesson was 'Improper fractions'. The teacher reviewed prior learning and introduced concepts pertaining to the use of least common multiple (LCM) in proper and improper fractions. The pupils were attentive and focused throughout the lesson. The teacher made use of probing questions to engage learners in solving mathematical problems and marked the mathematical exercises given. Some pupils presented their solutions on the blackboard and pupils clapped for the efforts of others in solving the problems. The teacher's methods supported the elevating of learner confidence and communication skills.

During the post-lesson discussion, Teacher 4 indicated that school performance is low and in particular, in mathematics for Grade 6. The pupils primarily faced challenges in mathematics in the topic of fractions and operations of multiplication and division.

Teacher 5

This overview presents the learning environment, CPD opportunities and an observed Grade 6 mathematics lesson for Teacher 5. Teacher 5 is from a rural district school with a Grade 6 class enrolment of 16 pupils, as illustrated in Table 5.1. The school class size was small. The school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:4. The Grade 6 mathematics teacher attended only one CPD training in three years. Moreover, Teacher 5 had only school-based training that was organised by the CCT as part of support supervision.

The topic presented by the teacher during the Grade 6 mathematics lesson was 'Fractions'. The teacher had a lesson plan but it was not well articulated. There was no prior learning in the lesson. The teacher made use of a cassava stem as a teaching aid by cutting it into various sizes. The teacher wrote various fractions on the blackboard and asked pupils to compare them and indicate which was larger. The teacher demonstrated the difference between a numerator and a denominator. The pupils listened and watched the teacher during the explanation of the topic on fractions. They answered in chorus the number of pieces cut from cassava to demonstrate the fractions. Pupils also raised their hands to answer the teacher's question from the board. However, at times the teacher used unfriendly language. Finally, the teacher assigned the pupils exercises from the textbooks during the lesson.

During the post-lesson discussion, Teacher 5 indicated that the pupils' overall performance in mathematics was poor. The learners faced challenges in curriculum areas of fractions, geometry and money. Even worse, they lacked mastery of basic foundational skills.

5.2.2 Teachers from the urban district schools

The selected urban district in this study had four teachers from the four targeted public primary schools. The schools were located in two different cluster centres in the district under a Centre for Coordinating Tutor (CCT). Table 5.2 illustrates the urban district teachers' classroom environment and CPD attended.

Table 5.2: Urban district teachers' classroom environment and CPD attended

Teacher	Sex of teacher	Grade 6 enrolment	Pupil textbook ratio	Mathematics lesson observed	Type of CPD attended in the last three years		
					CCT visit	Pedagogy	subject content
Teacher 6	Male	149	1:5	Probability	√	√	X
Teacher 7	Female	25	1:3	Graphs	X	√	X
Teacher 8	Male	128	1;4	Pictograph	√	√	√
Teacher 9	Male	132	1:4	Fractions	X	√	X

The case study engaged three male teachers and one female teacher from the schools in the urban district. All the schools had a large class size except one. The CPD lived experiences were diverse, including school-based training, cluster-based training, cascade training and higher education institutions training. Only two of the four teachers reported that a CCT representative visited their school for support supervision. The learning goals of the CPD training included pedagogical content knowledge and classroom assessment. The vignettes of the four teachers from the urban district illuminate their CPD lived experiences and observed classroom practices.

Teacher 6

This description provides an overview of the learning environment, CPD opportunities and an observed Grade 6 mathematics lesson for Teacher 6. Teacher 6 is from an urban district school with a Grade 6 class enrolment of 149 pupils, as illustrated in Table 5.2. The school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:5. In addition, the CCT made several visits in the recent three years as part of supervision support in classroom practices. The teacher attended CPD training of a mathematics school-based workshop by an examiner for two days. The training was beneficial and provided practices on handling learner needs.

The lesson observed was on the topic of 'Probability'. The teacher introduced the topic and conducted prior learning. Teaching aids included coloured chalk and a chalkboard. There was good pupil-teacher interaction throughout the lesson. However, there was limited practical based teaching, and the class suffered from overcrowding. The teaching approach was teacher-centred, with teacher action involving pupil repetition/recitation and the teacher explaining. The teacher wrote on the board all the problems to be solved and the students answered in chorus. The students also did some individual tasks, and marking occurred.

During the pots-lesson discussion, Teacher 6 indicated that school performance was low and, in general, pupils had a negative attitude towards mathematics. Though pupils were good in some areas, they had challenges in literacy in mathematics. The weak curriculum areas were measurement and use of operations for multiplication and division. Another challenge was the teaching of a large class size.

Teacher 7

This overview presents the learning environment, CPD opportunities and an observed Grade 6 mathematics lesson for Teacher 7. Teacher 7 is from an urban district school with a Grade 6 class enrolment of 14 pupils, as illustrated in Table 5.2. The teacher attended CPD on pedagogical training skills and subject content. In addition, there were supervisory visits from the Centre of Coordination Tutor (CCT). However, the school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:3.

The topic presented by the teacher during the Grade 6 mathematics lesson was 'Graphs'. There was no prior learning drawn from the previous lesson and the teacher mostly utilised a whole class approach followed by individual tasks. The teacher assigned an activity while other children were observing others, copying examples. Teacher action involved writing problems on the board, explaining to pupils and asking questions. The pupils' action, in most instances, was repetition/recitation after listening to the teacher. In one instance, some pupils were asked to draw a graph on the blackboard as others watched. However, the teaching was devoid of focus on individual learner needs although the teacher asked the pupils to copy from the blackboard and carry out individual task assignments.

During the post-lesson discussion, Teacher 7 indicated that pupils' performance in mathematics is weak in curriculum areas such as fractions, construction and geometry.

Teacher 8

This overview presents the learning environment, CPD opportunities and an observed Grade 6 mathematics lesson for Teacher 8. Teacher 8 is from an urban district school with a Grade 6 class enrolment of 128 pupils, as illustrated in Table 5.2. The school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:4. The Grade 6 mathematics teacher attended several CPD trainings that had learning goals of pedagogical skills and subject content. The CCT made several visits in the recent three years as part of supervision support in classroom practices. The teacher liked the training as it equipped with knowledge and skills for applying a learner-centred approach and use of Bloom's taxonomy in classroom assessment.

The topic presented by the teacher during the Grade 6 mathematics lesson was 'Pictograph'. The teacher had a clear lesson plan, opening the class with a prior lesson on graphs that included bar graphs and pie charts. Then he went ahead to introduce the new topic on statistics, starting with an explanation of mean, mode, median and modal frequency. The teacher used a small group approach and some instances, a whole class approach. The pupils were involved in listening and answering questions. The pupils were also involved in group tasks periodically throughout the lesson.

During the post-lesson discussion, Teacher 8 reported that school performance was low. The pupils faced challenges in some areas of the curriculum such as fractions and use of division and multiplication operations.

Teacher 9

This overview presents the learning environment, CPD opportunities and an observed Grade 6 mathematics lesson for Teacher 9. Teacher 9 is from an urban district school with a Grade 6 class enrolment of 132 pupils, as illustrated in Table 5.2. The school lacked adequate textbooks for mathematics with a pupil-textbook ratio of 1:4. The Grade 6 mathematics

teacher attended several CPD trainings with a learning goal of pedagogical skills. In addition, the CCT made visits in the previous three years as part of supervision support in classroom practices.

The topic presented by the teacher during the Grade 6 mathematics lesson was 'Fractions'. The teacher applied two methods with whole numbers and then a situation when the percentage was a fraction that confused the class. He again settled on a working number without fractions. The teacher was primarily writing problems on the board and explaining to the pupils. The teaching was also asking questions and marking the work of individual pupil in class. The pupils were involved in answering questions, copying from the board and writing on the blackboard. The teacher used a whole class problem for all to solve and individual tasks for the pupils.

During the post-lesson discussion, Teacher 9 reported that the performance of Grade 6 mathematics was low. One challenge was in teaching a large class size.

5.3 Summary

This chapter describes the context of the research that took place in the case study of teachers drawn from nine primary schools. The schools were selected purposively, targeting those that participated in the 2012 national assessment from two districts. It involved five teachers from a rural district and four teachers from an urban district in Uganda. The rural district had a population of 2 million and accounted for 81.1% of the 6-12 year old school-age students attending primary education. Similarly, the urban district had a population of 1.5 million and 85.0% of the 6-12 year old school-age children attending primary education.

The vignettes of the nine teachers explore the CPD professional learning experiences and their classroom practices in mathematics for Grade 6 pupils. For this research, visits were made to the nine schools to conduct in-depth interviews with math teachers and head teachers, Grade 6 mathematics lesson observations and focus group discussions with pupils. The interviews dwelt on teachers CPD professional learning, weak areas of curriculum in learner performance and issues of classroom practices.

The nine teacher observations of mathematics lessons for Grade 6 pupils were on fractions, construction, graphs, pictograph, money, improper fractions, probability and statistics. The observations took into consideration the existent of schemes of work and lesson plans, lesson introduction, prior learning and use of teacher aids. In addition, details of the teacher-pupil interaction and pupil-pupil interactions were considered. The goal was to determine each teacher's classroom abilities in lesson delivery, pedagogical content knowledge and classroom assessment practices.

The next chapter presents the findings and discussion of research question 1 on teachers' understandings of CPD benefits and drawbacks.

CHAPTER 6 : TEACHERS' PERSPECTIVES OF CPD BENEFITS AND DRAWBACKS

This chapter describes the CPD benefits and drawbacks derived from findings and discussions of research question 1, "**What are teachers' understanding of the benefits and drawbacks of the Continuous Professional Development (CPD) training they have attended?"** The analysis makes use of the narratives of the teachers' lived CPD experiences in training attended from 2013 to 2015. The information collaborated with descriptions from headteachers and pupils in the nine primary schools and education officials at the national and sub-national level. The findings and discussion are in three sections. Section 6.1 presents teachers' perspectives of the benefits of CPD training to their classroom practices, including pedagogical content knowledge, assessment and teachers' collaborative practices. Section 6.2 focuses on teachers' perspectives of drawbacks of CPD training, covering the weak policy framework, limited CPD opportunities, limited career progression and inadequate school instructional support. Finally, section 6.3 illustrates teachers' CPD training modalities and participation with a specific focus on diversity and duration of teachers' CPD training opportunities.

6.1 Teachers' perspectives on the benefits of CPD training

The benefits of CPD training concern types of gains in knowledge and skills for teachers to improve their classroom practices. Burke (2012) argues for CPD that promotes intellectual and emotional aspects of knowledge and skills acquired by teachers. In this perspective, the CPD benefits fall into in five categories: enhanced preparatory and initial delivery in classroom practices; improved pedagogical content knowledge; committed teachers in the teaching of mathematics; improved assessment practices; and empowered teacher collaborative practices. A detailed accounted of the CPD benefits are further explained.

6.1.1 Teacher preparation and initial delivery of classroom practice

In this study, the preparatory and initial delivery of classroom practices are activities that teachers plan and initiate to support lesson delivery in the teaching of a subject matter. The

study findings show that CPD improves classroom practices in terms of lesson preparation, introduction, use of prior learning and teaching aids.

Tasks in lesson preparation, introduction and prior learning

The findings indicate that CPD training did focus on knowledge and skills for lesson preparation, introduction and prior learning for quality of instructional practices. The activity on lesson preparation is about the systematic teaching of a well-prepared lesson with clear steps of delivery of the subject matter. One teacher said,

> *We were taught how to introduce the lesson and assess prior learning to get the learner to understand the concept. Also, one should not use all the 35 minutes of a lesson for teaching mathematics but can introduce singing, so that the pupils relax a bit.* (T1)

The discourse on lesson introduction and prior learning, as stated by Teacher 1, is about having a positive effect on learners when teaching. The teacher indicated that the CPD training emphasised expounding on learners' previous knowledge when introducing new concepts. In addition, the skills gained from the CPD called for the teachers to captivate the minds of learners as well as make proper use of the lesson time. Therefore, the CPD training attended positively encouraged teachers to reflect on well-prepared lessons for effective teaching and learning. Similarly, Lessing and Wit (2007) insist that teacher preparedness bolsters confidence in teaching and learning. It is about teacher commitment in planning for a well-thought out lesson delivery process.

These teachers' perspectives illustrate that CPD encourages reflective actions towards engaging in better instructional practices. The training also incorporated suggestions for addressing gender issues in the teaching and learning of subject matter. One teacher commented,

> *The continuous professional development I needed was to reflect on the approaches of teaching and strategies for the classroom. It was helpful....For example, it supported how to make girls perform better, especially in mathematics.* (T3)

According to Teacher 3, the attendees acquired teaching approaches and strategies for better classroom practices. In particular, gender-responsive teaching approaches were a notable achievement for the CPD teachers attended. Teacher 3 explained, for example, that the training specifically addressed aspects of low performance of girls in mathematics. The teacher attributed CPD attendance with gains in skills for addressing girls' performances.

Therefore, as this study has determined, teachers' benefits from CPD included gains in knowledge and skills on lesson preparation, introduction and prior knowledge. According to Muijs and Reynolds (2010), these gains are reflected in the quality of instructional practices. This assertion is supported by Black and William (1998) who insist that what teachers do as classroom practice is a matter of devotion and commitment. Just as Tytler et al. (1999) explain, CPD training equips teachers to not only get interested in preparing lesson activities but to adopt the acquired knowledge and skills for better learning outcomes for the students.

Effective use of teaching aids

Teaching aids are critical resources for teaching and learning. In this regard, according to the teachers, CPD training was beneficial as it explained how to make effective use of teaching aids. In fact, the teachers applauded CPD designed to improve the use of teaching aids. CPD that trained on the use of teaching aids was useful, as one teacher commented,

> *Continuous professional development did promote the use of teaching aids. It was how to create instructional materials, how to make learners understand the concepts, especially in mathematics.* (T3)

In this discourse of effective teaching aids, the training is to support innovative teacher approaches in the use of visual aids. The goal is to provide knowledge and skills to make learning faster, more efficient and consistent. CPD training encourages teachers to improvise teaching aids for quality instructional practices (Nasab et al., 2015). The understanding is that the teacher is to build on the CPD knowledge in the use of teaching aids in classroom practices.

Overall, the analysis illustrates the teachers' perspectives of the benefits attributed to the CPD training received on preparation and initial delivery in classroom practices. The benefits include the knowledge and skills of lesson preparation, content introduction, prior learning and effective use of teaching aids. Likewise, from the teachers' views, CPD can enhance commitment and confidence in the teaching of mathematics, thereby contributing to quality in teaching and learning.

6.1.2 Improved teacher pedagogical content knowledge

The second benefit of CPD training from the teachers' perspective was improved teacher pedagogical content knowledge. Pedagogical content knowledge falls into three domains: knowledge of the subject matter; knowledge of pedagogy; and knowledge of how to teach. CPD with the learning goal of pedagogical content improves teachers' ability to develop and make use of sound experience in the teaching of mathematics (Anthony and Walshaw, 2009). The findings in the discourse of pedagogical content knowledge on CPD benefits can be divided into three aspects: improved subject content knowledge; effective teaching techniques; and improved strategies in handling pupils with a poor attitude toward the subject matter.

Improved teachers' subject content knowledge

The teachers who attended CPD that focused on content reported improvement in their understanding of mathematical facts, concept and procedures. One headteacher said,

> *The CPD training focused on improving the quality of teaching in mathematics. In responding to this need, the education department of Kampala decided to organise a two-day mathematics workshop. The training was on how to address better learning in mathematics facts, concepts and mathematical procedures. From my school, three of my teachers attended the training.* (H9)

The quote of Headteacher 9 illuminates the consensus of the necessity for improving the quality of teaching mathematics. The concerns of the headteacher were to ensure that the teachers benefit from professional development to improve the quality in instructional

practices of mathematics. To this end, the headteacher allowed three teachers from the school to attend the CPD training workshop.

It is clear from the headteacher's point of view as a school administrator, teachers do benefit from subject content of mathematics in CPD training. The stated benefit in subject content knowledge is on how to handle mathematical facts, concepts and procedures. In essence, the training is a reinforcement of the knowledge and skills acquired in initial teacher training (Akyeampong et al., 2013).

Effective teacher pedagogy

The discourse on subject content knowledge as a CPD benefit outlines how it addressed effective teacher pedagogy. According to the teachers, the training led to the acquisition of skills and competencies for quality in teaching. One teacher admitted,

> *I used to feel I teach mathematics mechanically and not able to vary the methods. However, in training, we were taught on how to vary the methods of teaching ....One will teach easier. Instead of using only one method, I could come up with another alternative that the child will understand better.* (T9)

Teacher 9 acknowledged that the training provided a diversity of teaching methods in classroom practice. CPD benefit is in the knowledge acquired on diversified teaching methods as a way of making learning better and improving learner outcomes. One headteacher stated, *"Teachers of the upper primary classes have a problem in teaching. They are not practical in addressing the learning needs in their teaching"* (H7). Attending the CPD, however, equipped teachers with relevant skills for quality instructional practices in upper primary grades. The findings indicate that after attending professional development training, there was a noticeable improvement in pedagogical skills. Teacher competencies in pedagogy improved as they considered how to meet learner needs.

Some teachers attended training concerning knowledge of how to teach mathematics, training that intended to equip them with techniques for handling mathematical concepts and for considering learner needs. One teacher commented,

The CPD training I attended was good. It has been so good. What makes it good is the facilitator....I am going to improve on my teaching using the new techniques they have given me....I even learnt how to address multiplication and division, including multiplication as repeated additions. (T4)

This quote of Teacher 4 suggested renewed enthusiasm in the new techniques acquired in how to teach mathematical concepts involving multiplication and division. The training equipped teachers with ways to make it easier for learners in the use of operations of multiplication and division. From the Grade 6 pupils' point of view, one of them said, "*I used to dislike mathematics, but now the teacher has made me know how to apply multiplication and division in numbers*". This proves that the CPD training was useful in addressing the weak areas of learners in multiplication and division operations. Training on knowledge of how to teach mathematical concepts and procedures such as the use of multiplication as repeated additions was a clear benefit for improved quality of instructional practices.

