EFFECTS OF LESSON STUDY ON THEORY-PRACTICE GAP IN MATHEMATICS TEACHING PRACTICES IN SELECTED SECONDARY SCHOOLS IN MONZE DISTRICT, ZAMBIA

BY

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A Dissertation Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Education in Educational Psychology of the University of Zambia

THE UNIVERSITY OF ZAMBIA,

LUSAKA

2017

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DECLARATION

I Edgar Hangoma, do declare that this dissertation is entirely my own work other than the counsel of my supervisor and that it has not been submitted for any academic award, or part thereof, at this or any other educational establishment.

Signed: …………………………………………...…　　　Date: ……………………………..

CERTIFICATE OF APPROVAL

This dissertation prepared by Edgar Hangoma is approved in partial fulfilment of the requirements for the award of the degree of Master of Education (MEd) in Educational Psychology by the University of Zambia.

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Examiner 3: Signed……………………………….. Date………………..

ABSTRACT

The purpose of the study was to establish whether Lesson Study supports teachers of Mathematics in bridging theory-practice gap in their Mathematics teaching practices in selected Secondary Schools of Monze District of Zambia. To achieve this, the study endeavoured to: (a) ascertain the role of Lesson Study as a professional development process; (b) evaluate the effectiveness of Lesson Study in Mathematics teaching practices and (c) examine school-based factors influencing effective implementation of the Lesson Study approach in schools.

Lesson Study is a professional development practice with roots in Japanese schools. The Lesson Study is a structured process, a form of classroom inquiry, involving small groups of teachers that collaboratively plan, teach, observe, analyze, revise and refine actual classroom lessons (Cohan, & Honigsfeld, 2007). It has shown great promise in improving the quality of teaching Mathematics in ways that are sustainable and generative in nature. Despite Zambian teachers conducting Lesson studies for a considerable period of time, we do not know the effectiveness of the practice in teaching Mathematics in Zambian Secondary Schools.

The study employed a quantitative research design. Data was collected using a structured questionnaire to a sample of 35 teachers of Mathematics consisting of 29 male and 6 female, who were sampled from seven Secondary Schools. The data collected was analysed to generate descriptive and inferential statistics.

The results revealed that the Lesson Study approach enabled teachers to make significant improvements in both their lesson planning and implementation. In lesson planning, Lesson Study improved teachers' knowledge of the subject matter to be taught. It also enabled teachers to integrate Mathematics knowledge of content to be taught with knowledge of teaching methods. In practice, the approach improved teachers' pedagogical knowledge and enhanced pupil motivation for conceptual understanding. Furthermore, the results revealed that time was a major challenge to successfully implement Lesson Study, both scheduling time to meet as a group and the amount of time required to devote to Lesson Study. The most frequently cited factors fostering success were related to characteristics of Lesson Study.

Overall, the findings revealed that a majority of the teachers believed that Lesson Study helped them to become better Mathematics teachers, and that it was an effective way to continue their professional development. The study concludes that Lesson Study was an effective tool to bridge theory-practice gap in Mathematics teaching practice. Therefore, there should be a paradigm shift in educators' beliefs about effective professional development. Educators should make changes in their thinking and in practice, and embrace the Lesson Study which has proved to be a significant tool in development of practical wisdom.

DEDICATION

First and foremost, this dissertation is dedicated to my lovely children; Moonga, Muyuni, Maluba, and Maambo for enduring the father's absence during my studies at the University of Zambia. Secondly, it is dedicated to my lovely wife, Michelo, who has always supported me in my studies. Had it not been for her selflessness in as far as further studies are concerned, I would not be where I am today in my professional growth. Thank you dear, and may God bless you in all your endeavours.

ACKNOWLEDGEMENT

This educational journey on which I have traveled for the past two years has finally reached this milestone, the completion of my master studies. While I am filled with great pride, I am mostly humbled by the love, dedication, friendship, and guidance that was offered to me as I travelled this journey. Hand-in-hand, I traveled, first and foremost, with my best friend and life partner, Michelo. There are no words to describe what your love and support have meant to me throughout this process. I love you and am forever grateful.

My children, Moonga, Muyuni, Maluba, and Maambo have been my source of inspiration and my greatest supporters and cheerleaders. Hand-in-hand, you four have travelled alongside me, offering your love and support, now it’s your turn to continue the journey, learn much and often. It will be worth the effort.

I owe great thanks to Dr. Bestern Kaani, my supervisor. Your help, guidance and support throughout this journey are immeasurable. By your lead, I learned the value of scholarly work and what it means to be part of a true learning community. I will forever treasure our work together and you have been an inspiration to me and an invaluable part of my journey.

I would also like to extend my sincere thanks to my lecturers, Dr. E. Munsaka, Dr. S. Mwanza-Kabaghe, Dr. S. Kasonde-Ng’andu, Dr. B. Matafwali, Dr. G. Masaiti, Dr. A. Akakandelwa, Dr. D. Banda, and Dr. P. C. Manchishi. You have been an important part of my journey offering your wisdom, insights and guidance.

I am also grateful to the District Education Board Secretary (Monze District) for allowing me to conduct my study in Secondary Schools in Monze District. Lastly, I am grateful to all Head Teachers and teachers of Mathematics from all secondary schools in Monze District for their various contributions that made this study successful.

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ACRONYMS AND ABBREVIATIONS

CDC	Curriculum Development Centre
GRZ	Government of the Republic of Zambia
MGE	Ministry of General Education
MoE	Ministry of Education
US	United States
USA	United States of America
PD	Professional Development
CPD	Continuous Professional Development
SBCPD	School Based Continuous Professional Development
UNZA	The University of Zambia
SPSS	Statistical Package for Social Sciences
JICA	Japan International Cooperation Agency
NCTM	National Council of Teachers of Mathematics
HoD	Head of Department
DEBS	District Education Board Secretary
ECZ	Examinations Council Zambia
TIMSS	Third International Mathematics and Science Study

CHAPTER ONE: INTRODUCTION

1.1 Overview

This chapter begins with the background to the study. It, thereafter, presents the statement of the problem, purpose of the study, research objectives, and research questions. It further presents the significance of the study, theoretical framework, conceptual framework, definition of terms, limitations of the study, and ends with a summary.

1.2 Background to the Study

World-wide, there is a strong need for teachers to experience sustained and high-quality professional development in order to improve their teaching and pupils' learning. Rock and Wilson (2005) believed that a critical component of any educational reform effort should be to provide teachers with opportunities and appropriate support structures that encourage the critical work of on-going improvement of pedagogical practice. However, studies of initial teacher education have repeatedly revealed a disparity between the theory taught in teacher education programmes and the teachers' subsequent practice in real life classroom situations; hence creating the gap between theory and practice (Carroll, 2013).

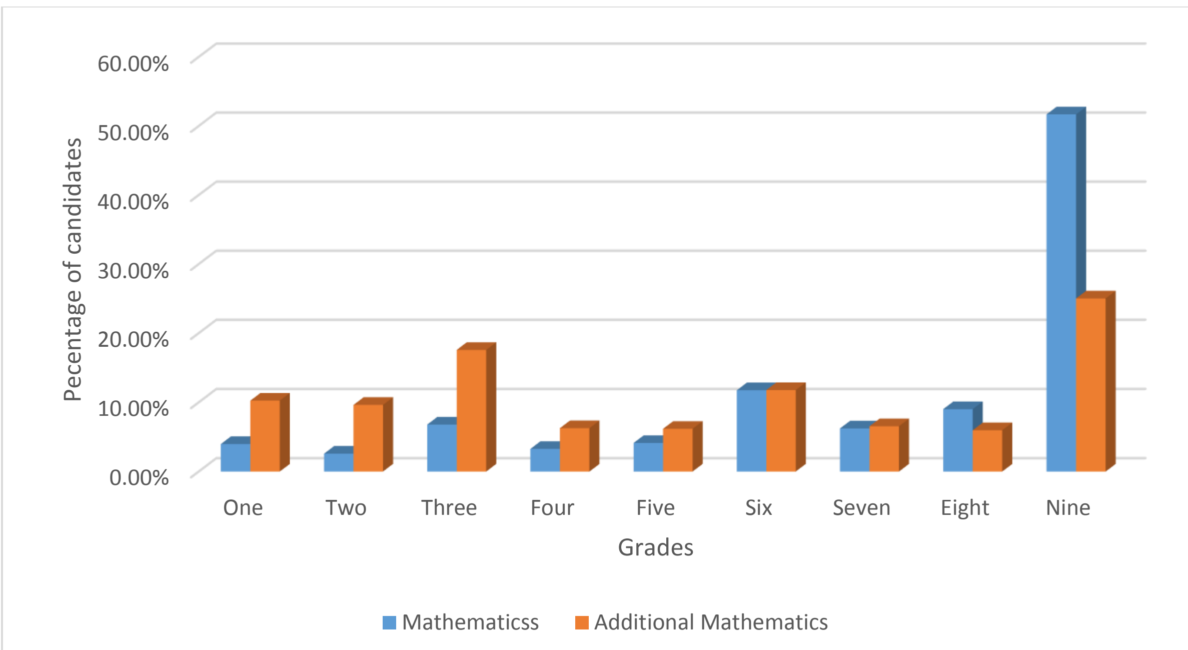
Studies by Brouwer and Korthagen (2005) and Korthagen (2007) show that the gap between theory and practice in teacher education persists across different times and contexts. Korthagen (2011) stated that more than 100 years ago (1904); Dewey identified the gap between theory and practice in teacher education programmes, which entails that it remained the central problem of teacher education world-wide for a long time. Allen and Peach (2007) also noted this gap between theory and practice. They argued that one of the major and long standing challenges of teacher education programmes is to strike a balance between theory and practice in the teaching profession. Masaiti and Manchishi (2011) evaluated the responsiveness of the

University of Zambia (UNZA) pre-service teacher education programme to the needs of schools and communities, and found that teachers were weak in the delivery of subject matter (methodology). They concluded that there was a gap between what the UNZA programme was offering and what was obtaining in the Secondary Schools.

It is evident from the studies that the gap between theory and practice in teaching is an issue of great concern for teacher educators (Allen & Peach, 2007; Brouwer & Korthagen, 2005; Korthagen, 2011; Masaiti & Manchishi, 2011). However, the sheer complexity of the problem means that it has remained a perennial problem in teacher education. Several reasons have been proposed as to why this theory-practice gap manifests in teacher education. One of these was the lack of connection between the teacher education programmes and school-based teaching experiences (Cheng, Cheng, & Tang, 2010). In an effort to improve the examinations results in Mathematics in Zambia, the Ministry of Education (MoE) initiated a project 1994 which was known as "Action to Improve English, Mathematics and Science" (AIEMS) (Ministry of Education, 2001).

AIEMS was a project designed to improve the quality of education through the development of a sustainable, decentralised system of INSET for teachers in Primary and Secondary Sectors. MoE (1996) outlined that the project stressed the role of the Teachers Resource Centres as being Instrumental in the decentralisation of INSET. In the quest of implementing this initiative, 78 Teacher Resource Centres at Provincial and District Levels were established and equipped with Textbooks in English, Mathematics and Science. In addition, Science kits as well as Mathematics kits were equally- distributed to all secondary schools. In the final analysis, following the subsequent reviews and evaluations of the initiative of AIEMS, MoE (2001) stated that despite all the inputs by the Ministry of Education, the idea of CPD was not institutionalised due to lack of clear monitoring and evaluative system at school level through which all in-service training would be relayed, and the inability to produce effective change in teaching practice and pupils' learning. This lack of continuity and ability to produce effective change in teacher professional development has resulted in theory and practice of teaching being treated as separate entities and has led to poor examination results especially in Mathematics in the Zambian education system as evidenced in the 2014 Performance Report. The report stated that performance in Mathematics at all levels, over the years, has been poor. One major challenge faced by some candidates was lack of mastery of the content (ECZ, 2015).

Figure 1.1: 2014 School Certificate/ General Certificate of Education Grade Distribution



Source: *2014 Examination Performance Report from ECZ*

Hiebert, Gallimore, and Stigler (2002), Korthagen (2010), and Álvarez (2015) examined how theory and practice may be integrated within teacher education. They suggested that if theory and practice are to be integrated successfully, teachers need cultivation of academic training of their professional development by raising their practices to help them understand the issues they were experiencing in the classroom and therefore improve their teaching practices. In this regard, one of the professional development processes that can raise critical self-regulation review of teaching experience to help teachers integrate theory and practice is the Japanese approach of Lesson Study – a model which has been gaining recognition over the last number of years in many countries including Zambia. This is an education model which treats theory and practice of teaching as inseparable entities (Long, Hall, & Murphy, 2012).

The Lesson Study (Jugyo kenkyu) is an approach initially developed and utilised by the Japanese to reform their teaching. It is based around the idea that teaching is a multifaceted cultural activity and can be improved through the gradual improvement of individual lessons, and through the knowledge developed and shared during this process (Stigler & Hiebert, 1999). In addition, Stigler and Hiebert opine that the Lesson Study has proven to be very successful in helping teachers of Mathematics in Japan to improve their teaching practices. Therefore, it is important to establish whether the Lesson Study supports teachers of Mathematics in bridging theory-practice gap in their Mathematics teaching practices in selected Secondary Schools of Monze District. Monze District was chosen because it was among the earliest districts to get involved in the Lesson studies when the programme was rolled out to the Southern Province from the Central Province in 2013 (Lesson Study Trainers' workshop, 2013). Additionally, Monze district was chosen to be the demonstration District in the Province on School Based Continuing Professional Development (SBCPD) through Lesson Study.

1.3 Statement of the Problem

Lesson Study conducted in Japanese schools stimulated the development of content knowledge and pedagogical knowledge for Mathematics teachers involved, which in turn greatly improved their practice and potentially improved pupils' learning (Fernandez & Yoshida, 2004). Despite Zambian teachers conducting Lesson Study modelled on principles of Japanese Lesson Study for a considerable period of time, the performance in Mathematics among pupils at grade 12 level was still poor. Therefore, there was need to evaluate the effectiveness of the practice of teaching Mathematics in Zambian Secondary Schools, in general, and Monze District, in particular. It was in view of this gap that this study was carried out.

1.4 Purpose of the Study

The purpose of this study was to establish the effectiveness of the Lesson Study in bridging theory-practice gap in Mathematics teaching practices in Zambia, in general, and selected Secondary Schools of Monze District, in particular.

1.5 Objectives of the Study

The study's specific objectives were to:

i. ascertain the role of Lesson Study as a professional development process in Mathematics teaching practices.
ii. evaluate the effectiveness of Lesson Study in Mathematics teaching practices.
iii. examine school-based factors influencing effective implementation of the Lesson Study approach in Secondary Schools in Monze District.

1.6 Research Questions

The study sought to answer the following questions:

i. What was the role of Lesson Study as a professional development process in Mathematics teaching practices?
ii. How effective was Lesson Study in Mathematics teaching practices?
iii. What school-based factors influenced the effective implementation of Lesson Study approach in Secondary Schools in Monze District?