Some of the methods the teachers reported benefiting from with the CPD were in active teaching and learning techniques. A few teachers attended CPD training on teaching strategies that incorporate active teaching and learning known as 'jigsaw makers', 'write and learn' and 'spider map'. For example, in one method of active teaching, one teacher described 'jigsaw makers' as improving classroom participation. The plans include the use of small groups to encourage collaborative learning among the pupils. Another teacher described the 'spider map' technique as follows,

A spider map is a strategy whereby you get a topic. In addition to that topic, you give groups. After getting the topic, you get the groups. Besides, each group is given ... for example, you take a topic and then have a sub-topic for a group....Each group discusses the sub-topic, and then they come together to present to the class. In this way, all the learners are actively involved in the lesson. (T3)

This quote of Teacher 3 explains how the spider strategy allows a teacher to form small groups for quality instructional practices. By this teacher's account, the 'spider' exercise allows learners to discover new ideas in the subject matter. The 'spider' strategy is about teaching in small groups and encouraging active participation of learners. In small groups,

what is important is how the teacher in a classroom session presents the tasks, monitors the work and observes the learning process. The CPD training equipped teachers with relevant skills and knowledge for engaging in active teaching and learning in a subject matter.

Improved handling of pupils with a poor attitude toward mathematics

The discourse on pedagogical content knowledge as a CPD benefit as recognised by the teachers pertained to handling pupils with a poor attitude to mathematics. The teachers reported facing situations of pupils with poor attitudes towards mathematics. Some teachers indicated attending training on strategies for encouraging pupil attentiveness and confidence and minimising the fear of failure. One teacher said, *''The CPD training is important since we have to address pupils' poor attitudes to mathematics, and dealing with family-level discouragement that maths is a difficult subject''* (T2). Teacher 2 indicated that the CPD training did benefit teachers with skills for handling pupils with a poor attitude toward mathematics. In particular, they learnt how to encourage parental home support in addressing the learners with challenges in mathematics.

From the pupils' perspectives, their opinion generated a lot of interest in their attitude to mathematics. Though faced with fear in the classroom, most pupils liked mathematics; many claimed to be attentive in class and work hard to perform better. One pupil explained,

> *When it is time for mathematics, I feel good. However, I feel bad when I get it wrong. When the teacher is teaching, I feel good, and when asked to do the sums and I fail, I feel terrible. At times, I end up asking the teacher where I have gone wrong. I am always happy when the teacher supports to get my sums correct.* (P2)

Pupil 2's quote highlights learner interest with a positive attitude toward mathematics and the supportive role of the teacher. CPD training that bolsters confidence in the teacher will support the teacher in accelerating learners' enjoyment of mathematics. The CPD is to provide teachers with strategies to address individual pupil learning needs. In the argument of Jacobs, Lamb and Phillips (2010), teachers ought to notice the challenges in pupils' learning to inform future instructional practice. Overall, the findings indicate CPD training did equip teachers with skills to address pupils' poor attitude toward mathematics.

CPD training on pedagogical content knowledge regards teachers having a sound grasp of the relevant application of teaching skills. Simone (1995) argues that pedagogical thinking is about building knowledge of mathematics pedagogy for the teaching of mathematics. CPD training on pedagogical content knowledge promotes active learning and supports the improvement of pupils' attitude to mathematics.

The next CPD benefit in this discourse is professional development training that enhances teachers' commitment to the teaching and learning of mathematics.

6.1.3 Improved teachers' commitment and confidence in the teaching of mathematics

The study identified teacher concerns about their commitment and confidence in the teaching of mathematics. The policy in Uganda is that teachers can teach mathematics in all grades of primary education. However, according to the headteachers, it was a challenge for some teachers to teach mathematics, especially in the upper primary classes, as one headteacher reported,

> *Mathematics requires a teacher who is devoted. The nature of our teachers is such that we force a teacher to teach mathematics. It is a gap, much as they say teachers trained to teach all subjects, and there is no specialisation. In mathematics, someone must have an interest at heart. We identify those teachers and provide them with CPD opportunities.* (H1)

Just as Headteacher 1 describes, teacher commitment in mathematics teaching is vital, especially for the upper primary. At the upper primary level, the learning of mathematics needs higher-order skills. Headteacher 1 also admitted that while teachers in primary school do not have subject specialisation, at the same time, not all teachers have an interest in teaching mathematics. The headteacher's opinion was that CPD training is to benefit teachers in enhancing commitment and creating confidence in the teaching of mathematics. There were concerns of pupils progressing from the lower grades to the upper primary grades with weak foundational skills in mathematics. One teacher shared the following experience:

When I came to this school, I started from Grade 5 and Grade 6 then in the following year, I was asked to teach grade 7 that had problems with the mathematics teacher, then last year, I taught Grade 6 that had similar challenges. However, due to the CPD I attended, I had gained skills that were directed to teaching weak pupils. I was committed to improving the pupils' performance. (T9)

In this quote, Teacher 9 makes clear that though there was discomfort in being shuffled from one class to another, the teacher was confident in teaching learners of low performance in mathematics. However, the teacher, having attended CPD training, was committed and confident in handling learner with weak foundational skills. Mupa and Chinooneka (2015) argue CPD training improves the teacher's morale and dedication to teaching. Besides, with adequate knowledge and skills for teaching mathematics, teachers can teach in either lower primary or upper primary, widening their productivity.

CPD training is a benefit to teachers in addressing teacher attitude and commitment to teaching mathematics. Training on pedagogical content knowledge encourages teacher commitment and confidence in classroom practices. In the next discussion, CPD benefits for effective assessment practices are presented.

6.1.4 Improving assessment practices

From the teachers' perspectives, improving assessment practices is a clear training benefit. Classroom assessment is part of the instruction to support and enhance pupil learning. In these findings, most of the teachers reflected that assessment practice was a learning focus in the CPD training, although the content was diverse. Some teachers acknowledged attending training on assessment practices. Assessment practice helps identify pupils' weak foundation skills. Shephard (2000) states that broad ranges of assessment tools are needed to capture important learning goals and processes and directly connect assessment to ongoing instruction. Therefore, training on assessment practices empowers teachers to map out learner needs in mathematical ideas and thinking.

In some of the CPD training, teachers trained on classroom test development. One teacher remarked, *"I liked the training, and it helped me to understand how to teach pupils. We also learnt how to prepare tests using Bloom's taxonomy"* (T8). CPD training is beneficial when

training includes classroom assessment practices. The teacher alluded to the training incorporating techniques using Bloom's Taxonomy.

Training of assessment practices was an important aspect for the ability to identify weak areas of learner knowledge and skills in a given subject matter. Skills in Bloom's taxonomy can support teachers in developing tests that monitor learning progress. To attest the importance of assessment practises, one education official remarked,

> *I would say that many of our teachers struggle to set questions. Most of them set questions at 'remembering' and 'understanding' levels. After the CPD training, tests were easy to develop that are useful in understanding the learning progress. We were encouraged to make use of Bloom's taxonomy in developing the tests.* (E2)

According to Education official 2, many teachers attended training for test preparation using Bloom's taxonomy. In that way, they learnt the tests to incorporate to verify learner competency in higher-order critical thinking and evaluation skills. Cullinane (2010) believes that knowledge of Bloom's taxonomy allows teachers to prepare tests covering the continuum of skills of the subject.

In the next section, the discourse focuses on CPD training that includes collaborative practices.

6.1.5 Empowering teachers with collaborative practices

Another benefit from the findings of the CPD training in Uganda is the CPD included training on collaborative teacher practices. Collaborative teaching practices involve the sharing of classroom activities and experiences, sharing information and experiences of the best practices for knowledge and skills in the classroom (Miller and Burden, 2007; Cordingley et al., 2003). In this discourse of empowering collaborative practices, the training benefits resonate in terms of peer-peer strategies, mentorship and formation of teacher association networks.

Peer-to-peer practices

Teachers acknowledged attendance at CPD training which included peer-to-peer strategies, involving teachers from within schools and between schools at the cluster level. The use of peer-to-peer strategy even enhanced CPD strategies among teaching peers who did not have the opportunity to attend the training. One teacher commented, *"The training I received encouraged sharing of good practices and more of the new techniques that we learnt. I made new friends, and we shared new ideas"* (T2). Teacher 2 indicates that the training attended encourage sharing of good practices.

Good practices come in the form of new techniques that lead to quality instructional practices, in particular, in creating a network of friends for the sharing of new ideas in teaching and learning. Indeed, teacher-teacher collaboration makes a difference in classroom practice, with one teacher saying, *"The problem that I see is the need for good practices... Maybe peer-to-peer meetings may be significant because when you meet with other groups, you learn what you didn't know"* (T6). Teacher 6 thinks that peer-to-peer strategies allow for sharing of good practices. CPD training on collaborative practices benefits teachers of mathematics. Teachers organised forums with neighbouring schools to come together to discuss mathematics teaching. The inclusion of peer-to-peer activities in CPD training is a solution for headteachers to apply instead of shifting good teachers from one grade to another or lower primary to upper primary.

Mentorship

In teacher education, *mentoring* is defined as a structured and sustained relationship for supporting professional teachers at the early stage of their career and through a career transition. In Uganda, mentorship strategies are incorporated within the CPD framework. Some teachers reported to have participated in mentorship that involved experienced facilitators from the Core Primary Teacher Training College. On the CPD mentorship programme, one education official stated,

We have a mentoring system going on in several identified colleges where we have international mentors working together with national mentors to support the core primary teacher training college (PTTC)...and these mentors together with the college staff visit the outreach schools to see how the Cluster Coordinating Tutors (CCTs) are supporting the schools and the teachers. (E2)

Education official 2 indicates that mentorship is an outreach CPD programme for specific schools conducted by the core primary teacher training colleges in Uganda. Some of the activities in the mentorship strategies included coaching, joint preparation of materials and lesson planning. According to Harwell et al. (2001), CPD training of collaboration combines the expertise of researchers and the knowledge of practising teachers. In some instances, mentorship programmes combine both international and national mentors, as explained by the education official:

We have a mentoring system going on in several identified colleges where we have international mentors working together with national mentors to support the college involving the principal, the deputy principal outreach officer and the CCTs. (E2)

The quote of Education official 2 clarifies that the mentorship programme was a collaborative effort to support schools between the college administration and the CCT who are responsible for schools in their cluster of jurisdiction. Some teachers accessed the mentoring system with support from international and national experts organised within the national CPD framework. Just as demonstrated in Griffiths, Thompson and Hryniewicz (2010), mentors build confidence and support in teachers to enhance quality in instructional practices. It is clear that the CPD framework in Uganda recognises the importance of mentorship for teacher quality. In particular, this mentorship is imperative during the induction of newly recruited teachers.

Teacher associations and networks

The discourse on the benefits of CPD revealed training support for the formation of teacher associations and networks for sharing good practices. The fact that teachers met regularly in clusters made such a proposition possible and only required teachers' commitment. The network brings together teachers as a community of practitioners. One teacher said,

In our training, we were encouraged to have professional networks. However, there are no professional teacher networks within our cluster. It is difficult to know best practices without opportunities for sharing and therefore, no knowledge transfers. (T2)

Teacher 2's quote suggests the importance of teacher associations, but unfortunately, within this particular cluster, one has yet to form. However, teacher networks can promote the culture of CPD knowledge sharing to facilitate better classroom practices.

In this discourse, teachers' views of the benefits of CPD in collaborative practices follow three pathways: peer-to-peer strategies, mentorship and teacher associations. The government has put in place an elaborate framework for mentorship within the teacher education institutions. Also established were administrative structures for inductions for new teachers and engagement of an internal and external facilitator of mentorship activities in the primary schools.

The next discussion is a discourse on teachers' understanding of drawbacks of CPD training.

6.2 Teachers' perspectives on CPD training drawbacks

This discourse of teachers' perspective of CPD training drawbacks dips into four broad areas: weak policy framework, limited CPD opportunities, limited career progressions and inadequate instructional support. The weak training policy framework concerns ways that the training policy inadequately addresses teachers' rights to professional development while limited CPD training opportunities concern the challenges that confront teachers in accessing professional development. The discussion on limited career progression describes how teachers' career paths are neglected in the education system. Lastly, inadequate school instructional support pertains to the challenges teachers face with inadequate school resources and poor support for classroom practices.

6.2.1 Weak training policy framework

The findings have determined bottlenecks that teachers face when accessing CPD training. The education system lacks training policy, work procedures and criteria on how and when teachers access CPD training. The teachers reported insufficient information for how and when to access professional development, thus infringing on their rights to professionalism. The lack of understanding of how to access professional development was a strong concern, as one teacher insisted, *"I know we are entitled to attend professional training. It is important as part of the teaching profession, but there is no documentation on how to access"* (T3). Despite teachers' recognition of rights to professional development through training participation, the education system lacked well-documented, published procedures. The lack of adequate information on how and when to attend a CPD programme means teachers were not empowered to meet their professional expectations. This situation contributed to teachers' anxieties and frustrations in professional development needs. The majority of the teachers had to wait an extended period before even being considered for training. This exacerbates the lack of documentation of procedures in the teacher training policy on professional development participation, contributing to CPD drawbacks of an already weak training policy framework.

Another challenge that contributes to the weak training policy framework is inadequate resources. Despite the existence of a teacher training policy, it is not well anchored in any education planning or resource allocation process. While headteachers have school development plans, they lack funding for professional development, as one headteacher lamented,

> *Though we are required to have a teacher professional development plan, we don't have the resources, because we don't get enough school grants. The funds are not enough to even buy textbooks and also prepare assessment tests for the whole school.* (H9)

In this discourse of weak training policy framework, it is clear from Headteacher 9 that the funds voted for teachers CPD participation at the school level are virtually non-existent. In other words, the schools lacked cost coverage for plans for teacher professional development.

Vegas and Umansky (2005) argue that an education system with strategies for motivating teachers must include professional rewards and financial incentives. However, in Uganda, the Ministry failed to provide for resources at school and had only limited resources at the national level that were shared with the district levels. Funding for professional development increases teacher participation, aids in realising the right to professionalism, and uplifts teacher quality (Heystek and Terhoven, 2015). The results have been only disjointed CPD training provision for teachers in primary schools of Uganda. In other words, the limited resources and lack of training access procedures contribute to a weak training policy framework, a drawback of CPD provision in Uganda.

6.2.2 Weakness in CPD opportunities

The findings indicate that weakness in CPD opportunities was a CPD training drawback. The weakness in CPD opportunities is divisible into three broad areas: inadequate scholarship support; weak pupil foundation skills; and inadequate mathematics content knowledge.

Inadequate scholarship support

Drawbacks in CPD are typically attributed to lack of scholarship support to teachers to access the training. Though most of the teachers were optimistic about attending CPD either for short and long term training for higher qualification, the opportunities were limited to a few, which is unfortunate as access to professional development is an excellent opportunity to improve their pedagogical skills. One of the teachers said, *"I need support to get training on pedagogy for a year....I also see it as an opportunity that I need to have"* (T8). A sense of desperation pervades this teacher's remarks about attending CPD training as training brings both individual and collective benefits into their teaching profession. There was a feeling that the education system did not recognise the teaching workforce fraternity.

Another concern of the training opportunity narrated by the teachers is that they should have incentives such as certificates and allowances. One headteacher remarked, *"My mathematics teacher attended a good CPD, but there was no motivation, that is, the teachers never got any allowances"* (H5). The headteacher indicated that in most cases, if there were any allowances at all, these were for transport reimbursement, nothing more.

Drawbacks from weak CPD opportunities can be explained as due to insufficiency in duration leading to inadequacy in content of the training. In most instances, for example, it was rare to have refresher courses as there was only a short time slotted for content delivery. One headteacher said,

> *The teachers lacked adequate refresher courses, especially on how to handle pupils in mathematics, on addressing situations where pupils have missed a stage of learning. Also, they did not differentiate on how to handle the lower primary and compared to the upper primary.* (H4)

Headteacher 4 complained that the CPD was not adequate to equip teachers with skills for effective classroom practices. In particular, it was challenging for some teachers to teach in both lower and upper primary as they were more comfortable teaching lower grades. So one CPD drawback is that it does not address teacher quality across the grades in primary schools.

Inadequate content on techniques to teach pupils with weak foundation skills

The drawback of weak CPD training opportunities is attributed to the inability to address the inadequacy of content on techniques for teaching pupils with weak foundation skills. Certainly, weak foundation skills for Grade 6 pupils could have been due to weak teacher pedagogical skills starting from the lower primary school grades. At all grades, pupils are to be exposed to the mathematics concepts, facts and procedures. Grouws and Cebulla (2000) argue teachers need to create opportunities for learning. The findings indicate that most teachers faced challenges in creating such opportunities, specifically in handling pupils with weak mathematics foundation skills. Pupils had challenges in multiplication and division operations, especially when involving more than two digits. One teacher lamented as follows,

> *The training I attended did not adequately address some skills I needed. Pupils have a weakness in multiplication and division…also when you look at fractions. I do not know why the pupils do not do well in fractions, and they are very poor. They are also weak in time, geometry and constructions.* (T7)

Teacher 7 reported a lack of adequate training on how to handle pupils' weakness in foundation skills that negatively affected their performance in mathematics topics such as fractions, time, geometry and constructions. Most of the participants noted most pupils did not have the prerequisite mathematics foundations skills at the lower primary grades. The pupils transitioned to Grade 6 already challenged in basic numeracy foundation skills. In particular, according to the teachers, the pupils had difficulties grasping even basic mathematical concepts and procedures.

One clear reason emerged: a link between pupils' weak foundation skills with the deployment of teachers in different grades. One headteacher said, "*The challenge is pupils at lower grades did not have adequate participation to mathematics foundation skills…It is because good teachers of mathematics get deployed in the upper primary*" (H2). It was common practice to assign good teachers to teach upper primary grades to assure the achievement of good results in the national examination at the end of the primary cycle. However, this relegates teachers who are not good in mathematics to the lower grades, maintaining a status quo of pupils with weak foundation skills. The result is that pupils transitioning to Grade 6 are not proficient in the numeracy foundations skills (NAPE, 2011). Teachers feel frustrated in teaching when confronted with pupils who lacked basic mathematics knowledge and skills. Thus, it is an evident drawback when teachers do not access adequate CPD training that incorporates techniques for addressing weak foundation skills.

The CPD drawback of missing the necessary content for handling weak foundation skills leaves teachers unprepared for handling learners with low mathematics literacy. This is compounded by the fact that pupils lacked adequate reading skills, further challenging their abilities to solve mathematical problems. Literacy is an essential skill in mathematics for learners to comprehend and identify appropriate mathematical steps, as one teacher explained,

> *Some pupils cannot read well and understand. When given a word number, they cannot read and interpret. The child could be perfect in some mathematics areas, but because there are some words like 'simplify', that one alone puts off the child. Those are the challenges that make mathematics poorly done. I need professional training on how to address the reading and understanding of the pupils.* (T6)

The lack of training, as reported by Teacher 6, is debilitating for teachers who are to uplift pupils with low literacy levels. Many learners are limited in translating the written tasks into mathematical operations. This situation calls for knowledge and skills for improving pupils literacy skills that support reading, reasoning and engaging in problem-solving tasks. However, the CPD training attended neglected to address the dearth of literacy skills needed for solving Grade 6 mathematical problems.

Inadequate training in mathematics content knowledge

The discourse of weak CPD training opportunities also concerns teachers' inadequate mathematics knowledge for quality instructional practices. Some teachers admitted to not having adequate mathematics content knowledge, posing a severe challenge for teaching. One teacher asserted, *"I need professional training in mathematics. The challenge is the way to handle content in the topics taught….It would be good if there is a way of teaching pupils to discover on their own"* (T8). The findings from discussion with headteachers and education officials reveal that most teachers had difficulty handling mathematics topics due to the limited subject content knowledge attributable to their weak academic background. This is a critical point: teachers require adequate access to training on mathematics content if pupils are to improve mathematically. One headteacher said,

> *Primary teacher training colleges admitted weak students to the pre-service programmes. The intake involved students with three passes. The intake was of poor grades, and hence the graduates of the TTIs were weak in practice. Many schools had no qualified teachers and schools were using unqualified teachers, and most of them had poor grades. Therefore, if they were asked to teach mathematics, then they could not teach very well.* (H9)

Headteacher 9 has raised the concern of the poor admission grades and the low quality of pre-service education graduates. Inadequate subject content knowledge is linked to sub-par entry grades in initial teacher preparation programmes. The findings indicate that teachers who joined pre-service training with low grades as entry qualifications had difficulty teaching mathematics. The quality of instructional practices is hampered in deployment since

the policy allows *any* teacher to teach *any* subject in primary schools. While the assumption is that trained and qualified teachers are competent to teach mathematics, this is not the case. Entry grades did not consider personal performance in mathematics, and low admission standards to pre-service training do not necessarily attract the best teachers. Though the teachers can gain more knowledge and skills in re-training, most CPD training opportunities unfortunately did not address this factor.

The discourse of drawbacks of weak CPD training opportunities demonstrates the challenges teachers face with inadequate knowledge and skills to handle learners in actual classroom practices. CPD training too often ignores teachers' professional knowledge needs for improving the quality of instructional practices (Frazer and Honneth, 2003).

The next discussion of CPD drawbacks is the weak framework in career progression.

6.2.3 Weak CPD framework in career progression

The findings highlight teachers' perspectives of CPD drawbacks on weak CPD framework for career progression. Though the teachers recognised the importance of CPD in professional and individual growth, there were concerns on limited career progression. Explicitly, access to professional development did not guarantee teachers career growth. One teacher complained,

> *Look! At this rate, there is no option of getting training, and one cannot climb up the ladder in the education system. I have taught for many years but not moved to any level, and after I have taught for the last 11 years, at least. I expect my salary to be higher.* (T6)

Teacher 6 expresses the frustrations that teachers face in that while there are chances to access training, there was no guarantee of career progression even while improving personally and professionally, especially since there was no assurance of progressing to higher grades in the teaching career. This magnifies disillusion and disappointment. The majority of teachers admitted that they have stagnated in their positions; and to make matters worse, they have had only minimal salary increases. Teachers understood that their

participation in CPD could be an opening to guarantee promotions and higher salaries. In essence, the limited career progression after CPDs does not address the teachers' aspirations for CPD participation for the maintenance and growth of teacher professionalism.

The next discourse of CPD drawbacks concerns inadequate school support and CPD follow up.

6.2.4 Inadequate school support and CPD follow up

The findings determined that inadequate school support and CPD follow up was a CPD training drawback. Teacher training policy guidelines call for school management and education officials to support teachers after attending CPDs. At the school level, the responsibility belongs to the headteacher and senior teacher. The support includes class observations, regular face-to-face meetings and availability of teaching and learning materials. However, one teacher said, *"No headteacher has ever come to my class to observe my lessons"* (T3). Despite observations being part of their job description – a vital part, many would argue – some headteachers did not conduct supervision support for their teachers, including observations of classroom practices.

However, in some instances, the opposite occurred: teachers were hostile about being observed in their classrooms by the headteacher or senior teacher. A discussion with education officials indicates that at times there are tensions among the teachers engaged in professional support. One education official narrated the following:

> *It is a challenge. There is a superiority complex between the head of the department and a teacher. The head of the department may fail to participate in the support supervision of the fellow teachers. Whenever a headteacher undertakes support supervision, teachers take it as coming to criticise.* (E1)

Education official 1 explains school instructional support involves the headteacher and senior teachers guiding teacher quality, and that includes classroom observation. However, where it was taking place, some teachers did not receive observation and feedback positively. Though it was the responsibility of school leadership to ensure adequacy in instructional

support, including competence in classroom resources, one education official facilitating the CPD indicated:

> *We keep on checking how the teachers are doing and if they are comfortable. We have the evaluation forms that teachers complete, and we can know how many did not get the concept. Like the last time, we had 20 teachers with deep knowledge. It helps to work out on aspects of the CPD to improve on.* (E1)

From the point of view of the Education official 1, CPD instructional support is a rewarding practice that facilitates effective collaboration. However, for most schools, instructional support occurred only infrequent. In other cases, it did not address the teachers' professional needs in the teaching of mathematics. However, when put in place, the instructional support assures professionalism associated with improving the quality and standards of teachers' practices (Demirkasımoğlu, 2010). In this discourse, the drawback of inadequate school support and CPD follow up led to a lack of enforcement of quality in instructional practices.

The next section presents a discourse on existing CPD training models in Uganda and teachers' participation in that CPD. It explains the CPD training opportunities that teachers attended within the framework of the content focus, active teaching and learning, duration and collective participation.

6.3 Teachers' CPD training models

Following the discourse of the CPD benefits and drawbacks, this section presents findings on the CPD training models in which teachers participated in Uganda. A CPD training model refers to the modalities of implementing teachers' professional development in terms of location, duration and content. Embedded in the teachers' CPD lived experiences are CPD models and learning goals. According to the nine teachers, some of the CPD models attended included school-based training, cluster-based training, cascade training, and higher education institution training. In this discourse surrounding the teachers' lived experiences of CPD training models, the narration focuses on the type of model, duration and content in the preceding three years of the study.

6.3.1 CPD training models attended by teachers in Uganda

The findings illustrate that teachers participated in diverse CPD models and learning goals, as presented in Table 6.1. The CPD models are school-based training, cluster-based training, cascade training and higher education institution training. The learning goals that the CPD training engaged were in preparatory classroom practices, pedagogical skills, subject matter content, assessment practices and collaborative practices. Teacher participation in CPD equips them with knowledge and skills for transfer in classroom practices (Altinyelken, 2010; Pryor et al., 2012).

Table 6.1: Teachers' CPD training models

CPD training model	Teacher who attended CPD	Advantages	Disadvantages
School-based training	T1, T2, T3, T4, T5, T6, T7, T8, T9	• Conducted in school and therefore less costly • Focused on preparatory classroom practices, pedagogical skills, assessment practices • Encouraged school level collaborative practices • Made use of both internal (headteacher and senior teacher) and external (education officials)	• Short duration • Did not adequately cover subject content • Collaborative practices were limited to teachers from the same school • Lacks certification for career progression
Cluster-based training	T1, T2, T9	• Conducted within a cluster centre of schools • Focused on pedagogy and assessment practices • Encouraged teacher collaborative practices amongst schools • External expert facilitation	• Requires some funding • Short duration • Did not have adequate subject content • Lacks certification for career progression
Cascade training	T1, T2, T4, T8	• Conducted at different levels (national, region and cluster) • Focused on pedagogical content knowledge • Encouraged teacher collaborative practices amongst schools • External expert facilitation including development partners	• Requires substantial funding • Use of different trainers makes the issue of quality of facilitators as an issue • Lacks certification for career progression
Higher education institution training	T3	• Conducted in higher education institutions • Adequate duration	• High costs in training • Lack of scholarship

		• Focused on pedagogical content knowledge • Encouraged teacher collaborative practices amongst schools • External expert facilitation • Has certification for career progression	

The findings show that the nine teachers experienced an array of levels of participation in CPD training with the CPD model and CPD learning goals. For example, T1 attended a total of three training opportunities in the CPD model, while T3 had two CPD training opportunities. As illustrated in Table 6.2, the nine teachers clustered in three levels of CPD participation, that is, high CPD participation, medium CPD participation and low CPD participation.

Table 6.2: Categorising the teachers and number of CPD training opportunities attended

	T1	T2	T3	T4	T8	T9	T5	T6	T7
No. of CPD opportunities	3	3	2	2	2	2	1	1	1
Level of CPD participation	High CPD participation		Medium CPD participation				Low CPD participation		

Harland and Kinder (1997) describe teachers' professional development models as activities structured for formal or informal skills development. The CPDs attended equipped teachers in one of the four learning goals, as illustrated in Figure 6.1.
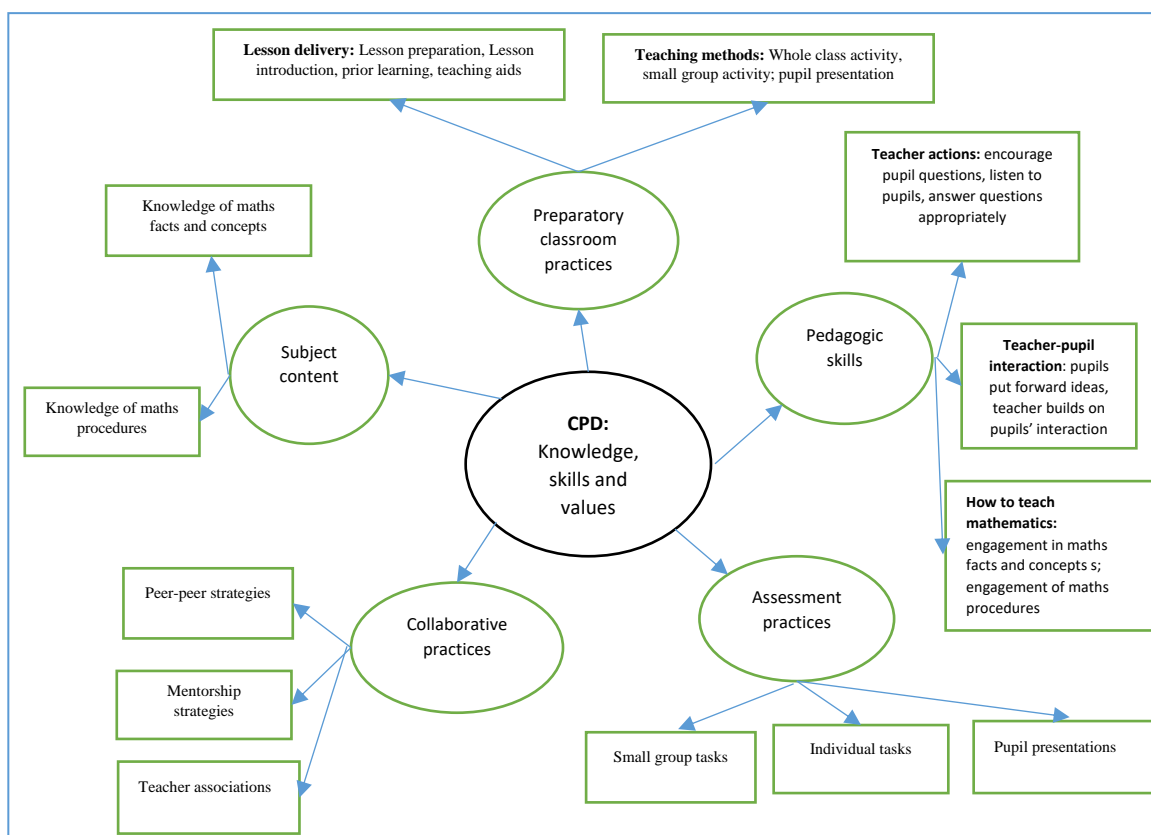
Figure 6.1 Teachers' CPD knowledge, skills and use in classroom practices

The learning goal of teacher preparation and initial delivery included lesson introduction, prior learning, use of teaching aids and gender perspectives. The learning goal on pedagogical content knowledge skills included subject content, knowledge of pedagogy and knowledge of how to teach mathematics. The learning goal of assessment practices involved small group activities, individual activities and pupil presentations. Finally, the learning goal of collaborative practices involved peer-to-peer strategies, mentorship strategies and teacher association networks.

The upcoming discussion describes the CPD training models on school-based training, cluster-based training, cascade training and higher education institution training.

6.3.2 CPD School-based training model

The school-based training model took place within the schools. It is a school arranged professional development for teachers usually lasting one or two days. The facilitators can be internal or external: internal facilitators include the headteacher and senior teacher; external facilitators include education officials and, typically, the Centre for Coordinating Tutors (CCT) and officials from the Uganda National Examination Board (UNEB). According to one teacher,

> *We have had workshops. I attended a seminar in school...facilitators are from the Ministry to come and share with them ideas. For instance, as a mathematics department, we called one person with thoughts to give us more ideas to pass on mathematics. This could be an examiner.* (T6)

Teacher 6 describes the training that took place in their school compound. It involved facilitators drawn from inside and outside the school. The training highlighted the subject content of mathematics to improve teacher quality in instructional practices.

It was routine for the education officials to make arrangements with school leadership for targeted professional development on pedagogical content knowledge and assessment practices. As one teacher put it,

> *We had school-based professional development in the school. In this year, she visited the school twice and carried training for 14 teachers. The Centre for Coordinating Tutor (CCT) education official always targets to support the teaching of mathematics.* (T1)

Teacher 1 acknowledged the professional training organised in the school and follow up visits conducted by an education official. In most instances, the follow up visits were intended to verify the lesson plans and schemes of work, as stated by one teacher: *"We have the CCT visits in school to check on the schemes of work and lesson plans. The CCT normally comes to school and has entered the class only once the last term"* (T7). This remark of Teacher 7 indicates that after lessons and schemes work, the education official only

occasionally engaged in classroom observation; it seemed a rare occurrence. The school-based model includes CCT visits that involve teacher appraisals and class observations.

However, CCTs are challenged with an excessive number of schools to visit (between 100 and 150) in their cluster in a year. To make matters worse, schools needed to facilitate their CPD support, a definite challenge as the schools lacked funds for professional development. One education official said,

> *Schools require professional training for their teachers....We have done one term and I am supposed to do 32 school visits. I have visited a few schools and carried out a follow-up. However, it has been difficult to undertake the appointments due to a lack of facilitation.* (E1)

As this Education official makes clear, despite hopeful targeting to reach out to 32 schools, a lack of facilitation prohibited the completion of the tasks. While the teacher training policy embedded school monitoring visits to uplift teacher quality, a lack of administrative and school capitation support interfered (MOE, 2014). As much as the school-based training model intends to ensure effective classroom practices, it faces limitations in addressing teacher quality (Bubb & Earley, 2007; Day, 1999). The next discussion brings into focus the CPD cluster-based training model.

6.3.3 CPD cluster training model

The cluster centre-based training model involves teachers from several schools meeting for professional development at the cluster centre. The training facilitated by the Center for Coordinating Tutor (CCT) lasts one to five days. There is a consultation between the CCT and the headteacher to map teacher training needs. According to one headteacher,

> *At the cluster training centre, the CCT carry out a CPD for the teachers and one for the headteachers. The school is asked to identify areas of weakness that the teachers have and share with the CCT. The CCTs are the facilitators of the training. The training is carried out at the beginning of the term.* (H9)

According to Headteacher 9, the schools determine the professional development requirements of their teachers. Subsequent to that, the CCT prepares the teacher professional development training programme in consultation with the headteacher. The CCT could also decide to bring additional experts from other education officials or expertise from development partners. This cluster-based training model has the advantage of pulling together diverse expertise from other centre clusters.

The CPD framework has the CCTs holding regular meetings and training with the outreach tutors from the core primary teacher training colleges and the Department of the Teacher Instruction, Education and Training (TIET). This allows the CCTs to support teachers with new development in curriculum implementation. Within the same district, the CCTs work as a team to equip the teachers with knowledge and skills for improving teacher quality in classroom practices. One education official said,

> *You find that we at times combined our efforts among five CCTs. At one time, we go as a group to discuss the issues from our respective schools at the Core PTC. We meet and share ideas on areas that we failed in and areas that we are doing well in, we then make visits for CPD support in ten or more schools to address the learning concerns*. (E1)

The joint training organised by the CCTs is a possible action in a cluster-based training model that is easily replicated in all the clusters. The education official alludes to joint training of teachers in the cluster-based training model, a collaborative approach enriching the capacity and diversity of knowledge and skills equipping teachers in professional development training.