1.7 Significance of the Study

The findings of this study may be vital to the developing Zambian Education system, in general, and teachers of Mathematics in particular, as they are likely embrace the Lesson Study as high quality professional development process. Specifically, teachers of Mathematics may be able to shift their approach to teaching Mathematics from "teaching as telling" to "teaching for understanding" through intense studying and sharing during Lesson Study (Lewis, 2002). Additionally, Lesson Study is likely to serve as a catalyst that may encourage teachers of Mathematics to become reflective practitioners that use what they have learned from research-based lessons to collegially revise and implement future lessons. The findings of this study would also contribute to the existing literature by providing knowledge about the Lesson Study and how it enhances the teaching-learning process. The findings of this study would provide information for further studies.

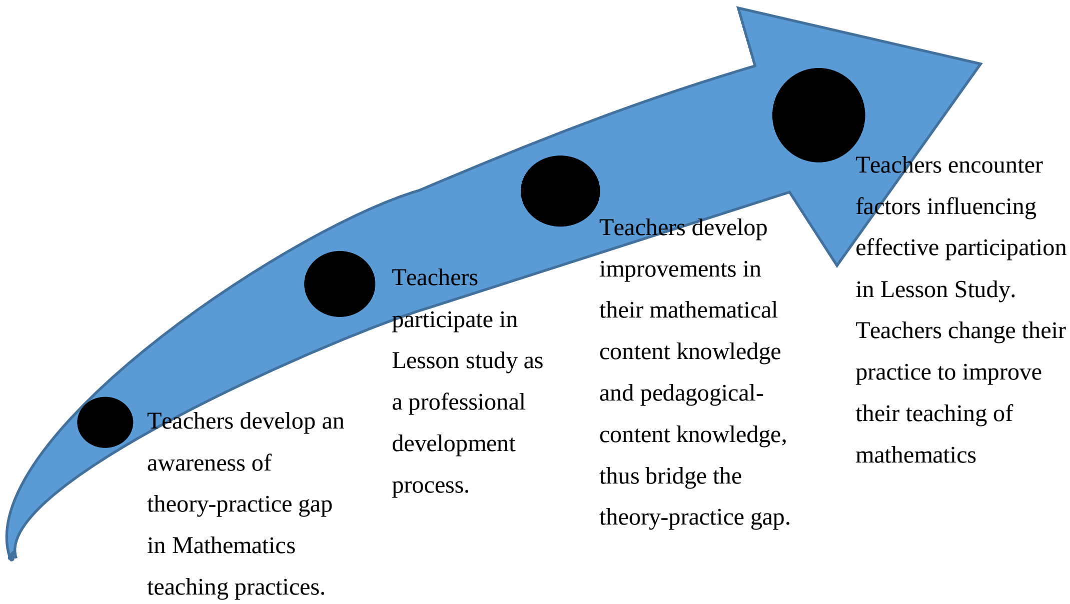
1.8 Theoretical Framework

The study was guided by the social constructivism theory which posits that knowledge is constructed through collaboration and social interaction to make sense of experience and is continually modified and tested in the light of new experiences (Amineh & Davatgari, 2015; Applefield, Huber & Moallem, 2002). During the Lesson Study process, there is professional collaboration among teachers, as teachers of various levels of experience work together and interact socially to construct personal knowledge which is a human product that is socially and culturally constructed through individual interactions. It was in this vain that social constructivism underlie Lesson Study and justify the importance of its process to bringing about increased professional knowledge and skills, and hence bridge theory-practice gap in Mathematics teaching practices.

1.9 Conceptual Framework

This study was situated within a context outlined in the conceptual design in figure 1.2 below. Research strongly suggests that teachers who participate in Lesson Study acquire many of the characteristics of effective professional development (Yamnitzky, 2010). Therefore, a conceptual design was provided as the foundation for the study and included the following characteristics: a) teachers develop an awareness of theory-practice gap in Mathematics teaching and that a reformation of their Mathematics instruction is necessary for improved pupil performance (Stigler & Hiebert, 1999); b) teachers participate in Lesson Study as an effective professional development (Cannon & Chokshi, 2003); c) teachers develop improvements in their content knowledge and pedagogical-content knowledge, thus bridge theory-practice gap; d) teachers encounter school-based factors that influence effective participation in Lesson Study; (Fernandez, 2008; Phillips, 2007; Schoenfeld, 2007). When teachers develop improvements in their Mathematical content and pedagogical knowledge as a result of their engagement in Lesson Study, they change their practice to improve their teaching of Mathematics and are much more likely to continue their participation in this effective professional development endeavor as a means in bridging theory-practice gap in Mathematics teaching practices.

Figure 1.2: Conceptual design



1.10 Operational Definition of Terms

Professional development; is the acquisition of an interrelated whole of knowledge a teacher needs for the day to day adequate practice of teaching in a given school environment.

Lesson Study; is a problem solving approach used in examining successful teaching strategies which enhance pupils' learning.

Theory-practice gap; is the inconsistencies between the selection of the best teaching strategies and the most common teaching strategies.

Mathematical Content Knowledge; is the specialised knowledge teachers have access to, for the purpose of teaching (O'Meara, 2010). **Mathematical Pedagogical-Content Knowledge;** is the practical knowledge that teachers require in order to teach.

1.11 Limitations of the Study

A large scale survey would have been much better, but due to the limited number of teachers of Mathematics in Secondary Schools in Monze District, the study was limited to a small scale survey of only 35 respondents. However, substantial information was still gathered because respondents provided a lot of answers in all questions.

Summary

This chapter has revealed that theory-practice gap in Mathematics teaching is not a new trend but rather an old one that dates back to the inception of modern Education in Zambia. The background to the study has clearly outlined the impact of theory-practice gap in Mathematics teaching practices on academic performance, and efforts carried out to bridge the gap. It has clearly been revealed the need for self-critical review of classroom experiences in order to enhance teacher competence through Lesson Study in order to bridge the gap. In the following chapter, a review of literature has been done according to the objectives of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview

This chapter provides insights into previous research undertaken in this field. It provides the effect of theory-practice gap on performance in Mathematics, background to the theory-practice gap, and outlines some of the contributory factors commonly identified in the literature as being responsible for this problem. The researcher also describes the Lesson Study model as an effective professional development process and examines the recent support for it in teacher education and the measures which have been adopted by some teacher educators in response to the theory-practice gap. Finally, it outlines the school-based factors that influence effective participation in Lesson Study, both internationally and nationally.

2.2 Performance in Mathematics and the Lesson Study

The competence gain in the study of Mathematics is widely used in all spheres of human life. This shows a key role Mathematics plays in shaping how individuals deal with the various spheres of private, social, and civil life (Anthony, & Walshaw, 2009). This justifies the compulsion of the study of Mathematics to all pupils who go through primary and secondary education in most countries. Mathematics is therefore, a core subject at these levels of education in Zambia. It is regrettable, however, that in the contemporary times many pupils struggle with Mathematics and perform abysmally low in their final examinations in most jurisdictions. In Zambia, learner's performance in Mathematics at both junior and senior secondary school levels has not been encouraging. One major challenge faced by some candidates is a lack of mastery of the content. Candidates are reported to exhibit lack of mastery of the Mathematical content (ECZ, 2015). Mensah, Okyere, and Kuranchie (2013) argued that it is an irrefutable fact that the successfulness of learning the subject is contingent on myriad of factors. In particular, the seriousness attached to the teaching of Mathematics invariably affects pupils' performance in their final examinations. In this, regard we do not know how teachers perceive the role of Lesson Study as a professional development process in their Mathematics teaching in Zambia, and Monze district in particular.

Noddings (1995) argued that effective teachers facilitate learning by truly caring about their pupils' engagement and that they create the right atmosphere that enhances pupil learning. This entails that practices of teaching Mathematics are complexly affected by teachers' beliefs, emotions, social context and content knowledge. Clarke, Thomas, and Vidakovic (2009) argued that usually, the way that Mathematics is represented in the classroom and perceived by pupils, even when teachers believe they are presenting it in authentic and context dependent way, stands to alienate many pupils from Mathematics, hence the continued poor results.

In an effort to improve the examinations results in Mathematics in Zambia, the Ministry of Education (MoE) initiated a project 1994 which was known as "Action to Improve English, Mathematics and Science" (AIEMS) (Ministry of Education, 2001). This was a project designed to improve the quality of education through the development of a sustainable, decentralised system of INSET for teachers in Primary and Secondary Sectors. MoE (1996) outlined that the project stressed the role of the Teachers Resource Centres as being Instrumental in the decentralisation of INSET. In the quest of implementing this initiative, 78 Teacher Resource Centres at Provincial and District Levels were established and equipped with Textbooks in English, Mathematics and Science. In addition, Science kits as well as Mathematics kits were equally- distributed to all secondary schools.

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However, the issue of poor results in Mathematics among pupils in Zambia is of much interest to the researchers. Nakawa (2012) and Nonaka (2013) argued that pupils in Zambia have very low performance in Mathematics due to teachers' low competence and limited views on Mathematics lessons. Nakawa (2010) added that pupils' low achievement is a major issue in Mathematics education. In an effort to improve competence among teachers of Mathematics and Science, the Ministry of General Education and Japan International Cooperation Agency (JICA) technical cooperation introduced the Lesson Study which was first rolled out in Central province of Zambia in the year 2005 (Hiroshi, 2015).

The Lesson Study is a central strategy in the success of the Japanese Mathematics teachers. It is an instructional approach that includes a group of teachers developing, observing, analyzing and revising lesson plans that are focused on a common goal with a focus on improving pupil thinking. A key element of the Lesson Study process is that it helps to facilitate teachers working together using interconnecting skills across grade levels and lessons (Teaching Today, 2006). Lesson Study, therefore, provides teachers an opportunity to grow in their Mathematical content and pedagogical knowledge (Ball, & Phelps, 2008). Dana and Yendol-Silva (2003) argued that by modifying the lesson plan, teachers have valuable discussions that allow the individual knowledge of content and pupils to be expanded by the collective knowledge of the group. During the Lesson Study, teachers develop their knowledge through the discussion of topics taught at each grade level and the instructional strategies used to teach such skills. This is exhibited through the understanding of the Mathematical concept and not only the implementation of the lesson. In this regard, we are not sure whether the Lesson Study produces similar results in the Zambian context.

It is, therefore, imperative for teachers to strive for continuous improvement of instructional strategies and knowledge because teachers are the key to pupils' understanding and achievement in Mathematics (Dana, & Yendol-Silva, 2003) and instructional changes are more likely to occur in sustained efforts and in small incremental steps (Guskey 2000). Even though, Lesson Study addresses one lesson at a time, but impacts learning and instruction in several aspects. It allowed teachers to view teaching and learning as they occur in the classroom. With time, Lesson Study has the potential to build learning communities within schools and ultimately result in instructional improvement and increase in teachers' knowledge with focus on the pupil and the content (Meyer, & Wilkerson, 2011). Therefore, there was need to establish if the Lesson Study was effective also in the teaching of Mathematics in Zambian secondary schools, and Monze district in particular.

2.3 The Gap between Theory and Practice

The main purpose of teacher education programmes is to provide trainee teachers with a set of competences and skills which enable them to cope with the complex situations they face in their everyday teaching in various classroom practices (Cheng, Cheng, & Tang, 2010). However it seems that the challenge of teacher education institutions is to provide necessary and up to date competences required for these trainee teachers to put what they have learned in the teacher education institutions into practice (Carroll, 2013). Allen (2009) observed and identified that the major challenge of teacher education institutions is being able to strike a balance between theory and practice in all trainee teacher education programmes. This failure to bridge the gap between theory and practice in educational institutions has resulted into graduating teachers who are not competent enough to teach. Ball and Bass (2000) concluded that this gap has caused practicing teachers to fail to identify the content knowledge that matters for teaching, understanding how such knowledge needs to be held, and what it takes to use such knowledge in practice.

During the twentieth century, efforts to bridge this gap focused on how teacher education faculties could better respond to reforms based on academic research (Korthagen, 2007). In more recent times researchers have acknowledged that their universal theories lacked concreteness, flexibility, subtlety and congruency and because of the situated nature of teachers' practice, translating research knowledge into forms useful for teaching could be problematic (Kessels, & Korthagen, 1996). This has led to a shift in focus on how the theory-practice gap should be approached. Efforts are now being focused on developing more reflective, more culture-sensitive, and more practice-orientated research (Clements, & Ellerton, 1996). In this regard, the researcher feels the more practice-oriented research is the use of the Lesson Study model. Therefore, there is need to establish the effects of the Lesson Study on theory-practice gap in Mathematics teaching.

2.4 Factors Contributing to the Theory-Practice Gap

Considering that as early as 1904, Dewey had perceived the gap between theory and practice and had proposed possible ways to bridge this gap, Carroll (2013) said that it is remarkable that it remains such a serious issue in teacher education in this 21st century. However closer examination of the contributory factors to the theory-practice gap reveals the sheer complexity of the problem. Korthagen (2007) believed that it is this complexity that makes the theory-practice gap more manifest in education. In particular Korthagen (2007) highlights the complex psychological and sociological phenomena influencing educational processes as posing particular difficulty for those searching for solutions to the problems causing the theory-practice gap. The following were identified as being contributing factors to the theory-practice gap in education.

2.4.1 *The Learning Process within Teacher Education*

Carroll (2013) explained that the cause of theory-practice gap has to do with the learning process within teacher education itself, that even before the stage in which theory can be applied to practice. She further explained that student teachers' prior knowledge plays a powerful role in their learning during a teacher education programme and their preconceptions show a remarkable resistance to change. This indicates that teachers' conceptions of teaching subject matter are strongly influenced by the way in which they themselves learned this subject content. Brouwer and Korthagen (2005) adds that student teachers who themselves experienced learning in an active way are more inclined to plan lessons that facilitate pupils' active knowledge construction in the classroom situation.

Korthagen (2007) showed that even with experienced teachers there is a strong relationship between their preferred way of teaching and the way they themselves are used to learning. They have a limited view of the learning styles of their pupils and tend to project their own way of learning onto the learning of their pupils. Korthagen and Kessels (1999) interpreted this poor transfer of theory to practice as a lack of integration of the theories presented in teacher education "the teacher educator's theory" into the conceptions student teachers bring to the teacher education program "the student teachers' theory". Cheng, Cheng, and Tang (2010) and Joram and Gabriele (1998) also believed that prior experiences can limit prospective teachers' receptivity to certain aspects of their teacher education programmes. Therefore, it is clear that it is important for teacher educators to take trainee teachers' preconceptions into consideration when developing teacher education programmes. They further stress that because these preconceptions are often long-standing they are remarkably stable and resistant to change which adds to the difficulty teacher educators' face in addressing the problem.

2.4.2 *The Feed-Forward Problem*

This has been said to be the more fundamental cause of the gap between theory and practice. Bartholomew (1976) stated that theory and practice are treated as separate entities within institutions of teacher education. Korthagen (2010) described this current practice in teacher education programmes as educators teaching theories to prospective teachers which on their own should try to apply during their teaching practice experiences. However, Bartholomew (1976) believed that students never experience in practice the ideas they are allowed to express in theory. Wittmann (1984) as cited in Carroll (2013) stated that theory and practice cannot be treated as separate entities, proposing that, theories which are developed independently of practice cannot be applied afterwards. Kessels and Korthagen (1996) added that certain aspects of teaching such as choosing a behaviour appropriate for a particular situation cannot be transferred through the use of purely conceptual knowledge.