Another advantage of the cluster-based training model is that it engages teacher-teacher collaboration. One education official stated, *"The core primary teachers college outreach tutors engage our teachers in peer-to-peer strategies and mentorship programmes for the schools"* (E1). According to Education official 1, the core primary teacher colleges support a community of practice amongst the teachers from the various schools. The activities involved supporting teachers to implement peer-to-peer strategies; likewise, tutors provide mentorship to the teachers.

The next discussion pertains to the cascade training model.

6.3.4 CPD cascade training model

The cascade training model involves identification of 'master trainers' and 'trainers of trainers' at national and district levels to undertake CPD training. The cascade training, starting with the training of master trainers and followed by teachers at lower levels, involves training countrywide to achieve similar goals in improving curriculum implementation. The duration of cascade training can be five days to two months, usually including experts from the Ministry of Education and occasionally including development partners. One teacher said,

> *I have attended two times in training organised by an International Non-Governmental Organisation (INGO)....The first training workshop under an INGO… was carried out as a non-residential workshop....I also attended leadership, counselling and classroom management training for school effectiveness that was organised by another INGO.* (T1)

According to Teacher 1, a development partner organised the training as a non-residential training. Training was conducted on leadership, counselling and classroom management, all critical topics for improving the quality of teaching and learning.

Cascade training requires meticulous arrangements in logistics in meeting the objectives and efforts made for adequate training materials. It involves introducing new practices and curriculum upgrades that require massive deployment across the country. One education official said,

> *We identify weakness amongst teachers in curriculum areas of literacy and numeracy. We developed materials, modules to help develop teachers' competence targeting CCTs and primary school teachers. We usually use the cascade model of training using master trainers mainly from university training lasts one week.* (E2)

According to Education official 2, when initiating cascade training, new materials are developed in the form of training modules. In particular, the training modules prepared were

on addressing the weak learning areas in literacy and numeracy. In using the cascade training model, the goal was to reach out to all the teachers for equity in education across the country.

The cascade training adhered to a modular CPD training, and in that way, spread the implementation across several holidays in a year. One education official said,

> *In the cascade training, only 'A' Primary School, 'B' Primary School and 'C' Church School took up the activity....The three schools out of the ten did very well. I remember a video recording done for 'A' Primary School was to show how African schools use the methods at schools to teach. Other elements are taken up. The videos used to demonstrate to other schools the best teaching methods.* (E1)

According to Education official 1, a video was shown at other venues to simulate some aspects of the training during the cascade training. The cascade training model is meant to ensure a broader reach of teachers, and the CCT is expected to conduct follow-up support. Though the cascade model is extensive and rich in content and expertise, it is expensive and potentially complicated to implement. The next discussion is about the higher education institution training model.

6.3.5 CPD higher education institutions training model

The higher education institutions training model involves training that offers certification of higher qualifications to already trained teachers. The training learning goals are diverse, including preparatory classroom practices, pedagogical skills, subject content, assessment practices and collaborative teaching practices. The duration of the training is between nine months to three years for a diploma or postgraduate diploma.

Teachers have an option to training during the school holidays, making it flexible for teachers and others working on a full-time basis. Only one teacher, T3, reported having accessed this model as part of their professional development, as a diploma course: *"I attended a 3-year professional training course for a diploma. If I had money, I would want to advance for two more years for a degree"* (T3). Teacher 3 had the ambition to acquire improved knowledge

and skills, and if it was possible, could have proceeded and obtained a degree. The higher qualification is also to guarantee prospects for career progression.

CPD organised for professional development in higher education institutions is a common phenomenon in developed countries such as England (Opfer and Pedder, 2010). However, for Uganda, due to the costs and lack of scholarships, it was a challenge. The positive aspect, though, is that policy allows for CPD organised with the higher education institutions.

6.4 Summary

The findings elaborate on the research question 1, ''What are the teachers' understanding of the benefits and drawbacks of the CPD training that they have attended''? To be a good teacher of mathematics requires professional training that supports learning and engages pupils in practices that promote higher-order skills in mathematics (Harland and Kinder, 1997; Desimone, 2009; Mona, 2017).

This study has determined five CPD training benefits from the perspectives of the teachers: 1) enhanced preparatory and initial delivery in classroom practices; 2) improved pedagogical content knowledge; 3) commitment to teachers in the teaching of mathematics; 4) improved assessment practices; and 5) empowered teacher-teacher collaborative practices. CPD training enhanced knowledge acquisition at individual, collaborative and institutional framework levels (Loughran, 2006; Heller, 2017).

In addition, the study derived four CPD drawbacks. The first CPD drawback is weak CPD training policy. Similar circumstances are prevalent in developed countries, as found by the study of Lipowskia et al. (2011). Indeed, structured CPD training policies and programmes strengthen teacher professionalism and identity formation (Beijard et al., 2003; Goodson and Cole, 1994; Sachs, 2001). A teacher policy stipulates the rights and procedures for accessing professional training. Most teachers were aware of the teacher training policy but lacked information on specific procedures for these training options. A lack of information on procedures in CPD provision is another drawback, as articulated by Hoyle and Megarry (2006) and Earley and Bubb (2004). The second CPD drawback as determined by this study

is limited CPD training opportunities. The third CPD drawback is limited career progression. Teacher professional development that does not adequately address career progression is not useful as in-school instructional support (Vegas and Umansky, 2005). Finally, the fourth CPD drawback is inadequate instructional support.

The study categorised teachers into levels of CPD participation – high, medium and low – with only a few teachers at a high level of CPD participation and training, some at a medium level and a few at low. Similar results are evident in selected OECD countries with most teachers at moderate, or medium, CPD participation (OECD, 2010). CPD training models in Uganda include school-based training, cluster-based training, cascade training and higher education institution training (Lieberman, 1996; Kennedy, 2005). The CPD learning focus includes teacher preparation and initial delivery, pedagogical content knowledge, assessment practices and teacher collaboration.

The next chapter, Chapter 7, considers the findings and discussions of research question 2 on teachers' use of CPD attended for Grade 6 pupils' mathematics classroom practices.

CHAPTER 7 : TEACHERS' USE OF CPD TRAINING IN CLASSROOM PRACTICES

This chapter presents the findings and discussions of research question 2: **''How do teachers use their continuous professional development (CPD) training in Grade 6 mathematics classrooms?''** In this discourse of observed Grade 6 mathematics lessons, the findings and discussion highlight classroom practices of the teachers at high, medium and low CPD participation. Section 7.1, *Teachers' use of CPD training on teacher preparation and initial lesson delivery*, explores the teachers' knowledge and skills in lesson preparation, lesson introduction, prior learning and use of teaching aids. Section 7.2, *Teachers' use of CPD training on pedagogy content knowledge*, describes the demonstrated use of knowledge of mathematics, knowledge of pedagogy and knowledge of how to teach mathematics. Finally, in section 7.3, *Teachers' use of assessment for learning*, explores the

arrangement of learners during assessment in small groups, as individual and in pupil presentations. Section 7.4 summarises the chapter.

7.1 Teachers' use of CPD training on teacher preparation and initial lesson delivery

This analysis explores teacher preparation and lesson delivery skills and teaching methods amongst the teachers at high, medium and low CPD participation from primary schools in Uganda. Also included in the discussion are findings on teachers' perspectives on the influence of CPD training activities.

7.1.1 Preparation and lesson delivery skills

Preparation and lesson delivery skills are a learned art of teaching approaches used in the initial delivery of classroom practices. These require a teacher to be systematic in meeting the subject matter through careful lesson preparing and deliberate choices for delivering a lesson. The preparation and initial lesson activities include lesson preparation, lesson introduction, assessing prior learning and use of teaching aids. Table 7.1 illustrates teachers' sufficient use of activities in classroom practice in lesson preparation and lesson delivery in a Grade 6 pupils' mathematics class.

Table 7.1 Teachers' sufficiency in activities on lesson preparation and initial lesson delivery activities for mathematics classroom practices

Status of teaching in classroom practice		Teachers' level of CPD participation		
		High (2)	**Medium (4)**	**Low (3)**
(a)Lesson delivery skills				
Lesson preparation	1. Evidence given on lesson prepared	T1	T3, T4, T8	-
	0. No evidence given on lesson prepared	T2	T9	T5, T6, T7
Lesson introduction	1. Lesson introduction applied	T1	T3, T4, T8	-
	0. No lesson introduction applied	T2	T9	T5, T6, T7
Prior learning	1. Prior learning conducted	T1	T3, T5	T6, T7
	0. No prior learning conducted	T2	T8, T9	T5
Use of teaching aids	1. Diversity in the use of teaching aids	T1	T3, T4	-
	0. No diversity in the use of teaching aids	T2	T8, T9	T5, T6, T7

Note: Status of 1= Sufficient incorporation of activity; 0= Insufficient incorporation of activity

Lesson preparation

The observed classroom practices in lesson preparation include schemes of work and lesson plans. Only teachers T1, T3, T4 and T5 had a scheme of work and lesson plan. Teacher 1 and Teacher 4 had well-articulated lesson plans with identified learning activities for the mathematics lesson. The two teachers at high CPD participation and the one teacher at medium CPD participation demonstrated gains in professional development. Conversely, the findings indicate that teachers with low CPD participation did not have schemes of work or lesson plans. Lack of commitment to plan teaching activities can hamper a teacher's ability to meet learner needs. When a teacher does not have lesson plans, it can lead to challenges in lesson deliver. This scenario of not preparing lesson plans was raised as a concern by the headteachers, as one headteacher commented,

> *In my school, some teachers go to class unprepared; schemes of work they make but lesson plans are rarely prepared. The teachers have serious challenges in devoting time for preparing for lessons.* (H1)

Headteacher 1 simply states that some teachers did not devote time to planning their lessons. The outcome is clear: the teacher is not prepared to meet learner needs and hence is ineffective in classroom practices. Teacher effectiveness is related to the obligation prepare lessons incorporating quality of instructional practices (Sap'at et al., 2016). Teachers need to

be consistent in lesson plan preparation as a daily routine in classroom practices. Since most of the teachers at high and medium participation in CPD did prepare lesson plans, there is a high chance that the professional development programme encourages teachers to devote time to prepare schemes of work and lesson plans.

Lesson introduction

Lesson introduction preps the learners for what the teacher has planned to deliver in a lesson. In this study, the findings show that four teachers (T1, T3, T4 and T8) introduced their lessons. Lesson introduction includes introducing learning objectives. For example, in the study, Teacher 4 said, "*I present the lesson objectives to make the pupils aware of what they are going to achieve at the end of the lesson*". The focus of the teacher is on ensuring that the learners understand the learning objectives. Lesson introduction was a learning focus of CPD training that teachers attended.

Lesson introduction allows teachers to prepare learners to understand the learning outcomes of the lesson. In that way, learners recognise the learning ideas engaged in the teaching and learning process. According to Webb and Rule (2014), a lesson introduction inspires students and allows them to access and display more content knowledge. The findings indicate that teachers benefit from CPD training and CPD training improves the devotion of the teachers to begin each lesson with a clear lesson introduction. In this way, the teacher directs the necessary attention to what learners must learn to improve their ability and meet their learning expectations.

Prior learning

The reference to prior learning in classroom practices is to capture the interest of learners and grab their attention in the learning process. Prior learning allows teachers to remind pupils of what has already been studied, thereby building on previous knowledge in the upcoming lesson. In the observed classroom practices, five out of nine teachers made use of prior learning. The teachers at the three levels of CPD participation who applied prior

knowledge were high (T1), medium (T3 and T5) and low (T6, T7). However, not all teachers committed to making use of prior learning activities.

The integration of prior knowledge has a positive and significant influence on learner understanding of the topic (Bringula et al., 2016). According to Hailikari et al. (2008), prior knowledge is essential when teachers are introducing tasks in classroom practices. CPD training for teachers emphasises use of prior learning in the subject matter. The findings indicate that while some teachers did use prior knowledge, not all did the same.

Diversity in the use of teaching aids

Teachers' use of teaching aids allows learners to grasp a better understanding through a visual perspective. The use of teaching aids includes a chalkboard, demonstration materials and textbooks. The use of a chalkboard in writing out mathematical problems as a demonstration was widely used, with teachers explaining mathematical tasks as pupils watched. However, diversity in the use of various teaching aids was seen in only three of the nine teachers. From the observed lessons, some teachers with the categorized levels of CPD participation of high (T1) and medium (T3 and T4) demonstrated better use of effective teaching aids. In their classes, they made use of innovative approaches, including selecting particular students and unique objects such as oranges to display mathematical procedures.

An example of the use of a teaching aid occurred in a class on construction, where the teacher demonstrated to the pupils a drawing with a ruler, a pair of compasses and a protractor. Similarly, the pupils were assigned an individual task to use a set of mathematical instruments (ruler, compass and dividers) to construct line segments. In another class, the teacher relied on coloured chalk to explain the concept of probability, and another teacher demonstrated the concept of fractions by cutting oranges and cassavas into pieces. One pupil said, *"The teacher demonstrates with an orange by cutting it into two and another time use a string in teaching us"* (P2). The pupil in School 2 explains how the teacher made use of oranges as a teaching aid. This use of a catchy teaching aid allows teachers to illustrate procedures in solving a mathematical problem.

However, in a class situation where the teacher lacked teaching aid, it was more challenging to present mathematical problems. One teacher admitted,

> *Yes, in this situation of lack of teaching aid, I can say in my case, I had no blackboard, ruler and divider, but I had to improvise. I had to explain to the pupils for them to understand what to do. But later, the school purchased the teaching aids for drawing.* (T3)

Teacher 3 illustrates how challenging it is to teach a mathematical topic, such as construction, without appropriate teaching aids. Most of the teachers reportedly faced similar circumstances: a lack of teaching aids, including shortages in core mathematics textbooks. Lack of core textbooks made assigning individual activities challenging in the classroom since students had to share textbooks. In some schools, one book was shared between three to five pupils. In one class, the teacher had to write the mathematical problems on the blackboard due to the inadequate number of core textbooks. The use of teaching aids is diverse, all depending on available localised materials and innovations in the class.

7.1.2 Teaching method

Teaching method refers to how the teacher organises to present a topic when teaching a lesson. Table 7.2 illustrates the teachers' use of teaching method activities that include whole group activity, small group activity and pupil presentation.

Table 7.2: Teachers' preparatory classroom practices in teaching methods of mathematics

Status of teaching in classroom practice		Teachers' level of CPD participation		
		High (2)	Medium (4)	Low (3)
Teaching methods				
Whole class activity	1. Applied whole class activities	T1, T2	T3, T4, T8, T9	T5, T6, T7
	0. Did not apply whole class activities	-	-	-
Small group activity	1. Applied small group activities	T1	T8	-
	0. Did not apply small group activities	T2	T3, T4, T9	T5, T6, T7
Pupil presentation	1. Allowed pupil presentation	T1	T4, T8	T6, T7
	0. Did not allow pupil presentation	T2	T3, T9	T5

Note: Status of 1= Sufficient incorporation of activity; 0= Insufficient incorporation of activity

Whole class tasks

The use of whole class teaching captures the attention of all learners, focusing them on the teacher's task in a class. The findings indicate that all teachers made use of a whole class activity to grab the learners' attention from diverse perspectives of the lessons. Some teachers captivated the minds of the learners by singing in the teaching. In one school, the pupils recited the words that the teacher wrote on the board. The teacher also listened to the explanation of the terms, their meanings and the formula presented on the board. In other schools, the pupils listened to the teacher who asked them to do the sum on the blackboard while others clapped for those who undertook the mathematical solutions on the blackboard. Whole class activities are to ensure that learners are at the same level of understanding. A pupil in one school said,

> *When the teacher enters the class, the first thing is to greet children in the class and then he tells us stories like to warm up our minds and revises previous work. After that, he gives us examples then gives exercises, and he explains what he has taught. He also asks whoever has not understood so that he can repeat*. (P4)

This quote of a pupil in School 4 indicates that the teachers had active interaction in the classroom using stories and encouraging recall of previous tasks. In one school, the teacher used a whole class approach by cutting a tuber of cassava into pieces. The pupils answered, in chorus, the number of cassava pieces as demonstrated to give the value of the fraction. The pupils listened to the explanations provided by the teacher, raised their hands to answer the teacher's questions, copied from the board and wrote on the blackboard.

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Small group tasks

The teaching method of small group work allows pupils to communicate and share mathematical ideas. However, only T1 and T8, at a high and medium level of CPD participation, respectively, made use of small group activity in their mathematics teaching and learning. According to Dixon and Nolan (2016), a teacher can use strategies to engage students in stimulating their thinking and understanding and encourage methods of problem solving. The use of small groups involves the sharing of ideas about the tasks provided. In the observed lessons, teachers who made use of small groups reported having gained this skill in CPD training. One teacher said that due to the large class size, it is challenging to make use of the small group activities.

A further reflection of Teacher 1, who arranged the pupils in pairs, indicates the easiness of the process. Teacher 1 employed the small group approach for most of the duration of the lesson. In pairs, the pupils were asked to reflect on their shopping practices and solve a mathematical problem on the topic of money. The learning was productive and pupils were more attentive to the mathematics concepts. One pupil explained,

> *When you are more than one, you understand better. It promotes discussion among the pupils. It involves revision to help each other. I like it because you get to know the answer, but sometimes others have no interest and disturb others' minds. Some of the pupils are not serious.* (P1)

The quote above from a pupil from School 1 indicates that small group activities improved their understanding. However, a challenge arises when some pupils are not actively engaged; their classmates did not see them as helpful. It brings the question of the extent of teacher support for the small group activities. Teachers with adequate CPD training made use of small group tasks that allowed learners to express their conceptual understanding of mathematical ideas. For effective use of small groups, common strategies include scaffolding, providing accommodations, enabling more in-depth knowledge, promoting layers of facilitation, making use of the formative assessment process and supporting perseverance (NTCM, 2010; Dixon et al., 2018).