Robinson (1998) suggested that the value of theory lies in its use in perceiving practice rather than providing teachers with concrete solutions. Kessels and Korthagen (1996) and Korthagen (2007) argued that it is important to help student teachers to become aware of the important aspects of their teaching experiences. He further points out that there has been too much emphasis on formal knowledge and that the development of perceptual awareness has been overlooked in teacher education institutions. Korthagen and Lagerwerf (2001) argued that in order to learn anything during teacher education, student teachers must have encountered concrete problems that can easily help them to put the theory into practice in a classroom situation. Otherwise, they do not perceive the usefulness of the theory and are not motivated to study it. Korthagen and Kessels (1999) concluded that the general theory is only helpful if there is some kind of coaching of the student teachers in connecting the theory to their actions in the concrete practical situations in which they encounter their problems. In this regard, there is need to engage students while still in institution in activities that bridges theory and practice.

2.4.3 *The Transition Shock*

The nature and complexity of teaching could be one of the reasons why student teachers often feel inadequate to deal with the challenges that lie ahead of them in their field of teaching (Frick, Carl, & Beets, 2010). This feeling of inadequacy explains why so many teachers experience a phenomenon described as 'the transition shock' once they leave their teacher education institutions and begin working in the field. The transition shock is the change in attitudes of graduate teachers as they seemingly leave university or college theory and begin to emulate the practice of the teachers around them in the field (Korthagen 2010).

There have been various suggestions as to why this might happen. Frick, Carl, and Beets (2010) proposed that student teachers ability to instigate change or explore new pedagogies may be inhibited as a result of power imbalances in the professional relationships between pre-service and in-service teachers. In addition, Leikin and Levav-Waynberg (2007) in their study of the theory-practice gap found that educational programs often do not provide sufficient opportunities for adequate conviction to form. Perhaps it is the short amount of time spent in preparation programs, coupled with the fact that the theory learned are not being reinforced by the approaches to teaching and learning the students encounter during their field experiences (Morrison, & Marshall, 2003), which contributes to the theory-practice gap.

2.4.4 *Lack of Good Communication between Researchers and Practitioners*

The notion that the theories being presented in universities and colleges is not being reinforced during their field experiences highlights the disconnectedness between university or college instruction and the classroom model (Morrison, & Marshall, 2003). Corte (2003) stressed that lack of good communication between researchers and practitioners is also responsible for the theory-practice gap. He said that it is important to realize that in view of accomplishing good and effective communication that can have impact on educational practice, it is not sufficient to translate research outcomes in such a way that they become accessible to teachers. He concluded that providing accessible and digestible research-based information is mostly not sufficient to guarantee good communication that can affect teachers' classroom practice.

Klein (1992) said that both researchers and practitioners want to maintain their comfortable status quo in education. Changes to their role is sometimes seen as threatening by both researchers and practitioners especially when there are few rewards for them to improve their practice (Klein 1992; Korthagen 2010). Another, reason for the gap between the cultures is the accessibility of the work done by researchers. Spencer and Logan (2003) argue that many teachers are not aware of the effective research-based strategies that educational researchers are developing. Klein (1992) pointed out that this is due to a combination of both the language used by the researchers and where they publish their work. He further clarifies this by pointing out that since researchers publish their research in academic journals, their audience is primarily other researchers and not practitioners.

There is also a lack of ownership the practitioners have over the theory. The importance of ownership of ideas has been strongly expressed by Goodson (2001) in his work on educational reform. Goodson found that reform in educational practice can only be successful if the teachers feel they have ownership of the ideas. Spencer and Logan (2003) added that teachers often dismiss research as having no connection to their classroom practices because it appears alien to them. Klein (1992) concluded that not until teachers accept researchers' ideas as being relevant and meaningful to them it will continue to have little impact on classroom practices. In addition, researchers-practitioner gap is caused by researchers who develop theories without thinking about the practical implications (Wittmann, 1984 as cited in Carroll 2013). This entails that both researchers and practitioners value different things (Wittmann, 2001). It is this idea of different values that has caused several researchers to examine the type of theory being developed by their fellow researchers.

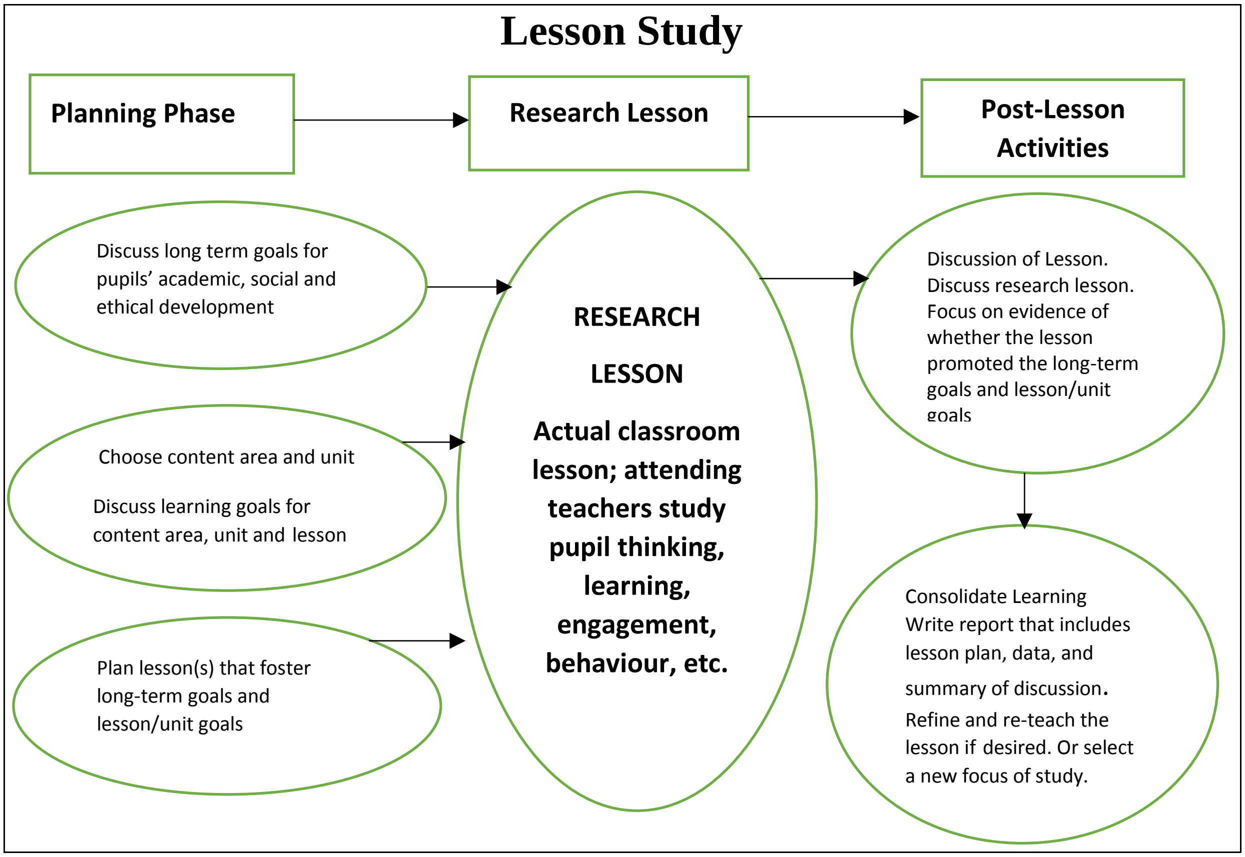
It is clear and well understood that there are problems associated with current practices in teacher education, however, given the complexity of the problem it is also evident that finding an appropriate solution may not be easy. There may be several different approaches to solving the problems associated with the theory-practice gap. Among the several approaches that may be considered is the use of the Lesson Study.

2.5 The Lesson Study

The Lesson Study is a relatively new approach adopted by many countries including Zambia in order to improve teaching, a popular professional development approach initiated in Japan (Fernandez, & Yoshida, 2004). Lesson Study is an approach which permits a critical analysis of the teaching process. Stigler and Hiebert (1999) described Lesson Study as an opportunity for teachers to examine their practice "with new eyes". This professional development model is used systematically to deepen content knowledge, increase understanding of pedagogy, and develop one's ability to observe and understand pupils' learning (Burroughs & Luebeck, 2010).

The term Lesson Study is a translation of the two Japanese words Jugyo (Lesson) and kenkyu (Study) (Fernandez, & Yoshida, 2004). Lesson Study is a structured process, a form of classroom inquiry, involving small groups of teachers that collaboratively plan, teach, observe, analyze, revise and refine actual classroom lessons (Cohan, & Honigsfeld, 2007). It is a form of extended professional learning as it involves a series of planned concrete steps that engages teachers. During Lesson Study, teachers prepare a lesson to demonstrate a specific teaching and learning goal. Other teachers observe and document what they see. After the lesson, the teachers meet and discuss the strengths and weaknesses of the lesson and make suggestions for improvement. Sometimes the lesson is revised and presented again. Lesson Study focuses on the core of the teaching process; what happens between teachers and pupils in the classroom. Lewis (2002), Lewis and Tsuchida (1998) pointed out that the Lesson Study represents a shift from "teaching as telling" to "teaching for understanding". Figure 2.1 below graphically represents the Lesson Study cycle. The Lesson Study consists of three critical stages and these are the planning stage, the implementation stage and the post-lesson stage as can be seen from Figure 2.1.

Figure 2.1: Lesson Study Cycle



(Lewis, Perry, Friedkin, Roth, Baker, & McGrew, 2012)

In the first stage of Lesson Study the teachers involved work together to formulate goals. These goals can be related to either developing a successful approach to a specific teaching topic or they can relate to broader educational goals (Lewis, & Tsuchida, 1998). Once the goal for the Lesson Study has been chosen the teachers work together in meticulously planning the lesson. Teachers, then, share ideas for how best to design a lesson to achieve these learning goals. They draw on past experiences, observations of their current pupils, their teacher's guide, their textbooks, and other research books (Fernandez, & Yoshida, 2004). The next stage is the implementation of the lesson, where one of the teachers teaches the lesson to the pupils. The other teachers come to the lesson as observers. They gather evidence of pupil learning throughout the lesson. Once the lesson has been taught the final stage is reflecting and revising the lesson. The teachers discuss the success of the lesson focusing on determining if the learning goals for the lesson were achieved. They use the evidence gathered during the teaching of the lesson to improve the lesson for future teaching or to improve their knowledge of instruction in general (Lewis, 2002).

The focus of the Lesson Study cycle is the research lesson. Although these research lessons are taught in the teachers' actual classrooms they differ from everyday lessons in that they comprise of a number of special features. Lewis and Tsuchida (1998) identified special features of research lessons that; they are carefully planned, sometimes over several months, typically in collaboration with at least one colleague. They are focused. They focus either on a specific goal, such as helping pupils become active problem-solvers, or developing a successful approach to a specific topic, for example subtraction with regrouping. They are observed by other teachers. They are recorded. This can be done in a number of ways: videotaped, audiotaped, narratives or copies of pupils' work. They are discussed. Subsequent to the teaching of the lesson, the strengths and weaknesses of the lesson are discussed. Particular emphasis is placed on the effectiveness of the lesson on achieving the learning goals.

This focus on the lesson as the unit of analysis and improvement means that the Lesson Study can still preserve the complexity that characterises classroom life. This is because even a single lesson retains the key complexities of the curriculum, pupil characteristics, materials, and physical environment, among other things that must be taken into account as we try to improve classroom learning (Stigler, & Hiebert, 1999). In order for it to be a successful lesson the teachers developing it must attend to all of these aspects, which together create significant learning opportunities for the pupils (Hiebert, Gallimore, & Stigler, 2002). Hence, the research lesson provides a unit of analysis which provides the teachers with knowledge which can be generalised to real classroom situations.

2.6 The Lesson Study as an Effective Professional Development Process

The relationship between pupil achievement in the school setting and the quality of teaching a child receives has been studied from many perspectives for a long period of time. Research continues to support the notion that a clear and positive linkage exists between the kinds and quality of instruction a pupil receives and his or her subsequent achievement in the classroom (American Institutes for Research, 2007). Moreover, it is the most influential element of academic success within the school setting (Coble & Piscatelli, 2002). This entails that a teacher's knowledge, and how he or she is able to convey it, has a direct impact on pupils' teaching. Cohen and Ball (1999) argued that while research has identified many key qualities and characteristics of high quality instruction, the most, historically, is the linkage between high quality instruction and the effective professional development in which teachers engage.

Professional development, when effective, offers teachers opportunities to deepen their knowledge, and supports the perspective that professional development must be collaborative, job-embedded, differentiated, content-specific and reflective (Yamnitzky, 2010). Many researchers have identified what characterizes the kind of professional development that is linked to improved pupil achievement. Guskey (2000) outlined the defining characteristics of professional development, as evidenced through his research. He notes that it is intentional, an ongoing process and a systemic process while Elmore (2000) identified the characteristics of successful professional development as that which focuses on concrete applications of ideas, exposes teachers to actual practice, involves observation, critique and reflection, is collaborative and involves deliberative evaluation and feedback. In addition, Sparks and Hirsch (2000) identify similar characteristics in their summary of research. They suggest that effective professional development is the one which is results-driven and job-embedded, focused on helping teachers become deeply immersed in subject matter and teaching methods and directly linked to what teachers do in their classrooms. In this regard, there was need to establish whether the Lesson Study as a professional development process helped teachers in Zambia, and Monze district in particular to produce similar results.

Stigler and Hiebert (1999) argued that effective professional development shares specific core components such as ongoing (measured in years) collaboration of teachers for purposes of planning, with the explicit goal of improving pupil’s achievement of clear learning goals, anchored by attention to pupil’s thinking, the curriculum, and pedagogy, with access to alternative ideas and methods and opportunities to observe these in action and to reflect on the reasons for their effectiveness. Garet (2001) supported this view. He stresses that professional development that takes place during the day, or is job-embedded, is much more likely to assist teachers in connecting their learning to their own teaching, and it has shown to be sustained over time. Carpenter, Fennema, and Franke (1996) argued that teachers’ knowledge of Mathematics and the development of the knowledge base related to that are important characteristics of effective professional development. Ma (1999) stressed that teachers must possess a profound understanding of fundamental Mathematics as a corollary to effective teaching. Professional development that focuses on both subject matter knowledge and knowledge of how pupils think and learn about Mathematics are more likely to benefit pupils (Kennedy, 1999). Ma (1999) added that teachers must possess a strong content knowledge of the “Basic Ideas, an awareness of the simple but powerful basic concepts and principles of Mathematics”. Making connections among Mathematical concepts and procedures, from simple and superficial to complicated and underlying, and identifying the connections among different operations is a prerequisite for effective teaching of Mathematics (Ma, 1999).

Yamnitzky (2010) opined that the kinds of tasks in which pupils engage impacts the Mathematics they learn. When pupils only work on low-level tasks, the learning that occurs tends to be procedural in nature. Pupils who solve cognitively demanding tasks, with an increase in the use of questions that require knowledge construction and problem-solving are more likely to develop a conceptual understanding (National Council of Teachers of Mathematics, 2000).

Additionally, the National Council of Teachers of Mathematics (NCTM) has called upon teachers to provide more opportunities for pupils to develop new understandings and construct their knowledge of important Mathematical ideas, through collaboration, discussion, problem-solving, construction of arguments, and real-world experiences (NCTM, 2000; National Mathematics Advisory Panel, 2008). Therefore, teachers are required to pose real-world and open-ended problems to their pupils, facilitate discussion and collaboration, and develop their pupils' ability to problem solving through investigation. However, it is imperative that teachers know and understand the cognitive demands of the Mathematical concepts in which their pupils are engaged. A conceptual understanding is called for more attention. Additionally, pupils need to learn to make connections and do so by developing conjectures, evaluating the thinking of themselves and others, and by developing reasoning skills (Hiebert, & Stigler, 2000; Ma, 1999; NCTM, 2000; Stigler, & Hiebert, 1999). Furthermore, professional development that provides opportunities for teachers to strengthen their understanding of the cognitive demands of Mathematical concepts is an effective endeavor.

The literature overwhelmingly suggested that improving pupil achievement through effective professional development is both imperative and possible with a change in the kinds and qualities of professional development afforded to teachers. It calls for a shift away from the externally provided, one-size-fits-all paradigm. Instead, it strongly urges a move toward professional development that is collaborative, engaging and tailored to the specifics strengths and weaknesses of the teacher. Most importantly, that professional development which focuses on teaching, rather than teachers, and evidence of pupil learning rather than just the pupil, will be an effective tool in improving pupil learning (Stigler & Hiebert, 1999).

Furthermore, high-quality and effective professional development is always an important component of the varied reform initiatives in the teaching and learning in schools, and the need for such continues to be pressing (Guskey, 2000) because teachers come to the profession with varied formal education and experience and some with no experience at all (Darling-Hammond, & Baratz-Snowden, 2007). Hence, professional development containing research-based characteristics such as Lesson Study have been identified as best practices and paramount to improving pupil performance. Many current research studies have generated Lesson Study as an effective professional development and pupil achievement model.

Rocky and Wilson (2005) in their research on improving teaching through Lesson Study found that teachers experienced professional growth as a direct result of their engagement in the on-going, sustained professional work of the Lesson Study. They also found that teachers experienced increased confidence in approaching instruction as a result of engaging in the Lesson Study. White and Southwell (2004) earlier evaluated the Lesson Study as a model of professional development for teachers of Mathematics in New South Wales, and found that the Lesson Study contributed substantially to the teachers own learning and in particular to their understanding of pupil learning and it was a rich experience for most teachers. It changed teachers' focus being directed to a greater extent on issues of teaching and learning with an increase in the willingness of colleagues to share ideas.

In the same vain Frick, Carl, and Beets (2010) and Posthuma (2012) carried out an investigation in South Africa on Mathematics teachers' reflective practice within the context of adapted Lesson Study as a professional development programme, and found that the Lesson Study has some potential value for planning professional learning programmes in which teachers are encouraged to talk about their classroom experiences, share their joys and challenges with one another and strive to build a community of reflective practitioners to enhance their learners' understanding of Mathematics.

The Lesson Study as a kind of professional development in which teachers engage in quality and effectiveness has emerged as one kind of professional development that has produced results in Japanese schools and is emerging as a practice with promise for success in other countries (Chokshi & Fernandez, 2005; Cohan & Honigsfeld, 2007). In addition, when looking at the elements of this practice, they embody many characteristics that have been linked to effective professional development, i.e. teacher collaboration, pupil centered, research-based, grounded in best instructional practices, has practical application in the classroom, and embraces adult learning theories (Lewis, Perry, Hurd, & O'Connell, 2006).

The length of time devoted to a particular professional development is also directly related to its effectiveness in improving teachers' knowledge of teaching and learning in meaningful ways (Elmore & Burney, 2000; Guskey & Sparks, 2002; Sparks & Hirsh, 2000). Lesson Study, is a professional development practice that is cyclical in nature and is, therefore, conducted over long periods of time. Engagement in this process requires that teachers devote time to collaborative planning with colleagues, research into best instructional practices, in-depth planning of a learning event, deliberation and reflection of learning events, revisions of learning events and a renewal of this process (Stepanek, 2001; Stigler & Hiebert, 1999). This entails that it is expected to be ongoing and enduring in nature.

Fundamentally, Lesson Study is a problem-solving process where small incremental improvements to teaching occur over a long period of time (Stigler, & Hiebert, 1999). An interest in this practice was sparked in the United States (U.S.) after Stigler and Heibert (1999) reported the findings of the Third International Mathematics and Science Study (TIMSS) noting the success of Japanese pupils in Mathematics (Lewis, 2002) and differences in how teachers in the U.S. and Japan teach Mathematics were identified, as well as important differences in lesson construction and teachers' attitudes toward this process (Fernandez & Cannon, 2005). One conclusion which was drawn from TIMSS was that Japanese teachers' participation in Lesson Study served to build professional knowledge and Mathematical content knowledge, resulting in improved pedagogical-content knowledge and pupil achievement (Stigler, & Hiebert, 1999). Japanese teachers agreed with this conclusion identifying their participation in Lesson Study as having a strong influence over their teaching noting that they improved their ability to "see children" succeed (Lewis, 2002) and this strongly urged U.S. teachers' participation. Therefore, there is need to establish whether Zambian teachers of Mathematics agrees to the conclusion drawn from TIMSS.

Essential components of teachers' pedagogical-content knowledge are the skills to be able to discern and identify pupils' understanding of the core Mathematical concepts presented to them (Carpenter, Fennema, & Franke, 1996). Specifically, understanding the conceptions, preconceptions and misconceptions that pupils possess about specific content assists teachers in developing their own knowledge; a key component to effective instruction (Carpenter, Fennema, & Franke, 1996). And, a professional development endeavor, such as Lesson Study that focuses on developing skills to better understand pupils' thinking provides important opportunities for teachers to improve their practice (Carpenter, Fennema, & Franke, 1996; Desimone, 2009). Lesson Study, as research suggests, affords teachers the opportunity to gain new knowledge of, or change their understanding about Mathematical concepts being taught. Teachers are able to make clearer connections between the standard being taught and classroom instruction and hence clarify or change their thinking about pupil learning (Lewis, Perry, & Murata, 2006).

2.7 The Effectiveness of the Lesson Study in Mathematics Teaching Practices

In education, there has been a gulf between the production of pedagogical knowledge and the way that it is put into practice in education centres, popularly known as the theory-practice gap. In view of the theory-practice gap, Álvarez (2015) examined how theory and practice can be integrated and argues that one of the possibilities that teachers have for starting a process of relating theory and practice is the cultivation of academic training of their professional development by raising their practices (self-critically reviewing their teaching experience), thus, creating their own theory and practice that are permanently related to each other. This is the sole purpose of the Lesson Study, which treats theory and practice as inseparable entities (Cohan & Honigsfeld, 2007; Lewis, Perry & Murata, 2006; Sims & Walsh, 2009).

In the same view of theory-practice gap, Allen and Peach (2007), and Carroll (2013) examined the impact of Lesson Study on the theory-practice gap in pre-service teacher education and found that Lesson Study was indeed an effective approach in assisting the pre-service teachers to bridge the theory-practice gap and particularly that it enabled teachers to make vast improvement in both their lesson planning and implementation. In practice, it developed a confidence in teachers' use of constructivist teaching approaches, improved their questioning and collaboration skills and they began to reflect more openly and honestly on their lessons. This echoes the findings of Khakbaz (2008) who had found that Lesson Study improved teachers' subject content knowledge and teaching knowledge (pedagogical-content knowledge), teacher knowledge and evaluation knowledge and improvement in teacher practices as teachers were able to integrate theory and action in real teaching-learning situation.

Van Sickle (2011) also examined the Lesson Study's impacts on teacher perception of efficacy in teaching, and found that it had the largest impact on teachers' teaching by improving their ability to match instructional strategies to pupils' learning needs and increases teaching confidence and has direct benefits for pupil learning through the collaboration with colleagues. This supported the findings of Meyer (2005) who had previously found that the Lesson Study had impact on teachers' instructional strategies in the areas of self-reflection, incorporating problem-solving activities, encouraging cooperative learning and improved teachers' content knowledge as a result of teacher collaboration.

In the similar manner, Meyer and Wilkerson (2011) conducted a research in United States of America (USA), and found that Lesson Study addresses one lesson at a time, but impacts learning and instruction in several aspects and that allows teachers to view teaching and learning as they occur in the classroom. These results are supported by Dawson (2013) who later found that Lesson Study enhanced teachers' conceptions of pupil understanding, enabling them to design, implement and review lessons to implement scaffolding that resulted in improved pupil outcomes. In addition, Lesson Study can be used to promote shared practice that, if sustained, could create a culture of powerful pupil intervention in the development of foundational concepts.

2.8 School-Based Factors Influencing Effective Implementation of Lesson Study

Without ignoring changes including the one on curriculum, it is the fact that teaching and learning process remains showing similar but unique phenomena. Todd (2006) points out that one of the phenomena is related to the teaching practice in a large class. This indicates that there are factors that influence effective implementation of Lesson Study in schools.

In view of the implementation challenges, Fatimah (2012) carried out a study on how to improve the implementation of Lesson Study, and found that the first challenge was to have preparation before the planning stage. She argued that it was important that the team communicates with the authority and related parties to support the Lesson Study in order to have the common goals and collaboratively design the teaching and learning activities to achieve the goals and learning objectives. The study also revealed that spending time for reflection is also another challenge when conducting Lesson Study. After the doing stage, limited time often hinders the members to have a thorough discussion. Furthermore, Fatimah's study revealed a challenge related to sustainability. She argues that support from teachers, authority and education network is the one to obtain in order to sustain the Lesson Study. This echoes the findings of Chassels and Melville (2009), and Yamnitzky (2010) who previously found that time was the major challenge both scheduling time to meet and the amount of time needed to devote to Lesson Study and amount of administrative structures that impede teacher collaboration when conducting Lesson Study cycles.

Banda, Mudenda, Tindi, and Nakai (2011) also carried out an impact survey on Lesson Study practice of science teachers in Central province of Zambia. They found that support from school managers and allocation of well-trained Lesson Study facilitators were enhancing factors of Lesson Study, while heavy loads of teachers and high pupil-teacher ratio were some of the hindering factors to successfully implement Lesson Study in secondary schools.

Literature review upholds the argument that Lesson Study have an effect on teachers' classroom practices and learners' achievement and upholds it as an effective professional development model. Further review of literature shows that none of the researchers have ventured into finding out the effect of the Lesson Study on theory-practice gap in Mathematics teaching practices in Zambia, and Monze District in particular; hence this study to fill this gap.

Summary

The literature overwhelming suggested that professional development such as the Lesson Study which embodies specific qualities including, but not limited to: collaboration, a content-focus, job-embeddedness, active learning and reflection can provide a means for improving teacher quality and, ultimately, pupil learning. Moreover, it can assist teachers in improving their practice in meaningful ways that can be sustained over time.

When teachers develop the skills to understand how pupils think about Mathematics, understand what evidence of authentic pupil learning looks like, and when teachers collaborate in ways that change their practice, the benefits of Lesson Study can be realized. Through the careful implementation of the universal principles of Lesson Study in ways that acknowledge the cultural nature of teaching, Lesson Study may assume an important place in effective professional development and potential support to teachers in bridging theory-practice gap in their Mathematics teaching practices.

CHAPTER THREE: METHODOLOGY

3.1 Overview

In this chapter, the researcher outlines the methodology used in this study and provides a rationale for choosing that particular method. This chapter also provides details of the research design, demographics, and background information of the participants who took part in the study, sampling procedure, research instrument, data collection procedure used and data analysis. Finally, it outlines limitations, delimitations and ethical considerations which were pertinent to this study.

3.2 Research Design

The study was a survey that used a quantitative research design. A quantitative research design was chosen because it assumes that the results of a study are more objective and not so open to bias since the researcher have little interference with what is being investigated. This is because research concepts, hypothesis, and variables are made prior to conducting the research as such it describes the situation as it is (Valsiner, 2006). A survey was used for this study because it was useful to collect original data for describing what was in existence in terms of effect and attitudes (White, 2005). Kombo and Tromp (2006: 71) quotes Ordho (2003) who adds that the survey design "… can be useful when collecting information about people's attitude, opinion, habits, experiences, or any of the variety of education or social issues." It was in this vain that a survey research design was selected as it provides an accurate portrayal or account of the characteristics of a particular group.

The study was an investigation into the effect of Lesson Study on theory-practice gap in Mathematics teaching practices with a purpose to establish whether the Lesson Study supports teachers of Mathematics in bridging theory-practice gap in their Mathematics teaching practices in selected secondary schools of Monze District. Teachers of Mathematics' personal experiences in the Lesson Study served as the basis for the study. While personal experiences cannot fully show the richness of any setting, as a starting point they generate a foundation upon which other knowledge can be added. This, in turn, can serve to further advance and deepen our understanding of the effectiveness of the Lesson Study approach. Mullens (1999) argued that teachers' self-reporting of the extent to which they use various teaching strategies, or engage in various learning events, can be strongly correlated to the actual existence of these self-reported events in their classrooms. As such, teachers' self-reporting of the effects that Lesson Study participation has had on their Mathematics teaching practices provided us with insight into the overall effect of Lesson Study on theory-practice gap in Mathematics teaching practices.

3.3 Study Site

The study was conducted in seven secondary schools in Monze District. Monze District is one of the 13 districts in the Southern Province of Zambia. It is about 182 kilometers to the south from the capital city of Zambia, Lusaka, and is 100 kilometers to the north from Choma the Provincial headquarters of Southern Province. Monze District has 105 Primary Schools, 47 Community Schools, 16 Private Schools, and seven Secondary Schools. Secondary schools were the main target in this research. The selected seven Secondary Schools were coded A, B, C, D, E, F, and G. Their names were withheld for the sake of adhering to research ethics. Monze District was chosen because it was among the earliest districts to get involved in the Lesson studies when the programme was rolled out to the Southern Province from the Central Province in 2013 (Lesson Study Trainers' workshop, 2013). Additionally, Monze district was chosen to be the demonstration District in the Province on School Based Continuing Professional Development (SBCPD) through Lesson Study.

3.4 Target Population and Study Sample

The target population of the survey were all 39 teachers of Mathematics in Secondary Schools in Monze District. Only teachers employed by government and were working in government or grant aided (mission) Secondary Schools throughout Monze district were considered. These teachers were chosen because of their being exposed to teaching Mathematics using the Lesson Study approach in Secondary Schools. All the 35 teachers of Mathematics who were available at the time of the survey were sampled. Table 3.1 shows the gender of the respondents according to the Secondary Schools they were drawn from. The table shows that 29 were male and six were female.