Pupil presentations

The use of individual pupil presentation in solving mathematical tasks allows learners to express their mathematical ideas to the whole class, improving communication and understanding of mathematical concepts in the teaching and learning process. The teacher and pupils could reflect on the approaches to identify the areas of learning strength and weakness. The findings indicate that five out of nine teachers requested that their pupils present in the classroom.

In School 4, the lesson was on graphs, with the teacher asking the pupils to draw the diagram. Teacher 4 asked pupils to explain the procedures in the drawing of charts on the chalkboard. The teacher then asked the class to identify the mistakes in the pupils' presentations. This teaching approach allowed the teacher to listen and build on the pupils' weak areas of learning. However, overall, despite the CPD participation, the uptake in pupil presentation was low amongst all the three categories of CPD participation. The use of pupil presentations was to support individual learner engagement, but most the teachers chose not to make use it.

In the next section, the discourse concerns teachers' ability to transfer acquired pedagogical content knowledge in classroom practices.

7.2 Teachers' use of CPD training on pedagogical content knowledge in classroom practices

The concept of pedagogical content knowledge relates to knowledge and skills of subject content, pedagogy and teaching of mathematics. Pedagogical content knowledge is divided into three domains: content knowledge of mathematics; knowledge of pedagogy; and knowledge of how to teach mathematics (Shulman, 1986; Kazemi and Rafiepour, 2018). The presentation of the findings, then, is in three subsections. Section 7.2.1, *Content knowledge of mathematics*, explores the teachers' activities with knowledge of mathematical facts and concepts and knowledge of mathematical procedures. Section 7.2.2, *Knowledge of pedagogy*,

analyses activities in teacher decisions and teacher-pupil interaction. Lastly, section 7.2.3, *Knowledge of how to teach mathematics*, examines teachers' engagement of mathematical facts and concepts, and engagement in mathematical procedures.

7.2.1 Content knowledge of mathematics

This discourse looks at teachers' transfer of knowledge and skills from CPD into mathematics classroom practices. According to Fennema and Franke (1992), conceptual understanding depends on teachers' knowledge of mathematics. The findings relate to teacher sufficiency in use of mathematical facts and concepts and mathematical procedures in classroom practices. Table 7.3 illustrates the sufficiency of the teachers' use of content knowledge in mathematics for Grade 6 mathematics.

Table 7.3: Sufficiency in the use of mathematics content knowledge in classroom practices

Classroom practices	Status classroom practice	Teachers' level of CPD participation		
		High (2)	Medium (4)	Low (3)
Knowledge of mathematical facts and concepts	1. Applied mathematical facts and concepts for student understanding and reasoning	T1	-	-
	0. Only applied familiar mathematical facts and concepts	T2	T3, T4, T8, T9	T5, T6, T7
Knowledge of mathematical procedures	1. Applied mathematical procedures for student understanding and reasoning	T1	-	-
	0. Only applied familiar mathematical procedures	T2	T3, T4, T8, T9	T5, T6, T7

Note: Status of 1= Sufficient incorporation of activity; 0= Insufficient incorporation of activity

Most of the teachers made use of familiar mathematical facts and concepts for the topic taught. The teachers made use of simple mathematical procedures that do not allow learners to construct useful ideas in their learning. Conversely, Teacher 1 applied the principles of understanding and reasoning of the learners in math facts and concepts, involving teaching carefully selected mathematical procedures to engage pupils in understanding and reasoning (Grouws and Cebulla, 2000).

Figure 7.1 further illustrates how Teacher 1, with high CPD participation, systematically applied the facts and concepts for pupils to reflect on the use of money in daily life application in shopping. The teacher articulated the mathematical concepts and procedures

and engaged pupils systematically to get clarity in whole number operations. Then the teacher engaged the pupils in performing carry-over tasks.

A. The teacher introduced the topic on money to the pupils. The pupils were asked to reflect on the use of money in pairs during shopping. The teacher created mathematical problem to be solved together with the students… "Today we are going to learn about money. You all at one time visit a shop to buy some items".

B. Mathematical problem: Ndagire went to a shop to buy some items with a 20,000/= note. The cost of the items bought was 17,700/=. What is the amount in change given back to him?

C. Question to pupils: Who can volunteer to give us the answer?
    (Several pupils volunteered and one picked to solve the mathematical problem).
      (The activity involved use of subtraction and carry over procedures).
$$20,000/=$$
$$-\ \underline{17,700/=}$$

D. Pupils were engaged in pairs to perform the task.

E. The teacher asked each pupil to solve a problem from the class textbook and went round the class to mark.
- The exercise involved the purchase of items for school: 5 exercise books, 2 pens and 1 mathematical set
- Concepts of money, units and the use of place value
- Mathematical procedures to determine the value of the purchase using multiplication and subtraction
- Individual tasks were to evaluate the pupils' mastery of the concepts and mathematical procedures.

Figure 7.1: Teacher 1 application of knowledge on mathematics in a lesson

From the steps provided in Figure 7.1, the learners engaged in several ideas for thinking about the mathematical problem and solving it in class. The teacher started with understanding the operation and the place value numbers, first engaging with learners' prior understanding, then building on ideas for how to use place value in the topic of money. According to the teacher, the CPD training skill was about creating learning opportunities.

An alternate example of inadequate application of knowledge of mathematics was observed in Teacher 2's classroom, as illustrated in Figure 7.2. Despite Teacher 2 having high CPD participation, concerns were on the teaching of the topic of construction. The teacher used simple steps that did not allow the pupils to use reasoning in mathematical facts, concepts and procedures. The teacher counted the units and not the mathematical facts and concepts

of measurement. The learners were made to recite the units in centimetres and millimetres from an illustration on the chalkboard.

A. The teacher displayed three instruments: divider, protractor and compass. Then teacher wrote the topic of the lessons on the chalkboard: "common units of length". The teacher introduced measurement units of meters, centimeters and millimeters as follows:

1 metre (m) = 100 centimetres (cm)
1 centimetre (cm) = 10 millimetres (mm)

B. Teacher demonstrated the rulers on centimeter and meters. She asked the pupils to view the rulers and count the parts in centimeters and millimeters. The pupils were asked how many parts are on the ruler?

C. The teacher asked the pupils to pick a pair of dividers and place the sharp point at zero and with a sharp pencil. She asked them to widen the divider to 5 cm mark of ruler, then 3 cm (those without dividers were asked to share).

(Pupils carried out the tasks as the teacher checked on them).
(The teacher repeats the task using the mm side of the ruler).

D. The teacher went round the class to check on the pupils' work, and confirmed their proficiency in constructing.
E. Pupils were engaged further in pairs to perform the task.
F. The teacher asked pupils with mathematical sets share with others in class.
- The exercise involved viewing the ruler marks, use of divider to draw a circle
- The pupils responded in chorus in the teaching of measurement.

Figure 7.2: Teacher 2 application of knowledge of mathematics on a mathematics topic

The steps in Figure 7.2 illustrate the presentation of mathematical facts and concepts; the procedures were not adequate when the teacher introduced the use of a mathematical set (divider, protractor and ruler). The pupils counted the units on the ruler in centimetres and meters. Then the teacher wrote on the blackboard the comparison of meters versus centimetres and centimetres versus millimetres. The process was akin to rote learning, not affording pupils the opportunity to engage productively in mathematical procedures. This teaching process lacked a deep understanding of the benefit of learner opportunity. Teaching is more productive when teachers use concrete and more meaningful mathematical examples (Hill et al., 2017).

7.2.2 Knowledge of pedagogy

The knowledge of pedagogy is about the skills used for teaching in the classroom. In this study, the observed pedagogical skills are teacher decisions and teacher-pupil interaction. The intention of teacher decisions is to encourage pupil questions, to listen to pupil questions and to answer questions appropriately. The findings on teacher-pupil interaction involved observing how pupils put forward ideas and how the teacher builds on the pupils' ideas. Table 7.4 illustrates the status of knowledge of pedagogy in the tasks of teacher decisions and teacher-pupil interaction.

Table 7.4: Status of teaching activities on knowledge of pedagogy in classroom practices

Teaching task/ activity	Adequacy of teaching activity	Teachers' level of CPD participation		
		High (2)	Medium (4)	Low (3)
(i) Teacher decisions				
Encouraged pupil questions	1. The teacher encouraged pupil questions	T1	T4, T8	T6
	0. Little encouragement of pupil questions	T2	T3, T9	T5, T7
Listened to pupils' questions	1. The teacher actively listens to pupils' questions	T1	T4, T8	T6
	0. Teacher lacked concentration in pupil questions	T2	T3, T9	T5, T7
Answered questions appropriately	1. The teacher responded to questions appropriately	T1	T4, T8	T6
	0. The teacher lacked concentration on pupil questions	T2	T3, T4, T9	T5, T7
(ii) Teacher-Pupil interaction				
Pupils put forward ideas	1. Pupils put forward ideas based on teacher-initiated discussion	T1	T8	-
	0. No teacher-initiated discussion for pupils to put forward ideas	T2	T3, T4, T9	T5, T6, T7
The teacher builds on pupils' ideas	1. The teacher builds on pupils' ideas in classroom interaction	T1	T8	-
	0. The teacher does not build upon pupils' ideas	T2	T3, T4, T9	T5, T6, T7

Note: Status of 1= Sufficient incorporation of activity; 0= Insufficient incorporation of activity

In these findings, the teachers explained their perspective on effective teaching decisions and effective teacher-pupil interaction. Nearly half of the teachers did not incorporate teacher decision skills adequately. Knowledge of pedagogy (or lack thereof) is evident in how mathematics teachers were sufficiently (or insufficiently) addressing the teaching of mathematics (Löfström and Pursiainen, 2015). For example, some teachers (Teachers 1, 4, and 8) made relevant decisions to engage the learners that promoted pupil questioning, listening to student questions and answering their questions. In some of the schools, teachers

did not give learners time to ask questions; that did not provide the teachers with a chance to determine the pupils' ability in constructing knowledge or solving problems in mathematics.

The majority of the teachers did not adequately engage in teacher-pupil interaction. The findings indicate that most teachers opt to write and explain solutions on the chalkboard with pupils listening and watching. Grouws and Cebulla (2000) argue that instruction of student intuitive solution methods can increase student learning, especially when combined with opportunities for student interaction and discussion. In particular, T1 and T8 allowed pupils to put forward ideas. In that way, pupils can gain competence to formulate and answer a mathematical problem. According to Grouws and Cebulla (2000), when teachers organise teaching around carefully chosen activities, it allows students to interact and solve the mathematical problems.

An illustration of Teacher 4's application of knowledge of pedagogy in classroom practice is presented in Figure 7.3.

Classroom practice in the knowledge of pedagogy of Teacher 4

Teacher 4's decisions in the lesson actively engaged the learners and made use of probing questions to entice the learners to solve the mathematical problems. The teacher actively involved learners in solving the problems, allowing pupils to think through some of their responses so that they could determine whether they were right or wrong. The participation of the learners is evident throughout this lesson. The teacher made good strides by paying attention to individual learner needs. The teacher gave the pupils adequate time to undertake individual activities, including pupil presentations, to build their confidence and communication skills.

> A.   The teacher reviewed the previous lessons on BODMAS and LCM and the procedures. He then introduced the concepts of proper and improper fractions.
>
> B.   The teacher wrote on the blackboard proper fraction: 12 divided 2 and add 12 divided by 3 then divide by 12.
>
> $$\frac{(\frac{1}{2} X 12) + (\frac{1}{3} X 12)}{12}$$
>
> (The pupils were taken through. They did illustrate on the board examples of proper fractions).
>
> C.   The teacher also presented an improper fraction by first discussing the LCM for 7, 21 and 3.
>
> $$\frac{4}{7} - \frac{13}{21} + \frac{1}{3}$$
>
> (The pupils' were given tasks and asked to illustrate on the board examples of improper fractions).
>
> D.   Teacher gives the pupils exercises from the textbooks on both proper and improper fractions as individual tasks.
>   (The teacher goes round the class to check on the pupils work and marks the solutions, including explaining the weak areas).
>
> F.   Pupils were engaged further in pairs to perform the task.
>
> G.   The teacher asks each pupil to solve a problem from the class textbook and goes round the class to mark.
>   - The exercise involved improper fractions
>   - Concepts of BODMAs, units and use and place value.
>   - Mathematical procedures to determine the value using multiplication and subtraction.

Figure 7.3: Teacher 4 application of knowledge on pedagogy in a mathematics topic

Overall, a teacher has to present an array of tasks to ensure learners conceptualise and reflect on the mathematical concepts and procedures. The teacher should consider enhancing her own awareness of learners' thinking by engaging them in tasks that promote their ideas.

7.2.3 Knowledge of how to teach mathematics

The knowledge of how to teach mathematics is about teaching techniques for engaging pupils in concepts and procedures in mathematics. The focus of the knowledge of how to teach mathematics is first, engagement of mathematical facts and concepts, and second, engagement of mathematical procedures. Table 7.5 illustrates the status of the application of knowledge on how to teach mathematics.

Table 7.5: The status of teaching activities on knowledge of how to teach mathematics

Classroom practices	Sufficiency of classroom practice	Teachers' level of CPD participation		
		High (2)	Medium (4)	Low (3)
Engagement in mathematical facts and concepts	1. Engaged pupils productively in the understanding of mathematical facts and concepts	T1	T3, T8	-
	0. Lacked opportunity in engaging pupils in mathematical facts and concepts	T2	T4, T9	T5, T6, T7
Engagement in mathematical procedures	1. Engaged pupils in productive mathematical practices	T1	T9	-
	0. Lacked opportunity in engaging pupils in productive mathematical practices	T2	T3, T4, T8	T5, T6, T7

Note: Status of 1= Sufficient incorporation of activity; 0= Insufficient incorporation of activity

The analysis shows that some teachers (T1, T3, T8) had sufficient knowledge of how to teach mathematics from the category of the high and medium level of participation in CPD training. These teachers applied material for teaching that helped the pupils to have a better grasp of the applicable skills. In this way, it becomes easier for the pupils to use the mathematical procedures in another context and progress with knowledge acquired. The teachers at low CPD participation were not sufficient in the knowledge of how to teach mathematics. Few teachers engaged pupils productively in the understanding of mathematical facts and concepts. Similarly, few teachers had sufficient engagement with pupils in the application of mathematical procedures.

The next discussion illustrates a teacher application of knowledge of how to teach mathematics in classroom practice.

Example of Teachers 3 and 5 on knowledge of how to teach mathematics

Teacher 3's tasks illustrate the beneficial incorporation of knowledge on how to teach mathematics, as presented in Figure 7.4. The teacher incorporated useful techniques for teaching simple statistics using the concepts of mean, median, range and mode. Ideally, a teacher should make the learner understand *why* a mathematical idea is vital by making use of a context that is useful (Grouws and Cebulla, 2000). Additionally, the teacher should impart skills that make learning easier to reduce the chances of errors. In this case, Teacher 3 engaged the pupils on the concept of simple statistics using the idea of pupil-subject scores

for mean, median, range and mode. There was also diversity in mathematical ideas in the context the pupil understand by making use of mathematical problems using pupil scores with which they are conversant.

A. The teacher introduced simple statistics starting with the concepts of mean, median, range and mode. She explained the concepts to whole class .She then explained mean and introduced the formula.

B. Teacher wrote pupils' subject scores as 80, 64 and 28. How many subjects are they? (Chorus answers). She demonstrated how to use the formula to get the mean.

Step 1: Add all the scores   80+64+28
Step 2: Get the sum   172

$$\frac{172}{3} = 36$$

Step 3: Get the mean

C. The teacher continued with demonstration of the mathematical procedures for median, range and mode using whole numbers. The teacher also reviewed all the concepts and mathematical procedures with the pupils.

(Pupils listened and answered in chorus most of the time).
(A few pupils were asked by the teachers to confirm the procedures).

D. The teacher wrote on the board exercises for the pupils to do as individual tasks. She then marked the assignment.
E. Pupils were engaged further in pairs to perform the task.
F. The teacher asked each of the pupils to solve a problem from the class textbook and went round the class to mark.
   - The exercise involved concepts of statistics.
   - Mathematical procedures determine mean, median, range and mode.

Figure 7.4: Teacher 3 application of knowledge on how to teach in a mathematics topic

When applying the mathematical procedures, Teacher 3 ensured that the learners were efficient and accurate in performing basic computations. The teacher was systematic, allowing the pupils to master the mathematical procedures at all stages. The pupils were engaged in the concepts and mathematical procedures, with the teacher recognising the requirements for higher-level skills.

To the contrary, for Teacher 5, as shown in Figure 7.5, pupils' engagement with the mathematical concepts and procedures did not address their learning needs, despite the teacher applying rich mathematical concepts and diversity in advancing learners' abilities for solving problems using proper and improper fractions.

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A. The teacher introduced the topic on fractions by using an orange. He cut the orange into four parts and illustrated the cut parts as a fraction of four parts. He introduced the facts on numerator and denominator. He illustrated the parts and developed proper fractions. A circle was also drawn and the pupils asked to identify the factions that were formed using the shaded areas.

(Pupils were reminded that it was a review of what was taught in Grade 5).

$$\frac{1}{3}, \frac{1}{2}, \frac{1}{4}$$

B. The teacher also illustrated improper fractions (where the numerator is larger than the denominator.

$$\frac{6}{5}, \frac{3}{2}, \frac{10}{7}$$

C. The teacher also presented the case of mixed fractions:

$$\frac{2}{6}, \frac{9}{11}, \frac{5}{6}, \frac{8}{9}$$

(The pupils recited the different types of fractions in class).