Table 3.1 Responses on the Gender of Research participants

Name of School	**Gender**		**Total**
	Male	Female	
School A	7	2	9
School B	4	1	5
School C	4	1	5
School D	4	1	5
School E	5	0	5
School F	3	1	4
School G	2	0	2
Total	**29**	**06**	**35**

3.5 Demography of the Respondents

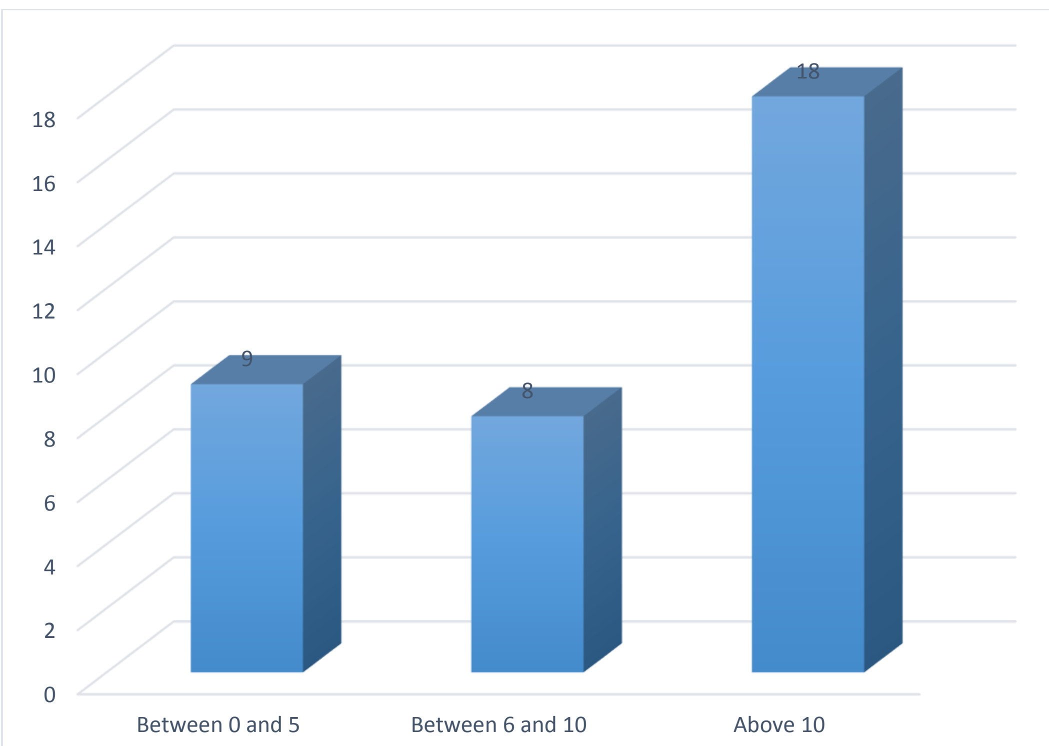
As regards the characteristics of the participants such as educational level, age, and work experience, the results on educational level of the respondents indicated that nine teachers were diploma holders, 25 were Bachelor’s degree holders and one was a Master’s degree holder. Table 2 below shows the distribution by professional qualification.

Table 3.2 Distribution of Respondents by Professional Qualification

Qualification	Male	Female	Total
Secondary Teacher's Diploma	7	2	**9**
Bachelor's Degree	21	4	**25**
Master's Degree	1	0	**1**
Total	**29**	**6**	**35**

As regards the age of the respondents, the mean age was 38 years (SD = 8.00) and the age range was from 25 years to 51 years. On average, the participants reported the length of time (in years) they had been teaching as of the time of the survey. The overall mean teaching experience was 11 years (SD = 6.00). Teaching experience ranged from 2 years to 22 years. Figure 3 below shows the distribution of respondents' teaching experience in years.

Figure 3.1: Respondents' teaching experiences (years)



3.6 Sampling Procedure

The study employed purposive sampling procedure and was used to select all teachers of Mathematics in selected Secondary Schools. Teachers were selected on purpose that they were teachers of Mathematics in secondary schools in Monze District. These teachers of Mathematics were considered to be able to give the appropriate information required for the study as they were exposed to Mathematics teaching using the Lesson Study approach.

Purposive sampling was used simply because the above cited respondents were the target group of people believed to be key informants in terms of providing relevant and reliable information related to the study due to their responsibilities and key result areas at their places of work. This was done in accordance to the explanation that White (2005) gave concerning the nature of purposive sampling. He said that the concern is to acquire in-depth knowledge from those who are in position to give it. Orodho and Kombo (2002) added that the power of purposive sampling lies in selecting information rich cases for in-depth analysis related to the central issues being studied. Best and Khan (2009) concluded that purposeful sampling allows the researcher to select those participants who will provide the richest information, those who are the most interesting, and those who manifest the characteristics of most interest to the researcher. It was in this vain that purposive sampling was selected as the appropriate procedure for the study.

3.7 Research Instruments

A structured questionnaire was used as an instrument to elicit responses during data collection. A questionnaire was used as a tool for data collection because it ensures a high response rate, it also offers the possibility of anonymity as subjects' names are not required on the completed questionnaires and most of the items in the questionnaire were closed, which makes it easier to compare the responses to each item (Burns & Grove, 1997).

The questionnaire had 30 questions which were divided into four parts. The first part sought to gather data about teachers' demographic information. The second part sought to gather data concerning teachers' perception of the role of Lesson Study as a professional development process in relation to research-based definitions of effective professional development. The third section sought to establish teachers' perception of the effectiveness of Lesson Study in Mathematics teaching' practices in line with the effect Lesson Study participation have on teachers' Mathematical content knowledge, and pedagogical content knowledge. The fourth and last set of questions of the survey sought to gather data about the challenges that the study participants faced when participating in Lesson Study, and factors that enabled the participants to feel that Lesson Study engagement was a successful professional development endeavor.

3.8 Data Collection Procedure

First and foremost, permission was sought from the office of the District Education Board Secretary in Monze District to conduct the research in Secondary Schools of Monze District. Thereafter, the researcher commenced with his research by personally distributing the questionnaires to the teachers through Heads of Mathematics Department (HODs) in Secondary Schools to complete. After being completed, the researcher collected the questionnaires through Heads of Department (Mathematics) on the same day to ensure that all the questionnaires were collected back.

3.9 Data Analysis

Before the statistical analysis of the results was done, data cleaning was conducted to ensure that all research participants had some experience of Lesson Study participation. Additionally, data was cleaned to ensure that all questions were answered by the respondents on each questionnaire by proof checking the questionnaires one by one. After data cleaning was done, the questionnaires were coded in order for them to be easily identified during data entries. The data was then analysed quantitatively to explore the three research questions that guided the study using Excel 2013 and the Statistical Package for Social Sciences (SPSS) Version 23.0 for Windows to generate descriptive and inferential statistics.

Descriptive statistics were conducted to generate frequencies and percentages. The data were further disaggregated by various factors, and descriptive statistics were again used to identify the extent, if any, of effects using cross tabulation and Chi-squares. Particular responses from the participants embedded in the survey questionnaire were initially coded in line with research questions.

3.10 Ethical Issues

The researcher sought permission from relevant authorities the district of each visited school by producing the letter of introduction together with consent letter. The researcher also did assure the respondents of the ethical issue of anonymity and confidentiality by advising them not to write their names and/or schools on the questionnaires.

3.11 Validity and Reliability

The researcher collected data using questionnaires that contributed to internal validity. Whereas external validity was achieved by questions generated from literature review. A pilot study was conducted to assess the reliability of the questionnaire at one Secondary School which was not included in the main study. To test the reliability of the questionnaire, a split-half was conducted.

Summary

The study employed a quantitative method approach using a survey questionnaire and a 100% response rate was achieved. The study provided in-depth insights into the effect of the Lesson Study approach in assisting teachers to bridge theory-practice gap in Mathematics teaching practices.

CHAPTER FOUR: PRESENTATION OF THE FINDINGS

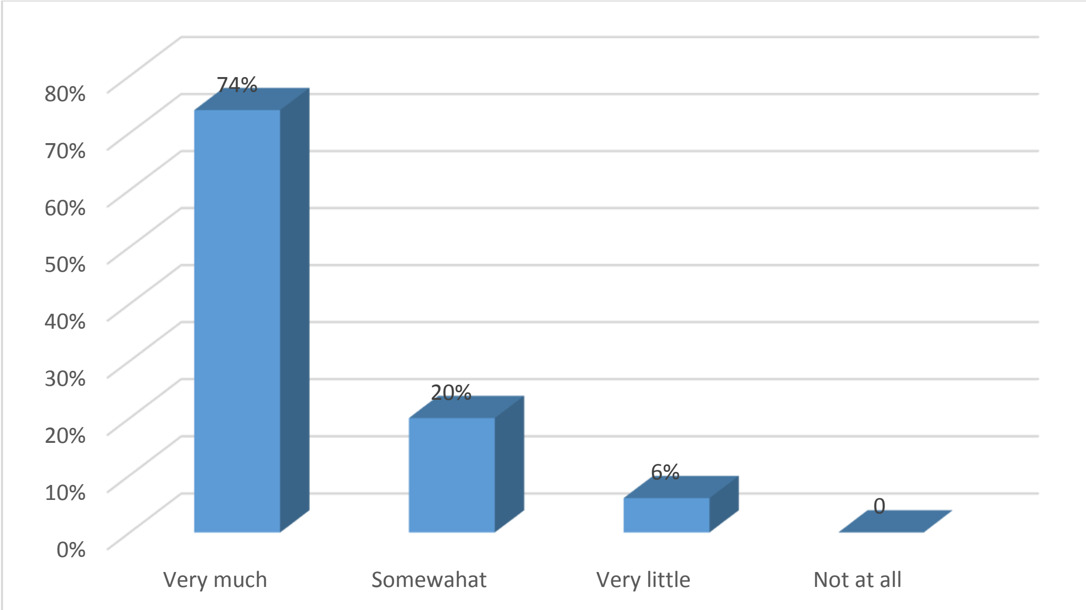
4.1 Overview

In this chapter, the researcher presents the findings of the study. The primary purpose of the study was to establish whether the Lesson study supported teachers of Mathematics in bridging the theory and practice gap in their teaching practices in Secondary Schools. The analyses were conducted according to the research questions. The research objectives were to: (a) ascertain the role of Lesson Study as a professional development process in Mathematics teaching practices; (b) evaluate the effectiveness of Lesson Study in Mathematics teaching practices and (c) examine school-based factors influencing effective implementation of the Lesson Study approach in Secondary Schools.

4.2 The Role of Lesson Study as a Professional Development Process

The first objective was focused on teachers' perception of the role of Lesson Study as a professional development process. The findings are reported in relation to the research-based qualities of effective professional development. In order to determine the role of Lesson Study as a professional development process, participants were asked how much they collaborated with colleagues from the same school as a result of their participation in Lesson Study. The results showed that 74% ($n = 26$) of the participants revealed that they regularly collaborated and shared their new Mathematical knowledge with colleagues from the same school. Figure 4.1 shows the frequencies of responses from the Likert's scale. A chi-square test of goodness-of-fit was also performed to determine whether collaboration frequencies among teachers of Mathematics involved in Lesson Study was high. Results show that teacher participants collaborated highly, χ^2 $(2, N = 35) = 27.47$, $p < .05$. The results indicated that Lesson Study enhances significant collaboration and sharing of knowledge among teachers.

Figure 4.1: Teachers collaborate and share knowledge with colleagues from the same school



Further analysis of data revealed that 73% of teachers who collaborated with colleagues very much, often shared their new Mathematical knowledge with others while 3% reported that they never shared their new Mathematical knowledge with colleagues despite collaborating very much with others. Eighty-six percent (86%) of those teachers who somewhat collaborated with colleagues during Lesson Study often shared their new Mathematical knowledge with colleagues, and 50% of those teachers who collaborated with colleagues very little, often shared their new Mathematical knowledge. It was also noted from the results that those teachers who had not at all collaborated with colleagues had never shared their Mathematical knowledge with others from the same school. The full results are shown in Table 4.1.

Table 4.1: Teachers Collaborate with colleagues from the same school and Share new mathematical knowledge with colleagues

	Responses	Collaborate with colleagues from the same school Very much	 Somewhat	 Very little	 Not at all
Share new mathematical knowledge with colleagues	Often	74%	86%	50%	0
	Sometimes	12%	0	50%	0
	Rarely	12%	14%	0	0
	Never	03%	0	0	0
	Total	100%	100%	100%	00

In an effort to further establish the role of Lesson Study as a professional development process, all participants revealed that the Lesson Study helped them to become better Mathematics teachers. All of the teachers of Mathematics acknowledged that the Lesson Study was an effective way of ensuring continued professional development and, pledged to continue participating in Lesson Study.

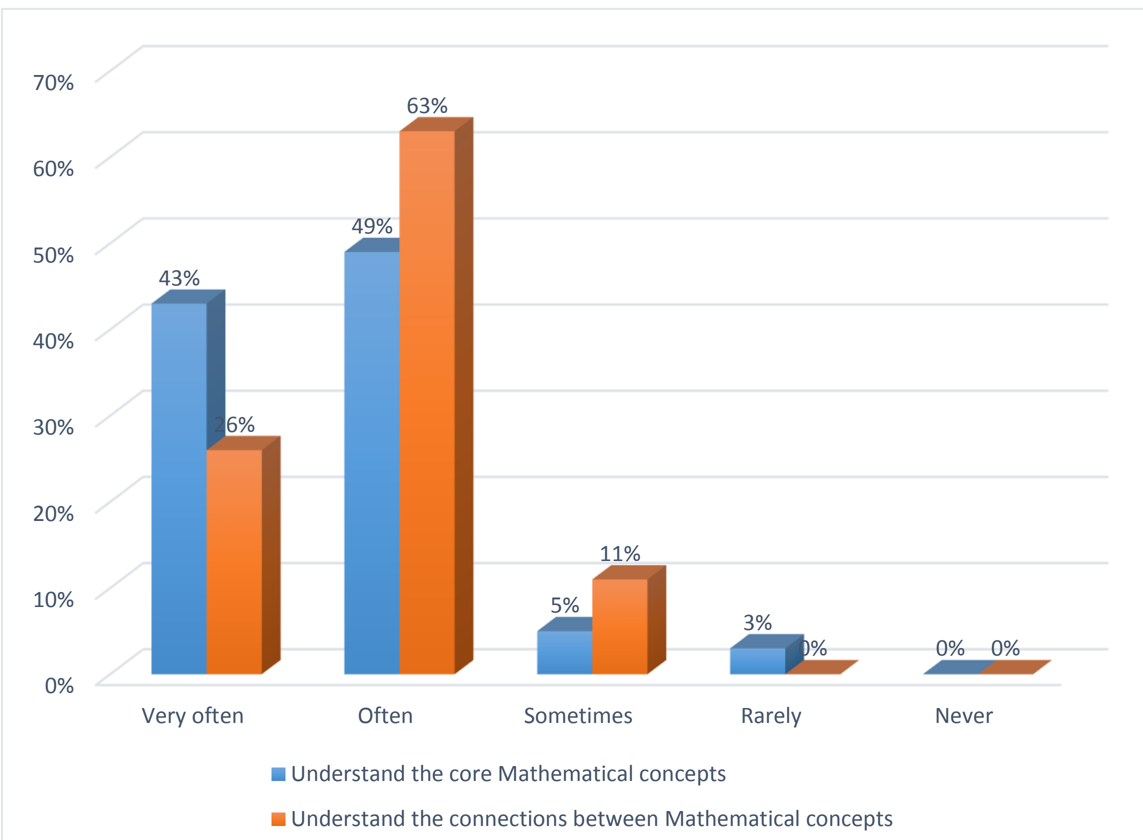
4.3 The Effectiveness of the Lesson Study in Mathematics Teaching Practices

Effective professional development focuses on developing teachers' pedagogical content knowledge. Effective professional development helps teachers become deeply immersed in the content. Learning and understanding Mathematics was a core feature of the Lesson Study engagement. Overall the purpose of Lesson Study was to produce new knowledge about content and pedagogy. Therefore, the second objective was focused on teachers' perception of the effectiveness of the Lesson Study in Mathematics teaching practices. The results are reported in the following sections in line with the effect of Lesson Study on Mathematical content-knowledge and Mathematical pedagogical-content knowledge as a measure of the overall effect of the Lesson Study on theory-practice gap in Mathematics teaching practices in Secondary Schools.

4.3.1 *Effects of Lesson Study on Teachers' Mathematical Content-Knowledge*

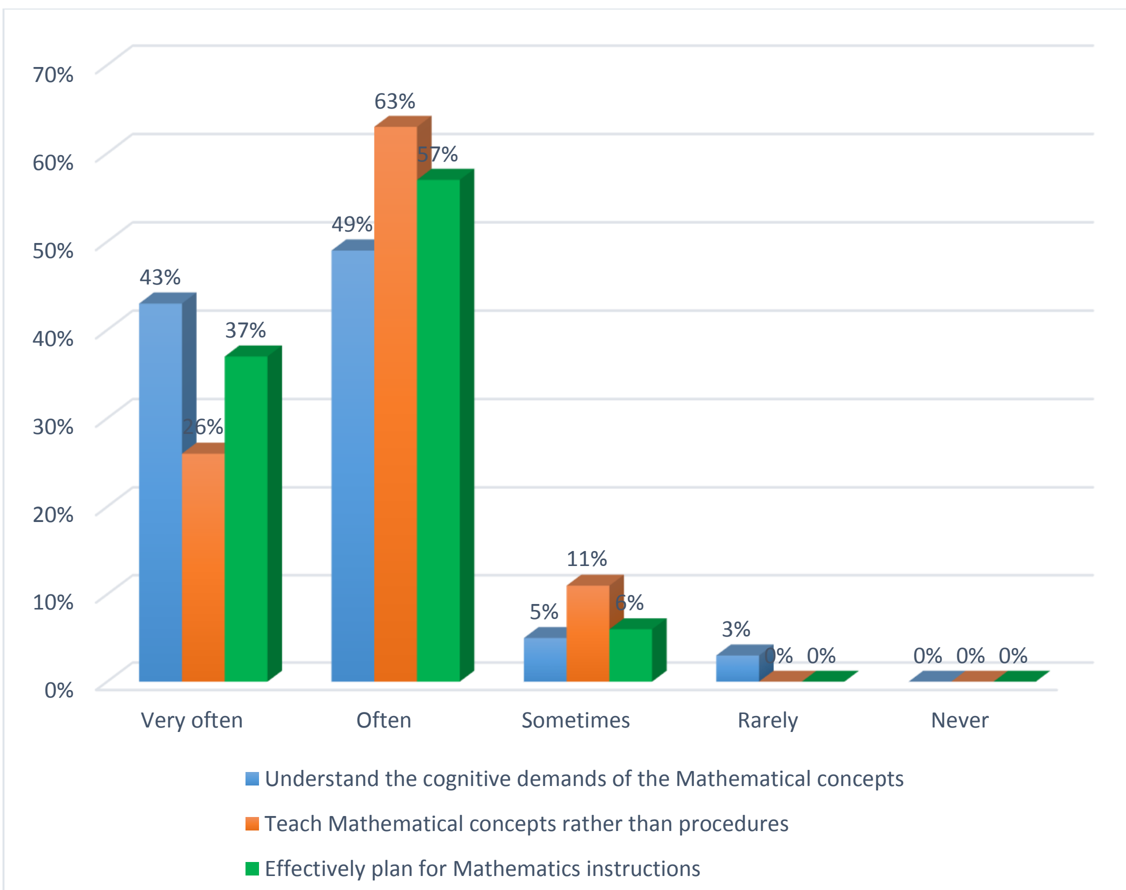
To gain an understanding of the effects of Lesson Study on Mathematical content knowledge, participants were asked about their perspectives on the effects that their Lesson Study participation had on their Mathematical content knowledge. The results indicated that 89% of the participants felt that the Lesson Study helped them to understand the core concepts of Mathematics that pupils were expected to learn. In addition, 94% of the participants noted that Lesson Study helped to understand connections between Mathematical concepts pupils were expected to learn as a result of engaging in Lesson Study activities. Figure 4.2 shows the distribution of responses that teachers felt the understanding of the connections between core Mathematical concepts and the content that pupils were expected to learn.

Figure 4.2: Teachers understood the core Mathematical concepts and the connections between Mathematical concepts that pupils were expected to learn



Further analyses of the data indicated that 92% of the participants understood the cognitive demands of the Mathematical concepts pupils were expected to learn. Eighty nine percent (89%) of the participants also noted that they often taught Mathematical concepts rather than Mathematical procedures as a result of participating in Lesson Study. In addition, 94% of the respondents reported that the Lesson Study helped for Mathematics instruction effectively. Figure 4.3 shows the distribution of responses that teachers understood the cognitive demands of the Mathematical concepts pupils were expected to learn, teach Mathematical concepts rather than Mathematical procedures and that they effectively planned for Mathematics teaching as a result of being engaged in Lesson Study activities.

Figure 4.3: Teachers understood the cognitive demands of the Mathematical concepts, teach Mathematical concepts rather than procedures and effectively plan for Mathematics instruction



In an effort to uncover the more effect Lesson Study had on teacher's Mathematical content knowledge, a chi-square test of independence was performed to examine the relationship between the period a teacher participated in the Lesson Study and how often they taught Mathematical concepts rather than Mathematical procedure. The relation between these variables was not significant, χ^2 (4, N = 35) = 3.71, $p > .05$. The results suggested that every teacher who participated in the Lesson Study experienced the professional growth regardless of the number of years they had been engaged in the Lesson Study.

The study also focused on evaluating the relationship between how often teachers effectively planned for Mathematics teaching and how often they taught Mathematical concepts rather than Mathematical procedures as a result of Lesson Study participation. The results indicated that of those teachers who often effectively planned for Mathematics instruction, they usually taught Mathematical concepts rather than Mathematical procedures to their pupils. It was also noted that those who never effectively planned for Mathematics teaching, they never taught Mathematical concepts, but procedures to their pupils. Table 4.2 shows all the results.

Table 4.2: Relationship between How often Teachers Effectively Plan for Mathematics Instruction and how often they teach Mathematical Concepts rather than Procedures

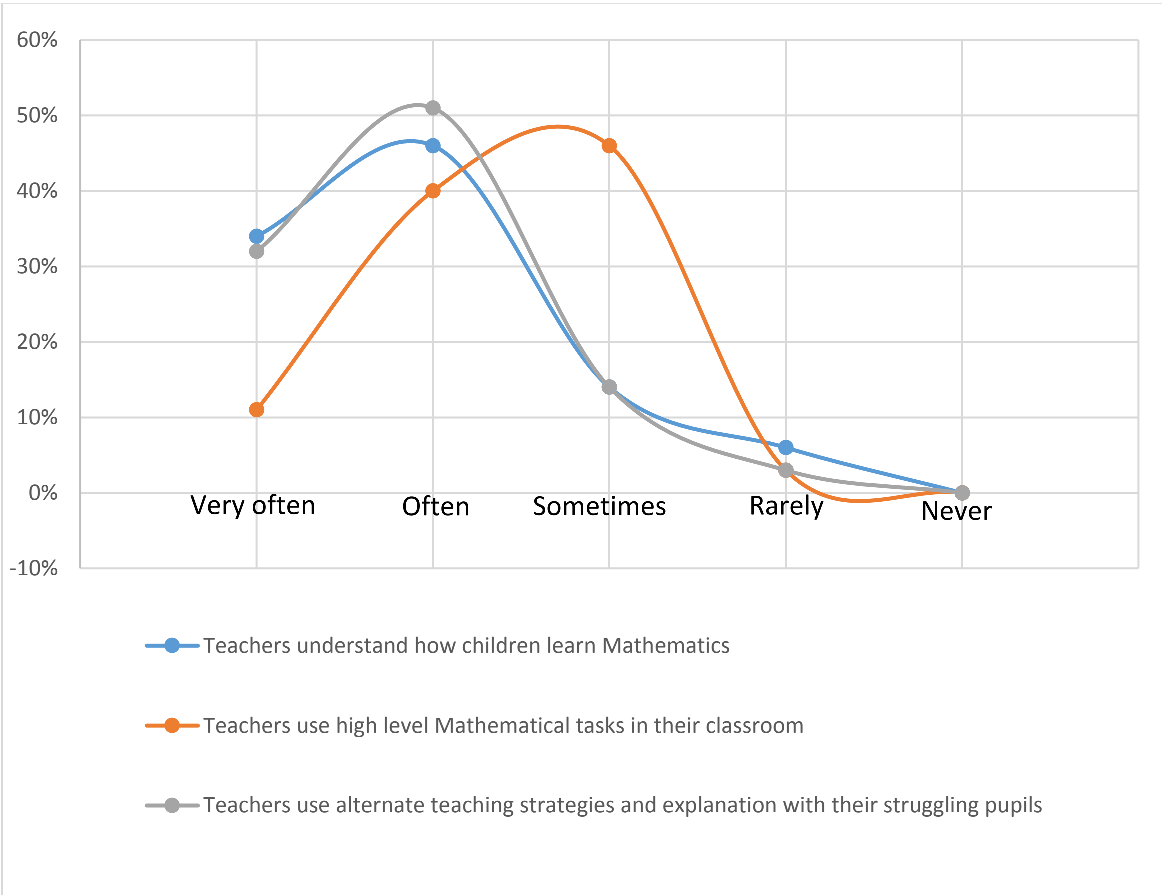
		Effectively plan for Mathematics instruction			
	Responses	Often	Sometimes	Never	**Total**
Teach Mathematical concepts rather than procedures	Often	30	1	0	**31**
	Sometimes	3	1	0	**4**
	Never	0	0	0	**0**
	Total	**33**	**2**	**0**	**35**

A chi-square test of independence was performed to examine the relation between how often teachers effectively planned for Mathematics teaching and how often they taught Mathematical concepts rather than procedures as a result of Lesson Study participation. The results showed that the relationship between these two variables was significant, χ^2 (4, N = 35) = 16.88, $p <$ .05. The results indicated that effective planning for Mathematics teaching lead to teaching of Mathematical concepts rather than procedures to pupils.

4.3.2 *Effects of the Lesson Study on Teachers' Mathematical Pedagogical-Content Knowledge*

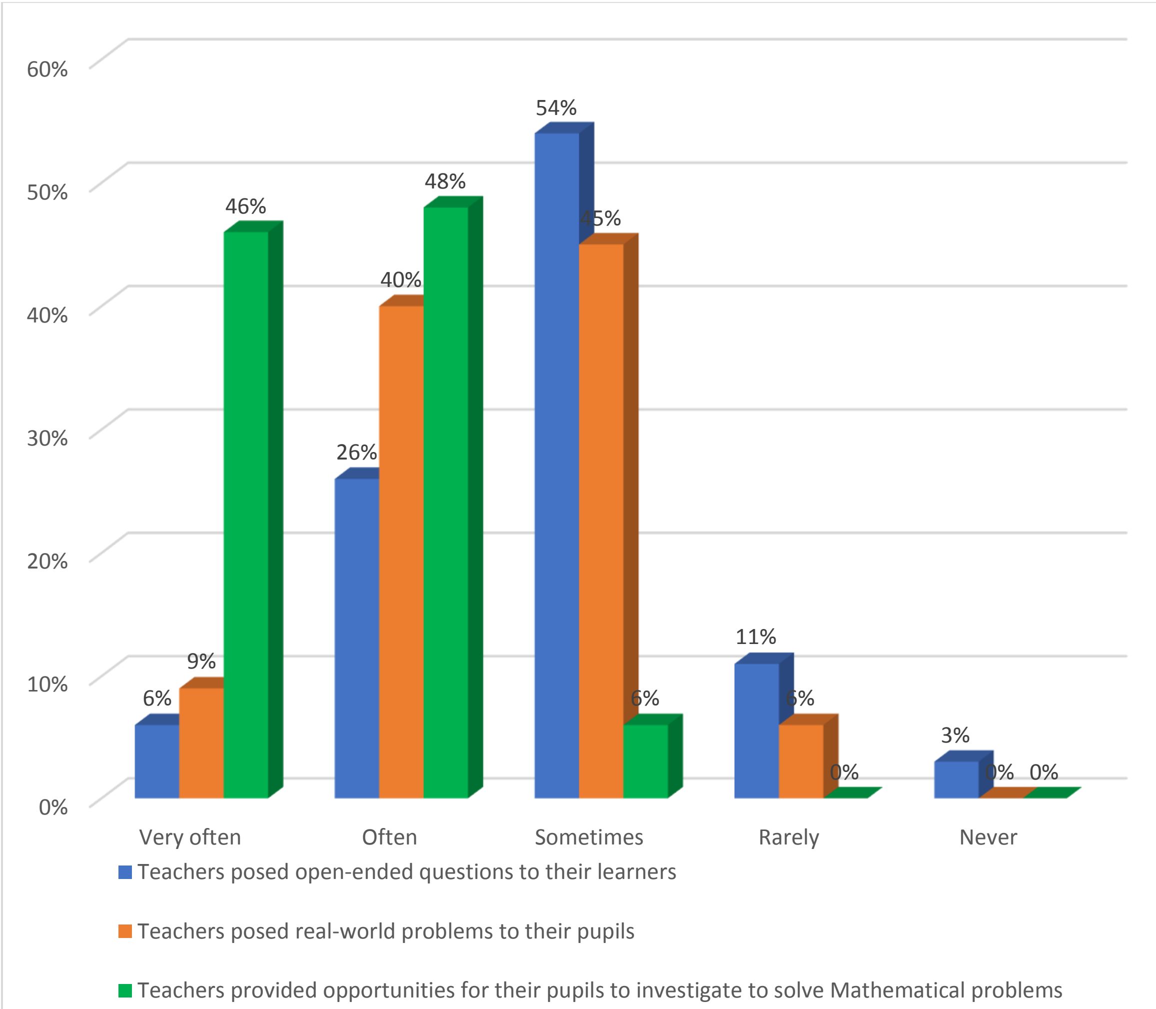
To determine the effect that Lesson Study have on teachers' Mathematical pedagogical-content knowledge, data were gathered to measure teachers' perceptions of the effect that Lesson Study participation had on their pedagogical-content knowledge. Results indicated that 80% of the participants understood how pupils learnt Mathematics as a result of being engaged in Lesson Study. Fifty one percent (51%) of the participants also reported using higher level Mathematical tasks in their classroom as a result of participating in Lesson Study. In addition, 83% of the participants revealed that they often used alternate strategies and explanations with struggling pupils as a result of Lesson Study engagement. Figure 4.4 shows all the results that teachers understood how pupils learnt Mathematics, use high level Mathematical tasks in their classroom and that they used alternate teaching strategies and explanations with their struggling pupils as a result of being engaged in Lesson Study.