D. Teacher asked pupils' to do individual tasks from the textbooks on proper and improper fractions

(The teacher went round the class to check on the pupils work).

E. Pupils were engaged further in pairs to perform the task.

F. The teacher asked each of the pupils to solve a problem from the class textbook and went round the class to mark.

- The exercise involved concepts of fractions.
- Mathematical procedures determined use of fractions.

Figure 7.5: Teacher 5 application of knowledge on how to teach in a mathematics topic

The teacher engaged the learners through recitation, introducing several mathematical situations but without allowing the pupils to develop the required understanding and application of the mathematical procedures. The teaching of proper and improper fractions to pupils simultaneously requires that they have already mastered the concept.

Teachers are required to present clear conceptualisation with learning articulated around concepts to be applied in mathematical procedures. In the argument of Hughes and Acedo (2009), learning should be a rigorous process for students to master an understanding of facts and concepts of the topics. It is also possible for learners with better basic understanding to learn and move to higher-order structures in learning.

7.3 Teachers' use of CPD training on assessment in classroom practices

The use of assessment in classroom practices is to support the teachers in identifying pupil weaknesses in learning. Teachers need to prepare tests that engage the pupils in tasks related to the subject matter. Assessment for learning practices provides opportunities for teachers to understand pupils' areas of strength and weakness. In assessment, the teacher engages pupils through small group tasks, individual tasks and pupil presentations. The sufficiency of teachers use on assessment practices is presented in Table 7.6.

Table 7.6: Teachers use of classroom assessment practices

CPD Training in Classroom practices	Description of status in classroom practices	Teachers' level of CPD participation		
		High (2)	Medium (4)	Low (3)
Small group tasks	1. Teacher marked, built on ideas and addressed an emerging misconception.	T1	T9	-
	0 Teacher marks did not consider pupils thinking and areas of weakness	T2	T3, T4, T8	T5, T6, T7
Individual tasks	1. Teacher marked and obtained the pupil's thinking	T1, T2	T3, T4, T8, T9	T5, T6, T7
	0 Teacher marks did not consider the pupil's thinking	-	-	-
Pupil presentation	1. The teacher considered the pupil's thinking and built on them	T1	T9	-
	0. The teacher did not consider the pupil's thinking and areas of weakness	T2	T3, T4, T8	T5, T6, T7

Note: Status of 1= Sufficient incorporation of activity; 0= Insufficient incorporation of activity

In this study findings, only a few teachers put pupils together in small groups, specifically Teacher 1 and Teacher 9. Similarly, few teachers engaged pupils to present their mathematics solutions to the class. However, teachers made use of tests from the textbooks to provide individual tasks in the classroom.

The use of Bloom's taxonomy to develop test items was raised by the teachers. In the CPD training, some teachers were trained on Bloom's taxonomy to equip teachers with skills to develop test items. However, to prepare test items for assessment in class, most of the teachers relied on tasks from the core textbooks.

Home assignments for the pupils were a common practice by all the teachers. The pupils indicated that the teachers assigned homework and marked the answers in school. The frequency of the homework varied; some teachers gave it every day while others once or slightly more than once a week. One pupil from School 9 said, "*We are given homework only on Fridays. However, it is also possible for the teacher to give homework on some other days".*

The use of classroom assessment allows teachers to identify weakness in pupil learning. Using a variety of classroom assessment practices is likely to engage and motivate pupils by providing them with diverse opportunities to demonstrate their potential. According to Hughes and Acedo (2011), classroom assessment involves a detailed process and tasks for specific feedback. Assessment facilitates learners to understand how they are doing, where they are going, and what they need to do next. In marking the assessment, a teacher gives feedback that is timely, specific and focused. However, the challenge that teachers face is developing an assessment that gives feedback effective for directing pupil learning.

7.4 Summary

The chapter presents the discourse on teachers' use of their CPD training in classroom practices of Grade 6 mathematics. The differences in teachers CPD participation of high, medium and low were taken into consideration in the analysis and discussion. The findings incorporate the three CPD learning goals: preparation and delivery in classroom practices, pedagogical content knowledge and formative assessment practices.

The first CPD learning goal in this discussion is preparation and delivery in classroom practices. Most teachers at the high and medium level of participation in CPD training sufficiently integrated the teaching tasks and activities associated with quality lesson delivery and varied teaching methods (Hailikari et al., 2008; Bringula et al., 2016). However, teachers at a low level of participation in CPD training did not widely vary the teaching activities for appealing lesson delivery and teaching methods.

The second CPD training learning goal discussed is pedagogical content knowledge and its application in classroom practices. Pedagogical content knowledge was demonstrated in three domains: knowledge in mathematics, knowledge of pedagogy and knowledge of how to teach mathematics. A few teachers with a high level of CPD participation applied the knowledge of mathematics effectively. Other teachers revealed limited subject content knowledge and pedagogical skills despite CPD training participation. CPD training must show teachers how to engage learners actively. Hughes and Acedo (2009) argue that learning should be a rigorous process for students to master understanding. Most teachers only relied on familiar mathematical facts and concepts and numerical procedures, an approach that lacked tasks to engage pupils in understanding and reasoning about mathematical concepts and procedures. Teachers must identify and build on pupils' precise learning needs (Grouws and Cebulla, 2000; Hill et al., 2017).

The third CPD learning goal discussion is assessment practice and its use in the classroom. The tasks involved whole class, small groups and individual presentation approaches. A few teachers at high and medium intensity sufficiently incorporated classroom assessment practices. Most teachers, however, lacked adequate skills to build on pupils' mathematical understanding. This suggests that though the CPD training had a learning goal on assessment techniques, sufficient use in the classroom was ultimately still minimal.

The next chapter presents the conclusions of the study, including implications for policy and ongoing practice.

CHAPTER 8 : CONCLUSIONS

This chapter concludes with a synthesis of the research findings and conclusions drawn from the study. It begins with section 8.1, *Summary of the findings on teachers' understanding of the CPD benefits and drawbacks*, followed by section 8.2, *Summary of finding on teachers' use of CPD training in classroom practices.* Then section 8.3 explains the implications for policy and practice followed by section 8.4, *Areas for further research.* Section 8.5 proffers the contribution of the study to knowledge, and finally, section 8.6 shares reflections of my research journey.

8.1 Summary of the findings on teachers' understanding of CPD benefits and drawbacks

This section provides a summary of the findings presented in Chapter 6 on research question 1 on teachers' understanding of the CPD training benefits and drawbacks. The results illuminate the CPD benefits as enhanced preparatory and initial delivery in classroom practices; improved pedagogical content knowledge; commitment of teachers in the teaching of mathematics; improved assessment practices; and empowered teacher-teacher collaborative practices. Similarly, the findings illustrate CPD training drawbacks as weak CPD training policy, limited CPD training opportunities, limited career progression and inadequate instructional support.

This concluding section presents a synthesis of teachers' perspectives of CPD training benefits and teachers' perspectives of CPD training drawbacks.

8.1.1 Teacher perspective of CPD training benefits

In this concluding the discussion, teachers' perspectives of the CPD training benefits are further elaborated as follows: teacher gains in rights to professionalism, teacher commitment to preparation and initial delivery skills, effective techniques in pedagogical content knowledge, useful techniques in classroom assessment, empowered teacher-teacher

collaboration practices and diversity in opportunities in CPD training models. A detailed synthesis of each of these perspectives is presented.

Teacher gains in rights to professionalism

The study shows teachers are aware of CPD training policy strategies on professional development and career path. This CPD policy operates in tandem with international and national commitments to an education plan for teacher professionalism. Teachers' rights to professionalism are central to quality in education, as acknowledged in the post-2015 education agenda (Sayed and Ahmed, 2015). Articulated in Sustainable Development Goal 4 is the call for teachers to be retrained to assure quality in learning (UNESCO, 2014). Uganda shows commitment in teacher professionalism as it adheres to a teacher policy providing a framework for recruitment, deployment and training (MOES, 2011). In ascertaining quality, Lee (2016) argues that elsewhere, such as in Hong Kong, quality in education is entrenched in policy strategies that advance explicit rights for regular continuous professional development (CPD).

The teacher policy furnishes procedures for career progression based on qualification and experience (MOES, 2011). That explains the existence of CPD tailored courses in higher education institutions that support teachers' career path. As Suryadi (2016) argues, policy strategies are important to fulfil for teacher opportunities to access professional development. Therefore, CPD training policy enforces the benefit of teacher gains in teacher professionalism.

Teacher commitment to preparation and initial classroom delivery skills

The study determined that teachers appreciate the benefit of CPD training that improves their commitment to preparation and initial classroom delivery skills. In particular, preparation allows a teacher to garner a more specific picture of what learners need in the subject being taught. From the CPD attended, the teachers learnt the importance of preparatory and initial classroom delivery in lesson introduction, prior learning and teaching aids. Evident from the teachers is the dedication to follow schemes of work and prepare lesson plans before the

lessons. For example, introducing clear lesson objectives allows learners to recognise, and celebrate, progress in the subject (Haylock, 1998).

Fiona (2014) notes countries such as Finland and Singapore showed improved pupil performance when teachers attended CPD training that emphasised preparation, induction and instructional support. Similarly, Hiebert and Grouws (1999) claim that effective preparatory classroom practices are about entry knowledge, nature and purpose of tasks and activities required to engage pupils. Therefore, teachers' commitment and initial classroom delivery skills are benefits gained from CPD training.

Improving techniques in pedagogical content knowledge

This study reveals that teachers recognised the CPD training benefit of effective techniques in pedagogical content knowledge. CPD training can address the required knowledge and skills in pedagogical content knowledge in engagement of mathematical facts, concepts and procedures in classroom practices (Taneri, 2017; Bell, 2016). In some instances, teachers acknowledged that the CPD learning focus strengthened their abilities in learner-centred teaching. The ability of some teachers to build on learner understanding was demonstrated in the observed classroom practices. Evident techniques in learner-centred teaching included creating learner interest, building on learning ideas and making mathematics lessons enjoyable.

Just like in Uganda, Lam (2015) found in Hong Kong that teachers' professional development focused on pedagogical decisions that fit learner needs with the use of generic skills. Teachers strengthened relevant competencies from the theory that was put into practice. In this study, the teachers appreciated the knowledge and skills acquired. Kyeyune, Membe and Baleta (2011) suggest that teachers with adequate pedagogical content knowledge expose learners to understand facts and concepts that are also applied in solving mathematical procedures. Ultimately, as Connolly et al. (2018) argue, professional development drives a teacher to engage in positive change in classroom practices. Therefore, teachers understand that effective techniques in pedagogical content knowledge are a CPD training benefit.

Improving techniques in classroom assessment practices

The study determined that improving techniques in classroom assessment practices is a CPD training benefit. During the CPD training, teachers were taken through the application of Bloom's taxonomy in test preparation, with teachers improving in knowledge and skills to prepare test items during the classroom practices. These tests are prepared and given to learners help to identify weak areas of mathematics teaching and learning. According to Cullinane (2010), useful tests are formulated to support and challenge learners during class time and in homework assignments. In particular, the teachers acknowledged that using relevant assessment accelerates learner proficiency in mathematics.

Kyeyune et al. (2011) argue CPD equips teachers on the effective use of assessment from textbooks and their development of tests. Diversity in assessment practices facilitates teachers in best building upon pupils' learning needs and addresses the weak areas of the curriculum (Pfannkuch, 2011; UWEZO, 2014; Jett, 2011; NAPE, 2012; SACMEQ, 2011). One of the goals of CPD training is to equip teachers with relevant assessment practices. Teachers require skills for identifying problem-based teaching strategies that engage pupils in discover the process of problem solving (Silberman, 1996; Koloi-Keaikitse, 2016). Therefore, effective techniques in classroom assessment practices are a CPD training benefit.

Empowering teacher collaboration practices

The study illustrates that teachers view collaborative practices as benefits during the CPD training. The teachers acknowledged CPD training provided them with a forum for engagement and sharing of classroom experiences. In Uganda, the CPD framework includes support to facilitators by the tutors of the teacher training colleges in peer-to-peer and mentorship strategies. The supervisory mechanism incorporates the principles of teacher-teacher collaborative practices (Kyeyune et al., 2011). Therefore, empowerment in teacher-teacher collaborative practices is a CPD training benefit.

Diversity in teacher participation in CPD training models

The study illuminates diverse CPD training opportunities for teachers that included school-based training, cluster-based training, cascade training and higher education institution training. The CPD training models are unique features, taking into consideration the duration, location, facilitators and costs (Kennedy, 2005; Zein, 2016). The facilitators are drawn from government and non-governmental organisation providers at national, district, cluster and school levels. The use of diverse providers allows for elaborate planning and accountability of teachers' professional development (Escalié and Chaliès, 2016; de-Oliveira, 2018). Therefore, the diversity in CPD training models was a CPD training benefit.

8.1.2 Teacher perspective of CPD training drawbacks

Teachers' understanding of CPD training drawbacks includes weak enforcement of teacher training policies, inadequate resources for CPD implementation, inadequate attention to learners' weak mathematics foundation skills, inadequate school leadership and collaboration support and inequity in teachers' engagement in CPD opportunities.

Weak enforcement of teacher training policy

The study determined that weak enforcement of the training policy is a CPD drawback. The teachers reported concern over the selection of CPD opportunities shrouded in mystery due to lack of clear admission procedures. Teachers' admission to CPD training was not well defined, not well coordinated and lacked adequate planning (Englund, 1996; Demirkasomolu, 2010). CPD barriers ought to be eliminated through well-established training procedures and demonstrate a standard approach to professional development opportunities (Broad, 2015).

Another aspect is the limited career progression with promotion depending on vacancies in school establishments (MOES, 2011). Teachers faced many demoralising years of stagnation in career path and salary. Mulkeen (2010) notes that many countries face a similar situation of limited teacher career growth. In general, the training policy implementation lacked clarity

as to how teachers were to be placed in CPD training and how career progression is rewarded. According to Kontagora et al. (2018), policies allow for adequate planning for all teachers that contribute to teacher equality. Therefore, weak enforcement of teacher training policies is a CPD training drawback.

Inadequate resources for the teachers' professional development

The study found that adequate resources were lacking as needed to support CPD training opportunities. Though CPD was included in school development plans, the government school grants were not adequate, with weak budgetary support as a planning instrument for the direct allocation of public resources (Foster et al., 2013). Hypolito (2015) argues policies on teacher development require investment decisions that target the right working conditions for teachers. Teacher quality in education planning calls for holistic education support (Montes et al., 2018). Therefore, inadequate resources for teachers' professional development pose a CPD training drawback.

Inadequate attention to learners' weak mathematics foundation skills

The study determined that CPD training did not adequately address teachers' knowledge and skills to uplift learners' weak mathematical foundation skills. Teachers reported numerous challenges in the teaching of mathematics for Grade 6 pupils. This is corroborated by other studies on Uganda indicating weak pedagogical skills and persistent poor performance in numeracy (NAPE, 2011; Pryor et al., 2012). South Africa faced similar challenges, reporting that pupils' inability to read and comprehend led to low achievement in mathematics (Prinsloo et al., 2018). In this case, South African education identified strategies that were introduced in CPD to address literacy in mathematics and which ultimately improved pupils' learning achievement. Similar action is required in Uganda to reinforce the CPD with strategies for teacher quality in instructional practices. Therefore, inadequate attention of weak mathematics foundation skills for learners is a CPD training drawback.

Inadequate school leadership and collaboration support

The study reports inadequate school leadership and collaboration support for teachers who have attended CPD training. The Centre for Coordinating Tutors lacked adequate facilitation to provide follow-up support. Moreover, teachers lacked classroom support and inadequacy in instructional materials for learners and teaching aids, all indications of weak school leadership. The schools deployed teachers through reshuffling good teachers from one grade to another, demonstrating a poor understanding of the use of teacher-teacher collaborative practices. Therefore, given the challenges, inadequate school leadership and collaboration support was a CPD training drawback.

Inequity in teachers' engagement in CPD training opportunities

The study sheds light on the categorisation of teachers at high, medium and low CPD participation, revealing inequity in teachers' engagement in CPD training. Despite attending CPDs, for the majority of teachers, professional development did not receive adequate attention (Ward et al., 2006; Nannyonjo, 2007; Timperley et al., 2007). According to Castano-Munoz et al. (2018), CPD should represent the knowledge base and wisdom of practice for teachers to build their professional knowledge and practice. Therefore, the inequity in teachers' engagement in CPD training opportunities was a CPD training drawback.

8.2 Summary of findings on teachers' use of CPD training in classroom practices

This section presents a summary of the findings of Chapter 7 on research question 2 regarding teachers' use of the CPD training in classroom practices of Grade 6 pupils mathematics. The results illustrate that most teachers with a high and medium level of CPD participation sufficiently integrated the teaching tasks and activities of lesson delivery and teaching methods. However, the use of pedagogical content knowledge was applied by only a few teachers with a high level of CPD participation. Most teachers continued teaching with limited subject content knowledge and pedagogical skills. Results also indicate that few teachers sufficiently incorporate classroom assessment practices.

This conclusion further illuminates the distinct contribution of the CPD training in the quality of teachers' instructional practices in preparation and initial lesson delivery, pedagogical content knowledge and classroom assessment practices.

8.2.1 Teachers' effective use of CPD training in preparation and initial lesson delivery skills in classroom practices

The study determined that teachers at high and medium CPD participation made use of improved preparation and initial delivery skills. Quality of classroom practice was illustrated in lesson plans, introducing topics in class and engaging the learners in prior learning. Conversely, most teachers with low CPD participation were not committed to engaging in preparation tasks and initial delivery skills. The same concern was raised by school leadership recognising inadequate teacher preparation and poor delivery skills as problematic.

Teachers with high and medium CPD participation made use of useful teaching aids and occasionally integrated innovative approaches in engaging the Grade 6 pupils. However, most teachers at low CPD participation lacked the skills to ascertain useful teaching aids in the classroom practices. This weakness hampered teachers' abilities to make good decisions in pedagogy. The results indicate teachers with adequate CPD training are committed to engagement in preparatory and initial delivery skills.

8.2.2 Teachers' effective use of CPD training in pedagogical content knowledge in classroom practices

In this study, most teachers did not adequately engage in pedagogical content knowledge in the classroom practice of Grade 6 pupils of mathematics. In particular, they relied heavily on familiar mathematics facts, concepts and procedures, an indication of low CPD training uptake in classroom practice. Understandably, CPD equips the teachers with the knowledge,

refines their teaching skills and enhances transfer in classroom practices (Louwsa et al., 2017). CPD training develops teachers' ability to identify critical topical areas to engage pupils and allow them to learn (Olteanu and Olteanu, 2010).

Even so, most teachers did not build on their learners' understanding of mathematics application. The teachers did not actively challenge the learners with new information to construct knowledge, or to make sense when involving a change in pedagogic decisions (Wells, 2002; Timperley et al., 2010; Koloi-Keaikitse, 2016). It is worth noting, however, that depending on teachers' instructional practices, learners can develop a progressive higher-order application and critical thinking competencies (Pontefract and Hardman, 2005; Akyeampong, Pryor and Ampiah, 2006; and Byamugisha, 2005). In this study, the teachers, mostly those with medium and low CPD participation, faced challenges resulting from their pedagogic decisions. As argued by Martinjak (2015), learners end up facing a problem of mismatch in learning during classroom lessons. Most teachers did not make adequate use of CPD training on pedagogical content knowledge in classroom practices

8.2.3 Teachers' effective use of CPD training in classroom assessment practices

The study considered teachers' effective use of classroom assessment practice. The teachers mainly used whole class and individual tasks in classroom assessment. A few teachers at high and medium CPD participation also used small groups in the assessment. The teachers who used small groups actively allowed learners to build on their mathematical ideas and communication skills. As Hughes and Acedo (2009) explain, learning of mathematics is best accomplished in groups or pairs as this allows students to co-construct knowledge through dialogue, discussion and sharing of ideas.

However, most teachers did not adequately use CPD training in classroom assessment. In the case of South Africa, Engelbrecht et al. (2015) insist that teachers with a deficit in assessment skills have direct and substantial effects in classroom practices. It is important that CPD training transferred into quality use of assessment in classroom practices. It is evident that teachers in Uganda did not adequately use CPD training in classroom assessment.

Synthesis of the study findings indicates both CPD benefits and drawbacks, particularly in how the teachers applied the CPD training in classroom practices. The section that follows covers the implications for policy and practice.

8.3 Implications for policy and practice

This section discusses the implications for policy and practice of CPD that emerge from the study, separately explaining both implications for policy on CPD and implications for practice on CPD.

8.3.1 Implications for policy on CPD

There are three emerging implications of policy on CPD for addressing the concerns of inequity and holistic provision of CPD for teachers: a review of CPD training policy and planning for sustained equity in teacher re-training; re-designing the CPD training to reflect teaching and learning needs; and regular publicity of the CPD training models and teacher career paths.

Review of CPD training policy and planning for sustained equity in teacher re-training

Equity in teacher re-training is not entirely possible due to lack of adequate planning, coordination and standards for the provision of professional development. It calls for a holistic and equitable provision to meet teachers' professional development needs. A comprehensive review is required in the planning and implementation of the CPD at school, district and national levels. CPD requires planning and allocation of adequate resources in the annual budgetary process. In addition, a CPD framework should engage CPD providers, both government and non-governmental entities, in consolidated countrywide planning of teachers' professional development.

Re-designing the CPD training to reflect teaching and learning needs

The CPD requires re-design since it did not adequately contribute to teacher quality. The focus for CPD training is to equip teachers with knowledge and skills for quality instructional practices that translate to more substantial learner achievement. This study shows CPD in design and form requires effective learning strategies that translate to teacher effectiveness. The re-designing of CPD training calls for the input of best practices from curriculum, assessment and teacher education experts. The consultation will include stakeholder participation that includes teachers and education partners, and considers teacher policies and CPD learning goals documented as teachers' professional concerns in CPD training and use in classroom practices.

Regular publicity of the CPD training models and teacher career paths

Teachers' access to information on CPD was a significant concern that resulted in limited training opportunities. Moreover, teachers lacked motivation, as CPD training was not linked to career progression. Publicity of CPD opportunities engages teachers' rights to professional development. However, the selection to CPD was conducted with only minimal sharing of the training vacancies to the teachers. It is imperative that the Teacher Instructor Education and Training (TIET) department establish a communication desk to collaborate with the CPD training providers. Similarly, the TIET department should develop, document and disseminate all CPD training opportunities, both short-term and long.

8.3.2 Implications for practice on CPD

The implications for policy include finding ways to address teacher concerns in the provision of CPD. Now discussed are three emerging implications for practice on CPD: innovations in strategic coordination and capacity building of CPD actors and facilitators; mainstreaming and monitoring the influence of CPD training in teacher change; and strengthening the influence of CPD training on teacher networks and collaboration.

Innovations in strategic coordination and capacity building of CPD providers and facilitators

The study shows that a CPD administrative framework includes instructional support at national, district and school levels. Therefore, collaborative strategies of CPD training providers and facilitators must be established. This calls for the development of innovative approaches, including the use of technology to support coordination and capacity building using e-learning tools. In particular, the Teacher Instructor Education and Training (TIET) department, core primary teacher training colleges and the Centres for Coordinating Tutors (CCTs) serve as 'nerve centres' for teacher CPD at the lowest levels. Therefore, an e-CPD platform must be established to support the CPD coordination and capacity building of training for teachers.

Mainstreaming monitoring of CPD training and its use in classroom practices

This study linked teacher participation in CPD to transfer of knowledge and skills in classroom practices. Policymakers can track CPD training to teacher quality in classroom practices. As such, the Teacher Instructor Education and Training (TIET) department must establish a monitoring tool to track the CPD training competencies in classroom practices. This will generate useful evidence on areas to improve and follow up when teachers attend CPD training.

Strengthening CPD training and school leadership to enhance teacher-teacher collaboration

This study illustrates the importance of school leadership support in teacher-teacher collaboration. CPD training and school leadership are required to promote teacher-teacher collaboration through peer-to-peer and mentorship strategies. Closer cooperation is needed between headteachers with the core primary teacher training colleges and the Centre for Coordinating Tutors as this will enhance teachers' professional learning communities and improve on CPD training and classroom practices experiences.

8.4 Areas for further research

This study identifies the benefits and challenges facing teachers in CPD provision in Uganda. Demonstrated is CPD influence in the teaching and learning of mathematics. The study generates areas for further research in terms of scope, methodology and focus of the study.

I explored the diversity of CPD models, learning goals and level of teacher participation in CPD training and related the use of CPD training in classroom practices. However, further research could follow a longitudinal approach, where specific CPD initiatives are tracked by following up with teachers in their classroom practices. This will require an extended period for collecting data and follow up in various lessons conducted at the training location and within the school. A standard rubric would need to be developed that tracks specific knowledge and skills in instructional practices.

Further research could make use of tools that track competencies and skills in classroom practices using video observation, mapping primary school teachers' competency profiles in CPD training with those applied in the classroom practices. This will link teacher competencies to the CPD learning goals. The use of videos is also beneficial in CPD training as videos visually and engagingly demonstrate and array of best practices.

A final area of further research could be comparing the differences in resources and wealth of schools with the teachers attending the CPD training. The investigation entails comparing the teacher quality in school location with significant differences in the school resources and wealth quintile.

8.5 Contribution of knowledge of the study

This study contributes to the understanding of how teachers in Uganda perceive forms and design of CPD in addressing pupil opportunity to learn in classroom practices. Conducting a teacher quality research paradigm allows education policymakers to conceive of and

construct strategies that affect the learning environment. As Harland and Kinder (1997) note, to understand teacher effectiveness requires an assessment of CPD processes and their influence in teacher practices. Teachers' perspectives of the CPD are corroborated with their ability in knowledge and skills transfer in classroom practices.

This study contributes to the understanding of equity in teachers' CPD participation when comparing accessed professional learning modalities and learning goals. It conveys teacher voices on their perceptions of CPD design and echoes policy impediments in their rights and equal opportunities to professional development. Illuminated are critical benefits and drawbacks that underscore necessary changes in policy, planning and management of teachers' professional development. It calls for teacher professional development enforcement for meeting SDG 4 Target 4c in re-training to achieve all-inclusive and equitable quality in education.

Furthermore, the study contributes to the knowledge of a mechanism required for monitoring CPD provision and teacher change in classroom practices. It is about linking CPD learning processes and classroom practices. In this way, it allows practitioners to assess the effectiveness of CPD initiatives and introduce motivation measures in teachers' career paths. The study identifies tools and approaches to monitoring CPD training and teachers' abilities in classroom practices. This tool gives policymakers and implementers a sustainable approach to track and maintain quality in classroom practices. This contribution fits in efforts to address CPD effectiveness in Sub-Saharan Africa, and in particular, Uganda (Akyeampong et al., 2013; Lowe and Prout, 2019) with a focus on promoting effective strategies in teacher management that ensure a motivated, professional teaching force.

In regards to methodology, the study contributes to how education practitioners and policy makers can reflect on teacher quality issues arising from the national assessment, CPD and classroom practices. In particular, the study allows for better understanding of the influence of teacher re-training in school-based training, cluster-based training, cascade training and higher education institution training as these influence quality in instructional practices. From

the national assessment and observed classroom practices, it is possible to identify emerging issues in curriculum implementation for incorporation in the CPD framework.

In this original research, I contribute to the knowledge surrounding aspects of CPD policy review for realising teacher quality in classroom practices in Uganda. The study outlines the areas of policy implications for a review of CPD policy and implementation. It provides policymakers and practitioners with strategies for an effective CPD that meets teachers' professional learning in primary education curriculum implementation.

After elaborating on the contribution of knowledge of the study, the next discussion is a reflection on my research journey

8.6 Reflection on my research journey

This thesis is the conclusion of my doctoral studies in international education. I started my research journey when working with UNESCO in Uganda as a Project Coordinator for Capacity Building on Education For All for teachers in 2013. At that time, I felt a research interest in understanding the factors that affect the performance of learners in mathematics despite massive investment in developing countries. In my first phase of the summer school, I conducted a review of an article by Hungi and Thuku (2010) entitled *Differences in pupil achievement in Kenya: Implications for policy and practice.* The study provided insight into assessing teacher quality and pupil learning outcomes. After that, I decided to analyse teacher quality issues in classroom practices using the 2007 Kenya SACMEQ III data. From this research outcome and the fact that I was engaged in professional support to teachers in Uganda, I recognised several challenges, including poor teacher classroom practices, absenteeism and lack of motivation. From that perspective, I needed to explore how CPD contributes to quality in teachers' classroom practices.

During my CAS, I explored literature relating to continuous professional development (CPD) in developing countries, in particular Uganda. It provided insight into the gaps in the existing literature on CPD. In my research proposal, the challenge was whether to conduct a

quantitative study or a qualitative study. From the experience of my first assignment, I realised it would be challenging to make use of the mixed-method approach. I held more in-depth negotiations with my supervisor on the pros and cons of the mixed-method approach and the direction to take my research. Eventually, based on the research questions, I arrived at the decision of a qualitative study. It changed my positionality to post-positivist in my research paradigm. My starting point in the study was to identify the study area, and in this, the national assessment data was an essential tool for the selection of the target population providing rich information on the learning crisis for Grade 6 pupils in primary schools and illuminating critical concerns in teacher quality. Another challenge concerned whether or not to conduct the study as an ongoing CPD initiative. However, the CPD initiatives were not coordinated and not well defined in implementation. I, therefore, decided to focus on teachers' experiences in CPD training in the last three years.

The journey of booking appointments, developing tools, data collection and data analysis was rich but intense. For me, the use of qualitative data was a new phenomenon in my research world. However, I gained a deeper understanding of lived issues affecting those in the teaching profession, issues such as effective policy decisions and implementation in teacher re-training. Teacher quality is a strong tenet of education, and my conviction is evident in this thesis: education practitioners can conceptualize the review and re-design of the CPD training policies and models to improve teacher quality.

This research journey has shaped my learning experience and given me the knowledge and skills to conduct a rigorous research process that informs leadership and education management. It has helped me to gain greater insight into the areas of policymaking in discourses of CPD and teacher quality. It has also strengthened my commitment to advocate for teacher professionalism. Within the SDG 4 target framework, CPD for teachers is imperative for achieving inclusion, equity and quality in learning in national education systems.

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ANNEXE

Appendix 1: Case Study Schools Sampling Frame of Selected Districts

A. List of primary schools that participated in the assessment

S. No	District	School Name	Location	Ownership
1	District 1	School 101	Rural	Government
2	District 1	School 102	Rural	Government
3	District 1	School 103	Rural	Government
4	District 1	School 104	Rural	Government
5	District 1	School 105	Rural	Government
6	District 1	School 106	Urban	Government
7	District 1	School 107	Urban	Government
8	District 1	School 108	Urban	Government
9	District 1	School 109	Urban	Government
10	District 1	School 110	Urban	Government
11	District 1	School 111	Urban	Government
12	District 1	School 112	Urban	Government
13	District 2	School 201	Urban	Government
14	District 2	School 202	Urban	Government
15	District 2	School 203	Urban	Government
16	District 2	School 204	Urban	Government
17	District 2	School 205	Urban	Government
18	District 2	School 206	Urban	Government

Source: Uganda National Examination Board, Ministry of Education and Sports, Uganda, 2015

Appendix 2: List of Reviewed Documents

1. NAPE (2012) *The Achievement of Primary School Pupils in Uganda in Numeracy and Literacy in English.* Uganda National Examination Board.

2. MOES (2010) *The Education and Sports Annual Performance Report for Financial Year 2008/09*. Ministry of Education and Sports

3. MOES (2011) *Handbook on Teacher/Tutor, Instructor Education and Training Policie*s. Ministry of Education and Sport

4. MOES (2013) *Aide Memoir for the 20th Education and Sports Sector Review (ESSR).* Ministry of Education and Sports.

5. MOES (2014) *Teachers Issues in Uganda: A shared vision for an effective teacher's policy, TISSA.* Ministry of Education and Sports, Uganda and UNESCO-IIEP Pole Dakar.

6. GOU (2012) *The Education Service: Teachers Professional Code of Conduct*. Notice No. 12. Legal Notices Supplement 8, Government of Uganda

7. MOES (2018) *Continuous school practice for National Teachers' Colleges*

8. MOE (2015) *Education Department: Lesson Supervision Sheet.* Wakiso district

9. MOE (2016) *Teacher Instructor and Education* (TIET) *Department.* Pedagogic project: Process Journal, 2016

10. TIET department: *Policies and support supervision and visitation report, 2015.*

11. MOES (2010) *Handbook on Teacher/Instructor/Tutor Education and Training Policies Acts, Policy Guidelines and Regulations*. Ministry of Education and Sports, Uganda.

12. Mapping of Centre Cluster countrywide

Appendix 3: Topical guides for research instruments

Research questions	Thematic areas/ sub-questions	Analysis approach	Document	Education Officials	Headteacher	Teacher	Pupils
Type of data collection for respondents	*Qualitative*		Content analysis	In-depth interview	In-depth interview	In-depth interview and classroom observation	Focus group discussion and classroom observation
1. To what extent do these relate to areas of reported training needs of primary school teachers in mathematics?	What are the teacher practices in relation to areas of weakness in the mathematics of Grade 6 pupils?	Phenomenology: Categorisation of information	√			√	√
	What are the teachers reported areas of weakness in mathematics teaching and learning?	Phenomenology: Categorisation of information		√	√	√	
2. What kind of CPD opportunities are there to primary school mathematics teachers? How accessible are these to teachers?	What was the purpose (content-specific, pedagogical skills, etc.) of the in-service training and how was it conducted?	Phenomenology: Categorisation of information		√	√	√	
	What type of in-service training has the teacher attended and selection criteria?	Phenomenology: Categorisation of information		√	√	√	
3. What do primary school mathematics teachers learn from their CPD? To what extent does this CPD meet their training needs?	What was the experience of the mathematics teachers in the professional training they attended?	Ground theory: Categorisation of information		√	√	√	
	How was the teacher delivery mechanism during the mathematics classroom lessons of standard six pupils?	Phenomenology: Categorisation of information		√	√	√	
	To what extent did the mathematics teachers incorporate their CPD experiences in classroom practices for standard six pupils?	Phenomenology: Categorisation of information			√	√	√
	What follows up mechanism was in place to provide support to mathematics teachers after the professional training?	Phenomenology: Categorisation of information		√	√	√	

Appendix 4: Research instruments: teacher interview guide

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Teachers Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

Teacher Interview Guide

Introduction

I am conducting a research project on the lived experience of mathematics teachers in primary schools in Uganda on continuous professional development (CPD) as part of my doctorate study at the University of Sussex. The purpose of this interview guide is to get in-depth understanding and experience on any of the CPDs attended and ongoing that addresses the quality of teaching and hence better performance of Grade 6 pupils in mathematics. You are requested to answer all the questions fully and truthfully. The answers you provide will be confidential. However, if you are not sure about a question, you can let me know. If you feel that you cannot answer a particular question, then you can tell me, or you do not have to answer, and I will proceed with the next question. You are also free to decide to stop the interview. If it is ok, as stated in the consent form, I will also audio record the interview.

Name of Moderator: _____
School Name: _____ _____
Teacher Coder: _____
Class enrolment: Boys _____Girls_____-- Total_____-

1. What can you explain about the performance of pupils' in mathematics in your class?

2. In your view, which are the curriculum areas of strength and weakness in the mathematics of the pupil learning outcomes?