Figure 4.4: Teachers understood how children learn Mathematics, use high level Mathematical tasks, and use alternate teaching strategies and explanations with their struggling pupils.



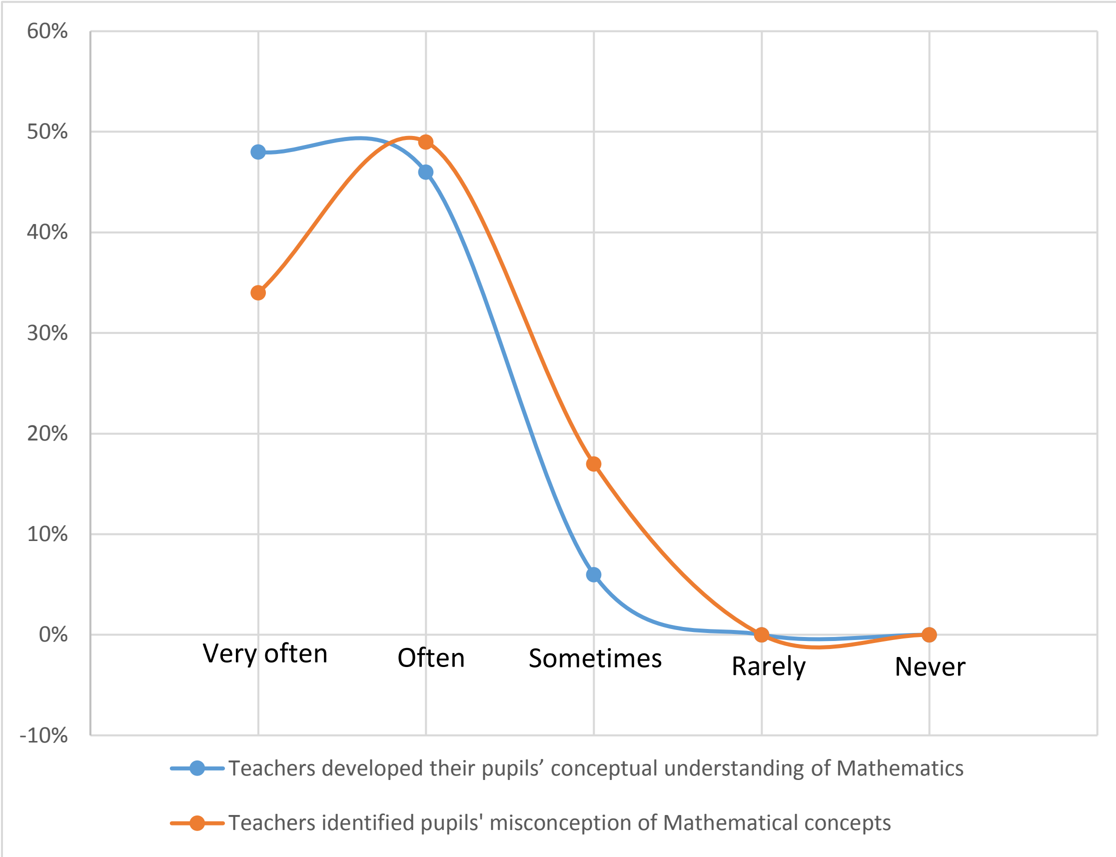
Furthermore, results showed that 32% of the sampled teachers reported that they often posed open-ended Mathematical questions to their pupils as a result of participating in Lesson Study, while 49% revealed posing real-world Mathematical problems to their pupils in their Mathematics lessons. Additionally, 94% said they often provided opportunities for pupils to investigate to solve Mathematical problems. Figure 4.5 shows the distribution of responses that teachers posed open-ended and real-world Mathematical problems to their pupils, and that they provided opportunities for pupils to investigate to solve Mathematical problems as a result of participating in Lesson Study.

Figure 4.5: Teachers posed open-ended Mathematical questions and real-world problems to their pupils and provided opportunities for pupils to investigate to solve Mathematical problems.



A further 94% of the participating Mathematics teachers reported being helped to develop their pupils' conceptual understanding of Mathematics knowledge from Lesson studies, while a further 83% stated they were able to identify pupils' misconception of Mathematical concepts. The distribution of the responses that teachers often developed their pupils' conceptual understanding of Mathematics and that they identified pupils' misconception of Mathematical concepts is shown in figure 4.6.

Figure 4.6: Teachers developed their pupils' conceptual understanding of Mathematics and identified pupils' misconception of Mathematical concepts.



When analysed to determine the relationship between the period a respondent participated in Lesson Study and how often they provided opportunities for their pupils to investigate to solve Mathematical problems, the results revealed that teachers often provided opportunities for their pupils to investigate to solve Mathematical problems regardless of the period of participation in Lesson Study. Table 4.3 shows all the results.

Table 4.3: Relationship between the Numbers of years a Teacher participated in Lesson Study and how often they provided Opportunities for their Pupils to Investigate to Solve Mathematical Problems

Responses	**Less than 2 years**	**2 to 3 years**	**4 or more years**	**Total**
Often	3	20	10	**33**
Sometimes	0	0	2	**2**
Never	0	0	0	**0**
Total	**3**	**20**	**12**	**35**

Furthermore, results showed that teacher's ability to help enhance pupils' conceptual understanding of Mathematics was not a function of how long they participated in the Lesson Study. Table 4.4 depicts these responses.

Table 4.4: Relationship between the Number of Years a Teacher Participated in Lesson Study and How often they Developed Pupils' Conceptual Understanding of Mathematics

Responses	**Less than 2 Years**	**2 to 3 Years**	**4 or more Years**	**Total**
Often	3	19	11	**33**
Sometimes	0	1	1	**2**
Never	0	0	0	**0**
Total	**3**	**20**	**12**	**35**

Additionally, a chi-square test of independence was performed to determine whether there was a relationship between the effectiveness of teachers in planning of Mathematics teaching as a result of participating in Lesson Study, and the extent to which they often identified their pupils' misconceptions of Mathematical concepts. The results shows that there was a high relationship between these variables, χ^2 (4, N = 35) = 14.20, p < .05. This suggests that those teachers who effectively planned for Mathematics instruction are more likely to identify their pupils' misconceptions of Mathematical concepts.

4.4 School-Based Factors Influencing Effective Implementation of Lesson Study

School-based factors that were identified as influencing effective implementation of Lesson Study in Secondary Schools were typically associated with teacher participation in the programme. Participants' responses revealed that the amount of time required and scheduling meeting time were the greatest challenges that hindered successful implementation of Lesson Study. Additionally, understanding the Lesson Study process, completing the steps in the Lesson Study process, the amount of administrative support given, and the size and make-up of the group were revealed as the most enabling factors to successful implementation. Table 4.5 shows the complete results.

Table 4.5: Factors Influencing Effective Implementation of Lesson Study

Responses	Size of the Group	Amount of time needed	Scheduling meeting time	Understanding LS process	Completing the steps	Amount of admin. support
Major challenge	14%	43%	34%	3%	6%	0%
Challenge	17%	43%	49%	17%	17%	26%
Factor enabling success	43%	11%	11%	63%	51%	54%
Major factor enabling success	26%	3%	6%	17%	26%	20%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Furthermore, data were analyzed to determine the effect of the period of participation in the Lesson Study on the challenges encountered during the process. The results indicated that factors related to time were the major challenges to all participants regardless of the number of years they participated in Lesson Study. Table 4.6 depicts these results.

Table 4.6: Relationship between Challenges Encountered when Participating in Lesson Study and the Number of Years of Lesson Study Participation

Challenges	**Less than 2 years**	**2 to 3 years**	**4 or more years**
Size of the group	33%	40%	16%
Amount of time needed	100%	85%	83%
Scheduling meeting time	100%	80%	83%
Understanding Lesson Study process	67%	20%	8%
Completing the steps in Lesson Study process	3%	30%	8%
Amount of administrative support	67%	15%	33%

[Less than 2 years = 3 teachers; 2 to 3 years = 20 teachers; 4 or more years = 12 teachers]

The data were also analyzed to examine the relationship between factors facilitating implementation of the Lesson Study and period of participation. The results showed that factors related to characteristics of Lesson Study were the major factors enabling successful implementation of Lesson Study to all respondents regardless of the number of years they participated in Lesson Study. Table 4.7 shows all the results.

Table 4.7: Relationship between Factors Facilitating Implementation of the Lesson Study and Period of Participation

Enabling factors	**Less than 2 years**	**2 to 3 years**	**4 or more years**
Size of the group	67%	60%	83%
Amount of time needed	0%	15%	17%
Scheduling meeting time	0%	20%	17%
Understanding Lesson Study process	33%	80%	92%
Completing the steps in Lesson Study process	67%	70%	92%
Amount of administrative support	33%	85%	67%

[Less than 2 years = 3 teachers; 2 to 3 years = 20 teachers; 4 or more years = 12 teachers]

In addition, data were also analysed to examine how the challenges teachers of Mathematics encountered in Lesson Study participation are affected by the number of years teachers had been teaching. The results indicated that the major challenges related to time were consistently reported in each category regardless of the number of years a teacher had been teaching as shown in table 4.8. The data were also analyzed to establish the effects of participants' teaching experience on factors facilitating implementation of Lesson Study. The results indicated that factors related to characteristics of Lesson Study were the major factors enabling successful implementation of the approach to all participants regardless of the number of years they had been teaching as shown in table 4.9. These reported results are similar to the reported challenges and factors facilitating implementation of the Lesson Study when compared to the period a teacher participated.

Table 4.8: Relationship between Challenges Encountered when Participating in Lesson Study and Teaching Experience

Challenges	**Less than 5 years**	**5 to 10 years**	**More than 10 years**
Size of the group	56%	25%	22%
Amount of time needed	100%	86%	78%
Scheduling meeting time	100%	63%	83%
Understanding Lesson Study process	22%	13%	22%
Completing the steps in Lesson Study process	33%	13%	22%
Amount of administrative support	33%	13%	28%

[Less than 5 years = 9 teachers; 6 to 10 years = 8 teachers; above 10 years = 18 teachers]

Table 4.9: Relationship between Factors Facilitating Implementation of Lesson Study and Teaching Experience

Enabling factors	Less than 5 years	5 to 10 years	More than 10 years
Size of the group	44%	75%	78%
Amount of time needed	0%	13%	22%
Scheduling meeting time	0%	38%	17%
Understanding of the Lesson Study process	78%	88%	78%
Completing the steps in Lesson Study process	67%	88%	78%
Amount of administrative support	67%	88%	72%

[Less than 5 years = 9 teachers; 6 to 10 years = 8 teachers; above 10 years = 18 teachers]

Summary

The researcher presented the results of the study on the effects of Lesson Study on theory-practice gap in Mathematics teaching practices in Secondary Schools. Overall, the results showed that Lesson Study participation had a positive effect on teachers of Mathematics' content-knowledge and pedagogical-content knowledge. The majority of the participants indicated that they believed that Lesson Study helped them to become better Mathematics teachers, and was an effective way to continue their professional development.

Finally, the participants indicated the challenges and enabling factors they encountered while engaging in Lesson Study. The results indicated consistently that scheduling time to meet as a group was a major challenge and characteristics of Lesson Study were factors facilitating successful implementation of Lesson studies in Secondary Schools. Having presented the results, discussion of the findings will be done in the next chapter

CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Overview

In this chapter, the researcher discusses the results and offers an analysis of how the findings of this study results shed light on the initial research questions as well as connect to literature of the field. This allows the reader to see the similarities and differences between the findings of this investigation and those of other previous researchers. The discussion will follow the trajectory in which the results were presented with special focus on the objectives of the study. It also explains why Lesson Study proved to be successful where other models have failed.

5.2 The Role of the Lesson Study as a Professional Development Process

Lesson Study process embodies the core features of an effective professional development experience that has significant positive effects on teacher knowledge and skills, and changes to instructional practice (Garet, Porter, Desimone, Birman, & Yoon, 2001). The results of this study indicate that teachers' personal experiences are related to the role of Lesson Study as an effective professional development process.

This study revealed that teachers often collaborated more with colleagues from their own schools while engaging in Lesson Study. Since collaboration involves many components such as planning, with focus on common goal and on pupil's thinking, the curriculum, and pedagogy, in addition to planning collaboratively with colleagues, the results indicated that teachers often shared their knowledge of Mathematics with colleagues as a result of participating in Lesson Study. The significance of teacher collaboration and Mathematical knowledge sharing with colleagues were key findings in the study. Lesson Study was a new and different way in which Zambian teachers of Mathematics were participating in school-based continuing professional development. This new way of teachers working together, and the subsequent reporting of the value of teacher collaboration indicated that there was a reduction in teachers working in isolation. Working collaboratively lays the groundwork for knowledge construction which leads to professional growth and development in meaningful ways. Additionally, teacher collaboration has been strongly linked to explicit improvement of pupil's performance (Stigler, & Hiebert, 1999). While this study did not examine pupil performance, it is acknowledged that, it remains the primary purpose of teacher practice and was, therefore, a potential by-product of these teachers' engagement in Lesson Study which was a collaborative practice.

The frequency in collaboration indicated by the teachers of Mathematics in the study also provided knowledge construction which leads to practical wisdom. Shulman (2004) argued that teaching is a complex endeavor that required extensive skill, knowledge, experience, and sound moral judgment – a task almost too large to be accomplished in isolation and by ones' self. In this regard, collaboration with colleagues affords isolated teachers the opportunity to benefit from the collective knowledge construction, experience and skills of several others. In this way, there will be significant improvement in their pedagogical-content knowledge of Mathematics which are necessary for effective teaching of the subject.

The results also showed that Lesson Study as a professional development process increases teachers' knowledge and helped them to become better teachers of Mathematics. These results are similar to the results Sparks and Hirsch (2000) identified in their research. Their study revealed that effective professional development was the one which was results-driven and job-embedded, focused on helping teachers become deeply immersed in the subject matter and teaching methods and directly linked to what teachers do in their classrooms. The increase in teachers' knowledge of Mathematics indicated the role that Lesson Study as a professional development process have on classroom teaching practices. Yamnitzky (2010) supported that professional development when effective offered teachers opportunities to deepen their knowledge, and supported the perspective that professional development must be collaborative, job-embedded, differentiated, content-specific and reflective. Carpenter, Fennema and Franke (1996) added that teachers' knowledge of Mathematics and the development of the knowledge base related to that are important characteristics of effective professional development. Ma (1999) concluded that teachers must possess a profound understanding of fundamental Mathematics as a corollary to effective teaching. Therefore, the research reports that effective teaching and Mathematics teachers' profound understanding of fundamental Mathematical knowledge development may be more realized through Lesson Study.