3. What are the professional development needs towards upgrading your skills in the teaching and learning of mathematics?

4. How do the concerns in pupils learning achievement in the curriculum areas relate to the professional development needs you have identified?

5. What are the forms of professional training that have you attended in the last three years? How was it designed?

6. What was your experience in the professional development training you attended? Were there any challenges?

7. To what extent did you incorporate the CPD experience in the teaching and learning of mathematics?
8. How were the curriculum areas of concern in numeracy pupil learning outcomes during the teaching of mathematics?
9. What follows up support were available after attending the continuous professional development?
10. Do you have any suggestion for improving the provision of continuous professional development towards addressing the teaching and learning of mathematics? (scope, duration)

Thank you very much for your cooperation

Appendix 5: Research Instruments: headteacher interview guide

US

University of Sussex

Teachers' Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

Head Teacher Interview Guide

Introduction

I am conducting a research project on the lived experience of mathematics teachers in primary schools in Uganda on continuous professional development (CPD) as part of my doctorate study at the University of Sussex. The purpose of this interview guide is to gather information on the teaching and learning of mathematics and relate it to the CPD lived experiences of the teachers. You have been selected to participate in this exercise, given your important role in teacher education and training policy and support supervision. You are requested to answer all the questions fully and truthfully. The answers you provide will be confidential. However, if you are not sure about a question, you can let me know. If you feel that you cannot answer a particular question, then you can tell me, or you do not have to answer, and I will proceed with the next question. You are also free to decide to stop the interview. If it is ok, as stated in the consent form, I will also audio record the interview.

Name of Moderator: _____

School Name: _____

Head teacher code: _____

School Enrolment: Boys___ Girls____ Total ____Grade 6 Enrolment Boys___ Girls__ Total_____

Number of Teachers: Male___female ___ Total__Grade 6 Teachers: Male __Female ____Total____

Number of classrooms: _____

Introduction

1. What can you explain about the performance of pupils in mathematics in your school?
2. In your view, which are the curriculum areas of strength and weakness in the mathematics of the pupil learning outcomes?
3. Which are the professional developments needs for teachers of mathematics in your school?
4. How do the concerns of pupils learning achievement in the curriculum areas relate to the identified teacher professional development needs?

5. What are the forms of professional training that were attended by the mathematics teachers in the last three years?
6. What was the experience of the mathematics teachers' in the professional training they attended? Were there any challenges?
7. What follows up support exists for teachers' who have attended the professional training?
8. What can you say about the teacher classroom practices in mathematics lessons, especially in the curriculum areas of concern in mathematics?
9. To what extent do the teachers incorporate their CPD experiences in the teaching and learning of mathematics?
10. Do you have any suggestion for improving the provision of continuous professional development for teachers to improve on the teaching and learning of mathematics?

Appendix 6: Research Instruments: education official interview guide

US
University of Sussex

Teachers Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

Education Official Interview Guide

Introduction

I am conducting a research project on the lived experience of mathematics teachers in primary schools in Uganda on continuous professional development (CPD) as part of my doctorate study at the University of Sussex. The purpose of this interview guide is to gather information on the teaching and learning of mathematics and relate it to the CPD lived experiences of the teachers. You have been selected to participate in this exercise, given your important role in teacher education and training policy and support supervision. You are requested to answer all the questions fully and truthfully. The answers you provide will be confidential. However, if you are not sure about a question, you can let me know. If you feel that you cannot answer a particular question, then you can tell me, or you do not have to answer, and I will proceed with the next question. You are also free to decide to stop the interview. If it is ok, as stated in the consent form, I will also audio record the interview.

Name of Moderator: _____

Name of Administrative level (HQ/District/CCT Cluster): _____

Education Official: _____

1. Briefly describe the CPD framework and the teacher policy on staff professional development and how it is implemented at national, district and school levels?

2. Which continuous professional development training initiatives have taken place since 2011? *Probe for type, if subject-specific, year, length of time and provider.*

3. In your opinion, did the CPD initiative sufficiently prepare the teachers to teach mathematics? Yes/no. Explain. *For those that have had in-service training on a specific teaching approach, probe for details on value addition of the training.*

4. Are the mathematics teachers sufficiently supported in planning and carrying out their tasks of teaching and learning? *Probe for details (frequency, type and relevance) of support by CCT/education officer, senior teacher, peers and parents.*

5. *What type of support and mentoring is provided to the teachers? Probe for frequency, specific areas of support including lesson planning, class observation, and teaching and learning materials development; probe for challenges/obstacles.*

6. Are there issues related to the teaching practices that may affect the teaching and learning of Mathematics? If yes, which ones? (*probe for teacher content knowledge, teacher characteristics, teacher instructional competence, teacher motivation, gender, absenteeism)*

7. Would you recommend specialized training for mathematics teachers and why?

   Thank you very much for your cooperation

US
University of Sussex

Teachers' Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

Lesson Observation Guide

Introduction
I am conducting a research project on the lived experience of mathematics teachers in primary schools in Uganda on continuous professional development (CPD) as part of my doctorate study at the University of Sussex. The purpose of this lesson observation guide is to gather information on the teaching and learning of mathematics and relate it to the CPD lived experiences of the teachers. Your class has been selected to participate in this exercise to observe classroom management during a mathematics lesson for Grade 6 pupils. The information obtained will be confidential. If you feel that I cannot observe your class during your teaching, you are free to let me know. In case the pupils have no permission from their parents as requested from the headteachers, we may not proceed with the observation. However, if there are no refusals and consent from parents is there, then I can proceed with the lesson observation. If it is ok, as stated in the consent form, I will also audio record your class teaching.

Date:
School code:
Teacher code: F / M
Grade/Class: Six
Number of Students: T: F: M:
The topic being taught:
Researcher name:
Time:

Teaching materials:
Condition of classroom:
Walls/ notice boards:

Seating: seats/board/ teacher's position/observer's position/door/windows etc.

Student talk: Indicate which groups you were able to listen to more carefully

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┌─────────────────────────────────────────┐
│                                         │
│                                         │
└─────────────────────────────────────────┘
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Prior learning of students (what happened in the previous lesson?)
Other observations:

Prompts to help the observer record what they see in the classroom

Other or don't know

MATERIAL RESOURCES:

C) Teacher Action in each grade

Space — Repeating/recitation

Layout of classroom — Writing problems on board

Facilities — Explaining

Displays — Listening to pupils (s)

Access to curriculum materials — Asking question(s)

Use of teaching aids — Marks pupils' work

Non-instructional (behaviour mgmt, etc.)

CLASSROOM OBSERVATION

D) Student actions in each grade

A) Teacher focus in each grade

Repeating/recitation

Whole class — Listening/watching teacher

Small group — Asking question

One individual pupil — Answering question

Other/Not focusing on students — Copying from board

The teacher not in the room — Writing on the blackboard

B) Instructional Content in each grade:

Whole class problem solving

Teaches one subject to both classes — Small group desk work (tasks)

One scheme of work and lesson plan for both grades — Individual desk work (tasks)

Other (projects, games, etc.)

Reciting number words — Off task (talking, sleeping, playing)

Number Identification — **E) Materials used by pupils in each grade.**

Counting

Comparing sets — Blackboard

Addition - 1 digit — Textbook

Addition – 2 or more digits — Workbook/Worksheet/Copies

Subtraction - 1 digit — Flashcards

Subtraction - 2 or more digits — Posters/Wall charts

Multiplication — Manipulative: Counting

Division — Manipulative: Geometry

Fractions — Manipulative: Fractions

Money — Slates

Time — Student notebooks

Standard Measurement Tools — Other

Geometry (shapes, attributes)

PART II: CLASSROOM INVENTORY

Is the classroom clean and neat?

Is there sufficient light in the room?

Is there a ceiling?

Is there enough space in the class for the teacher to move around freely?

Number of pupils with exercise book in each grade

Number of pupils with a pen / pencil in each grade

Does the classroom have a chalkboard?

If the answer is **'Yes'** in 72, is the chalkboard in good condition?

Are the following materials available & accessible in the classroom for children?

Books/booklets other than textbooks

Are there posters/charts on display?

Are there posters/charts specifically about health and/or safety?

Is there a teacher made displays/resources visible?

Is students' work in each grade displayed on the walls?

Are there pupils sitting on the floor? How many?

Are there pupils who are squeezed on shared desks?

Time	Teacher Strategies & Talk	Student Activity & Talk	Observations/remarks

Post-lesson reflections by an observer with co-observer or teacher involved:

Thank you very much for your cooperation

Appendix 8: Research Instruments: CBD observation schedule

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Teachers' Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

CPD Observation Schedule

Introduction
I am conducting a research project on the lived experience of mathematics teachers in primary schools in Uganda on continuous professional development (CPD) as part of my doctorate study at the University of Sussex. The purpose of this observation is to gather information on the professional learning of teachers. You have been selected to participate in this exercise, given your important role in teacher education and training policy and support supervision. I will obtain information on the design, planning and organisation of the CPD to help me understand the programme. I will request that you answer all the questions fully and truthfully. The answers you provide will be confidential. However, if you are not sure about a question, you can let me know. If you feel that you cannot answer a particular question, then you can tell me, or you do not have to answer, and I will proceed with the next question. You are also free to decide to stop the interview. On the basis of the information provided, I will carry out an observation of the CPD if it is ongoing. If it is ok, as stated in the consent form, I will also audio record the interview and also the subsequent observation.

Name of Moderator: _____

CPD Name: _____

CPD Manager: _____

Number of participants: Male____ Female_____Total_

Form of CPD: 1. School based professional development
_____

           2. Workshop based CPD focusing on subject content:
_____

           3. Workshop based CPD focusing on upgrading pedagogical skills:
_____

Part A: CPD Manager

1. What are the CPD needs for teachers of mathematics in primary schools?
2. How do the concerns of Grade 6 pupils learning achievement in the curriculum areas relate to the identified CPD needs of their teachers?
3. What are the forms of professional training that have been offered to teachers' in the last three years?
4. How was the CPD initiative designed to meet the professional needs of teachers' (content-specific, pedagogical skills, etc.)? How is it conducted?
5. Are there any challenges in the provision of the CPD initiatives for primary school teachers?

Part B: CPD Participants

1. What contributed to your decision to attend the CPD?
2. How would you describe your experience of attending the CPD?
3. Did you have any expectations from it? If so, can you describe them?
4. Did you have any perceptions or beliefs before/during the experience? If so, can you describe them?
5. What do you think of your professional training experience?

Appendix 9: Research instruments: pupils' focus group discussion guide

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Teachers Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

Pupil FGD Guide
Introduction

I am conducting a research project on the lived experience of mathematics teachers in primary schools in Uganda on continuous professional development (CPD) as part of my doctorate study at the University of Sussex. The purpose of this focus group discussion is to gather information on the teaching and learning of mathematics. Your school and in particular, your class has been selected to participate in this exercise. The information we are going to discuss as a group is on your mathematics subject knowledge, attitude and practice. In addition, we shall discuss how you are supported in the mathematics homework at home and school. You are therefore requested to raise your hand if you have an answer to the questions I ask. You will all get a chance to say something. We must respect each one's opinion in our discussion. It is important that you give a truthful answer based on what you know. The answers you provide will be kept confidential by all of us. However, if you are not sure about a question, you can let me know. If you feel that you cannot answer a particular question, then you do not have to answer, and I will proceed with the next question. You are also free to decide not to participate in the discussion. If it is ok, as stated in the consent form, I will also audio record the discussions.

Name of Moderator: _____
School Name: _____

1. What do you like best about your school? Which are your favourite subjects?

2. *What do you like best and worst about when you are in the class of mathematics? Probe for knowledge, attitude and practices- role models,*

3. Which topics of mathematics do you like? Which topics of mathematics do you dislike?

4. How do you find yourself working on the mathematics topics you like or dislike when the teacher(*Probe for frequency and effectiveness*):
   (i) asks questions to be answered in class?
   (ii) gives exercises in pairs?
   (iii) gives exercises in groups?
5. Which teaching aids such as (charts, cards, real objects and textbooks) does the teacher use in class?
6. Am going to discuss the mathematics textbooks you use. How many of you share the mathematics textbook and with how many other pupils?
7. Where else can you get mathematics textbooks in school and when out of school? *Probe for the school library, Classroom or community library*
8. I want to discuss homework. How do you find the homework given by your mathematics teacher? What type of support do you get in completing the homework at home and in school? *Probe for frequency, family/siblings/friends support and marking.*
9. Now, I would like to discuss school attendance. What makes pupils miss classes? What about yourselves? *Probe for Sickness, Monthly period, Suspension from school, Work at home, Lack of uniform, Lack of school levies, indiscipline, etc*

Thank you very much for your cooperation

Appendix 10: Ethics Permission Certificate

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Certificate of Approval	
Reference Number	ER/CO206/3
Title Of Project	Teachers Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy (COPY)
Principal Investigator (PI):	Charles Obiero (amended application)
Student	Charles Obiero
Collaborators	
Duration Of Approval	n/a
Expected Start Date	20-Oct-2014
Date Of Approval	28-Sep-2015
Approval Expiry Date	30-Dec-2016
Approved By	Jayne Paulin
Name of Authorised Signatory	Janet Boddy
Date	28-Sep-2015

*NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:

Amendments to protocol
* Any changes or amendments to approved protocols must be submitted to the C-REC for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects
* Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the C-REC.

Feedback regarding any adverse and unexpected events
* Any adverse (undesirable and unintended) and unexpected events that occur during the implementation of the project must be reported to the Chair of the Social Sciences C-REC. In the event of a serious adverse event, research must be stopped immediately and the Chair alerted within 24 hours of the occurrence.

Appendix 11: Consent form

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CONSENT FORM FOR TEACHERS AND HEADTEACHERS
  PROJECT TITLE: **Teachers Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy**

Project Approval Reference: _____

I agree to take part in the above University of Sussex research project. I have had the project explained to me, and I have read and understood the Information Sheet, which I may keep for records. I understand that agreeing to take part means that I am willing to:

- Be interviewed by the researcher
- Allow the interview to be audio taped
- Allow a class observation of a mathematics lesson
- Use a computer to capture, process and store information being sought
- Make myself available for a further interview should that be required

I understand that any information I provide is confidential and that no information that I disclose will lead to the identification of any individual in the reports on the project, either by the researcher or by any other party.

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project without being penalised or disadvantaged in any way.

I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the Data Protection Act 1998.

Name: _____

Signature _____

Date: _____

Appendix 12: Transcript of full interview

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Teachers Experience and Understanding of Continuous Professional Development (CPD) for Primary Mathematics in Uganda and its implication on Policy

Teacher Interview Guide

Introduction

Name of Moderator: _____
School Name: _____....__ _____
Teacher code: _____ _____
Class enrolment: Boys _____Girls_____-- Total_____-

6. What can you explain about the performance of pupils' in mathematics in your class?

    Self: What do you feel about the performance of mathematics the pupils in mathematics?

    Teacher: Generally, there are those who are doing well and are happy about them; slightly more than half get 50% and above. These pupils are normally confident. However, those who get below 50%, I always try to encourage them. The majority of such pupils have poor attitudes, and some come from a poor background. They say maths is a difficult subject

7. In your view, which are the curriculum areas of strength and weakness in the mathematics of the pupil learning outcomes?

    Self: I want to understand which topics that they do not do well.

    Teacher: They have a problem in division, fractions and multiplication. However, they are good insets, number patterns. They are good at graphs, mode, mean and median.

8. What are the professional development needs towards upgrading your skills in the teaching and learning of mathematics?

    Self: What training is required to attend the pupil's weak learning areas?

Teacher: If we can have training that addresses some pedagogy. The way a teacher is trained is to be to handle all the topics if there was a way of teaching pupils to discover their owning.

9. How do the concerns in pupils learning achievement in the curriculum areas relate to the professional development needs you have identified?

   Self: The weak areas are also

   Teacher: Yes, they address the pupils learning needs

10. What are the forms of professional training that have you attended in the last three years? How was it designed?

    Self: have you ever attended the training
    Teacher: I attended training in 2014 on pedagogy that took one week. I also attended trained on how to teach mathematics using technology in 2015. It also took one week.

11. What was your experience in the professional development training you attended? Were there any challenges?

    Self: What was your experience in training on pedagogy?
    Teacher: I liked the trained, and it helps to understand how to teach pupils using a learner-centred approach. We also learnt on blooms taxonomy

    Self: What about your experience in training on ICT
    Teacher: It involved training in integrating ICT in mathematics. I had a good experience on how to integrate ICT in mathematics. Some of the schools could not take it up. However, it was expensive in terms of buying the stationery and equipment required.

12. To what extent did you incorporate the CPD experience in the teaching and learning of mathematics?
    Self: To what extent did you incorporate what is learnt in the pedagogy training in your classroom practices?
    Teacher: Though I feel I incorporated what was learnt, I still have challenges. The main problem is the large classroom, and we were not taught how well to handle what was learnt in such a scenario.

    Self: What about ICT training?
    Teacher: I did not incorporate because I lacked equipment in school.

13. How were the curriculum areas of concern in numeracy pupil learning outcomes during the teaching of mathematics?

    Self: Can you say the training helped you to address the learning areas concerns?
    Teacher: Yes, at least when you apply, you find that the learner interest in mathematics was improved.

14. What follows up support were available after attending the continuous professional development?
    Self: Was there follow-up support after the training that was conducted?
    Teacher: The organisation which provided the training did a follow up twice. Have never been visited by the CCTs

15. Do you have any suggestion for improving the provision of continuous professional development towards addressing the teaching and learning of mathematics? (scope, duration)
    Self: For you to improve your skills, what trainings would you need?
    Teacher: Need training on pedagogy for a year. It is also important that I have adequate instructional materials. There is a need for allowance to be provided during the training.