Additionally, the results indicated that teachers of Mathematics acknowledged that the Lesson Study was an effective way of ensuring continued professional development and, pledged to continue participating in Lesson Study. The interest of continued participation in Lesson Study indicate the positive effect that the approach has as a professional development process in the teaching of Mathematics. Elmore and Burney (2000), Guskey and Sparks (2002), Stigler and Hiebert (1999), Sparks and Hirsh (2000) argued that the desire and length of time devoted to a particular professional development is directly related to its effectiveness in improving teachers' knowledge of teaching and learning in meaningful ways.

In the recent past, the Lesson Study has emerged as one kind of professional development that has produced results in Japanese schools and is emerging as a practice with promise for success in other countries (Chokshi & Fernandez, 2005; Fernandez, 2005; Honigsfeld & Cohan, 2006). This is the similar case in Zambia, and Monze district in particular. Rocky and Wilson (2005) found that teachers who participated in Lesson Study experienced increased confidence in approaching instruction in the USA. In South Wales, White and Southwell (2004) evaluated the Lesson Study as a model of professional development for teachers of Mathematics and found that it contributed substantially to teachers' understanding of pupil learning and it changed teachers' focus being directed to a greater extent on issues of teaching and learning with an increase in the willingness of colleagues to share ideas. Frick, Carl, and Beets (2010) and Posthuma (2012) found that the Lesson Study has the potential value for planning professional learning programmes in which teachers were encouraged to talk about their classroom experiences, share their joys, and challenges with one another.

Considering the research that has emerged from other countries that provides insight into Lesson Study as a high-quality professional development. The findings of this research reveals that the Lesson Study as a professional development process is successful in changing teacher practice in important and positive ways as it focuses on building a community of reflective practitioners.

5.3 The Effectiveness of the Lesson Study in Mathematics Teaching Practices

The focus of the Lesson Study was on developing teachers' Mathematical content-knowledge and pedagogical content-knowledge (Elmore & Burney, 2000; Guskey, 2000). The development of teachers' knowledge of Mathematics was an important benefit from Lesson studies (Carpenter, Fennema, & Franke, 1996). Lesson Study requires that participants collaboratively plan a lesson based upon the research goal (Stigler & Hiebert, 1999). The research into the subject matter provides teachers with opportunities to deepen their understanding of what they were supposed to teach. It was in this vain that Japanese teachers indicated that Lesson Study participation increased their subject-matter knowledge (Lewis, Perry, & Murata, 2006). Therefore, it was the effects of Lesson Study to produce new Mathematical knowledge about content and pedagogy. The results of this study shows similar effects of Lesson Study in Mathematics teaching practices in Zambia, and Monze in particular.

5.3.1 *Effects of Lesson Study on Teachers' Mathematical Content-Knowledge*

The results showed that Lesson Study enhance teacher's Mathematical content knowledge. Specifically, majority of the teachers often understood the core Mathematical concepts and connections between Mathematical concepts their pupils were expected to learn. Understanding the core Mathematical concepts pupils need to master was vital to effective teaching. Ma (1999) argued that teachers must possess a strong knowledge of the basic ideas and awareness of the simple, but powerful basic concepts and principles of Mathematics. He further argued that connectedness, or making connections among Mathematical concepts and procedures, from simple and superficial, to complicated and underlying, and identifying the connections among different operations was a prerequisite for effective teaching of Mathematics.

The results also indicated that teachers often understand the cognitive demands of the Mathematical concepts pupils were expected to learn as a result of engaging in Lesson Study. This showed that Lesson Study provided opportunities for teachers to strengthen their understanding of the cognitive demands of Mathematical concepts their pupils were expected to learn. Stein, Grover, and Henningsen (1996) supported that pupils who solve cognitively demanding tasks are more likely to develop a conceptual understanding. Therefore, it was imperative that teachers know and understand the cognitive demands of the Mathematical concepts in which their pupils were engaged. In this regard, Lesson Study engagement provided opportunities for teachers to examine the cognitive demands of the Mathematical concepts pupils were expected to learn.

Additionally, the results showed that teachers of Mathematics often teach Mathematical concepts rather than Mathematical procedures as a result of participating in Lesson Study. This indicated that the kind of tasks in which pupils engaged impacted the Mathematics they learn.

Lewis, Perry, and Murata (2006) argued that when pupils only work on low-level tasks, the learning that occurs tends to be procedural in nature. Therefore, Lesson Study afforded teachers the opportunity to gain new knowledge of, or change their understanding about Mathematical concepts being taught, and teachers were able to make clearer connections between the standard being taught and classroom teaching.

The results also indicated that teachers effectively planned for Mathematics teaching as a result of participating in Lesson Study. Lewis and Tsuchida (1998) and Yamnitzky (2010) argued that Lesson Study engagement enabled teachers to plan thoroughly for a lesson, including identifying goals, questions, and expected pupil responses. This planning process was different from the procedures used in traditional Zambian schools. As such, this thorough and collaborative planning during Lesson Study accounted for teachers' experience of an improvement in the way they planned for Mathematics teaching.

The results further showed that most of the teachers experienced an improvement in their skills or competencies often associated with Mathematical content-knowledge regardless of their period of participation in Lesson Study. However, more improvement were reported by teachers who participated in Lesson Study for 4 or more years. Therefore, the longer a teacher participated in Lesson Study, the more likely they would improve their understanding of competencies associated with Mathematical content-knowledge. This improvement was as result of teachers devoting long period of time to collaboratively plan with colleagues, researching, in-depth planning, deliberating and reflecting, which is typical of Lesson Study cycle (Stepanek, 2001; Stigler & Hiebert, 1999; Watanabe, 2002). In this regard, in order to experience notable improvement to one's content knowledge, one need to participate in Lesson Study for a longer period of time. The increase in Mathematical content-knowledge teachers of Mathematics experienced, was the acknowledgement that Lesson Study have an effect on a teacher's content-Knowledge in Mathematics teaching practices.

5.3.2 *Effects of Lesson Study on Teachers' Mathematical Pedagogical-Content Knowledge*

Teachers' knowledge of Mathematics and the development of the knowledge base are important characteristics of effective professional development. Additionally, pedagogical-content knowledge and a knowledge of pupils' thinking were essential elements for improving Mathematics teaching (Carpenter, Fennema, & Franke, 1996). Chokshi and Fernandez (2005), and Fernandez (2005) argued that Lesson studies fulfills these characteristics of effective professional development.

The results indicated that teachers had enhanced understanding of how children learn Mathematics as a result of participating in Lesson Study. This finding was important because excellent teachers need to be concerned with knowing what pupils understand and how they learn, so that they can help their pupils to integrate new ideas and transform prior conceptions (Thousand, Villa, & Nevin, 2004). Teaching was a very complex undertaking, and all teachers need to clearly understand what Mathematics pupils must know and be able to do (Ma, 1999; NCTM, 2000; Stigler & Hiebert, 1999). Carpenter, Fennema, and Franke (1996) pointed out that knowledge of pupils' thinking was an essential element for an improvement in teaching. Therefore, Lesson studies effectively affords teachers the opportunity to expand their understanding of how their pupils learn Mathematics.

Results also indicated that teachers often use high level Mathematical tasks, and alternate strategies, and explanations with struggling pupils. These results are in line with the NCTM's (2000) calling. The council called for a reformation of the teaching of Mathematics in schools in order for all pupils to be able to understand and use Mathematics in everyday life and in the workplace. As such, all pupils need to have access to an excellent Mathematical program that was responsive to their needs, including prior knowledge, personal interests and strengths and the support to use these skills to make connections (Ma, 1999; Stigler & Hiebert, 1999).

The NCTM (2000) suggested reform of Mathematics teaching with a call for an increase in the use of questions that require knowledge construction and problem-solving. Generally, Mathematical knowledge was being constructed when pupils were given tasks that were open-ended. However, the results showed that few teachers of Mathematics often used open-ended Mathematical questions despite being engaged in the Lesson Study. This could be as a result of heavy loads teachers of Mathematics have in Zambia and high pupil-teacher ratio in most Zambian Secondary Schools (Banda, Mudenda, Tindi, & Nakai, 2011). Therefore, teachers may fear that if used open-ended Mathematical questions, they would not cover the required work as stipulated in the Mathematics curriculum.

In addition, the study found that teachers exposed their pupils to real-world Mathematical problems, as a result of being engaged in Lesson Study. Additionally, the results indicated that the majority of the teachers often provided opportunities for their pupils to investigate to solve Mathematical problems. The NCTM (2000) has also called upon teachers to provide more opportunities for pupils to develop new understandings and construct their knowledge of important Mathematical ideas, through collaboration, discussion, problem-solving, construction of arguments, and real-world experiences (NCTM, 2000; National Mathematics Advisory Panel, 2008). Therefore, Lesson Study provided opportunities for teachers involved to pose real-world problems to their pupils, facilitate discussion and collaboration, and help develop their pupils’ ability to solve problems through investigation.

Furthermore, the results showed that Lesson Study participation helps the majority of teachers of Mathematics to develop their pupils' conceptual understanding, and identify misconception of Mathematical concepts. The ability to discern and identify pupils' understanding of core Mathematical concepts are essential components of teachers' pedagogical-content knowledge (Carpenter, Fennema, & Franke, 1996; Carpenter, Fennema, Peterson, Chiang, & Loef, 1989). Specifically, understanding the conceptions, and misconceptions that pupils possess about specific content assist teachers in developing their own knowledge – a key component to effective teaching (Carpenter, Fennema, & Franke, 1996). Therefore, a professional development endeavor, such as Lesson Study, that focuses on developing skills to better understand pupils' thinking provides important opportunities for teachers to improve and develop their practical wisdom (Carpenter, Fennema, & Franke, 1996; Desimone, 2009).

The results also revealed that Lesson Study was directly related to its effectiveness in improving teachers' content and pedagogy in meaningful ways. The increase in Mathematical content-knowledge and pedagogical-content knowledge in meaningful ways was the acknowledgement of the effectiveness of Lesson Study in Mathematics teaching practices.

5.4 School-Based Factors that Influence Effective Implementation of Lesson Study

Without ignoring changes including the one on curriculum, it was a fact that there are factors influencing the teaching and learning processes in Secondary Schools. Todd (2006) pointed out that one of the factors was related to the teaching practice in a large class. Lesson Study as a professional development endeavor posed some challenges in other countries due to its cultural nature. In this regard, teachers of Mathematics indicated the factors influencing effective implementation of Lesson Study they encountered during their participation. The results showed that the amount of time required and scheduling meeting time were the greatest challenges that hindered successful implementation of the Lesson Study in Secondary Schools.

This collaborated Chassels and Melville's (2009), and Yamnitzky's (2010) findings who revealed that time was the major challenge, both scheduling time to meet and the amount of time required to devote to Lesson Study that impede teacher collaboration. Fatimah (2012) added that spending time for reflection when conducting Lesson Study was of challenge. After the Lesson Study implementation stages, limited time often hinders the members to have a thorough discussion in order for them to reflect on the outcome of their lesson.

However, the finding of scheduling time as a challenge to successfully implement Lesson Study was quite unexpected in Zambia, because it was a common practice in Zambian Secondary Schools for teachers to have at least a day per term scheduled for professional development. As such, it was possible to have time for thorough implementation of Lesson Study. This was an indication that the education system in Zambia have support structures in place to facilitate collaboration among teachers, the kind of engagement required for Lesson Study. Unlike, in the U.S where it was quite rare for schools to have time for professional development to be included in the school day. As such, teachers engage in Lesson Study on their own time, before or after the day ends (Lewis, 2002).

The results also showed that understanding the Lesson Study process, completing the steps in the Lesson Study process, the amount of administrative support given and the size and make-up of the group were the most factors facilitating successful implementation of the Lesson Study. The findings showed that an administrator played an important role in the Lesson Study process for the teachers. Teachers indicated that they consistently received the amount of administrative support required for them to successfully implement Lesson studies in Secondary Schools. Fatimah (2012) acknowledged that support from authority and education network was important in sustaining Lesson Study participation in schools. In addition to teacher collaboration, administrators should be prepared to assist with the implementation of

Lesson Study by providing skilled Lesson Study facilitators. These facilitators provides knowledge, experience, and facilitation skills necessary for understanding Lesson Study characteristics which are key to assisting teachers in acquiring values necessary for effective Mathematics teaching (Elmore, 2000; Fullan, 2001; Marzano, Waters, & McNulty, 2005). Banda et al (2011) added that support from school managers and allocation of well-trained Lesson Study facilitators were enhancing factors to successful implementation of the Lesson Study in schools. Therefore, there was need for teachers embrace the Lesson Study as it had been proved to produce required skills and competences for bridging the gap between theory and practice in Mathematics teaching practices.

Summary

The results yielded in this study are very encouraging and both support and are supported by the work of other researchers in the field. The teachers in the study demonstrated substantial growth in their knowledge and practice of teaching as a result of participating in the Lesson Study. These results provided significant evidence that Lesson Study has the potential to help teachers of Mathematics to bridge theory-practice gap in their teaching practices. The conclusion and recommendations of the study would be done in the next chapter (chapter six).

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Overview

The data which was obtained in the study provided some useful information to bring out important recommendations on the effect of the Lesson Study on theory-practice gap in Mathematics teaching practices. In this chapter, therefore, the researcher, presents the conclusion and recommendations of salient points emanating from the study's results.

6.2 Conclusion

It was revealed throughout the research that professional development that was enduring in nature was directly related to its effectiveness in improving teachers' content and pedagogical-content knowledge in meaningful ways (Elmore & Burney, 2000; Guskey & Sparks, 2002; Hiebert, 1999; Sparks & Hirsh, 2000). The findings showed that the Lesson Study as a professional development process lays a platform for teachers to collaboratively talk about their classroom experiences, shared their joys and challenges with one another and helped teachers to build a community of reflective practitioners to enhance their learners' understanding of Mathematics. Collaboration with colleagues affords isolated teachers the opportunity to benefit from the collective knowledge construction, experience and skills of several others.

The results also showed that Lesson Study participation had a positive effect on teachers' content-knowledge and pedagogical-content knowledge which helped teachers to possess a profound understanding of fundamental Mathematics as a corollary to effective teaching. The participants acknowledged that the Lesson Study was an effective professional development process, and that it helped them to become better Mathematics teachers and pledged for continued participation. It was concluded in the study that Lesson Study was an excellent way for teachers to enjoy the benefits of effective professional development and was an effective model which had the potential to help teachers of Mathematics to bridge theory-practice gap in their teaching practices.

6.3 Recommendations

In view of the findings of this study, the following recommendations are made;

1. There should be a paradigm shift in educators' beliefs about effective professional development. Educators should make changes in their thinking and in practice, and embrace the Lesson Study which has proved to be a significant tool in development of practical wisdom.
2. The Ministry of General Education should collaborate with teacher education institutions in order to agree on what type of a Secondary School teacher to be trained;
3. Teacher education institutions should also adopt Lesson Study model in their teaching methodology to bridge the gap between theory and practice when trainee teachers are still within their institutions of learning; and
4. The Ministry of General Education should formulate programmes and policies that will encourage all teachers to participate in Lesson Study indiscriminately because it has been proved to be helping teachers to improve in their classroom teaching practices.

6.4 Future Research

While Lesson Study possesses the research-based characteristics of effective professional development, it was still a very new practice in Zambia and requires a level of engagement that may be new and challenging for teachers. Therefore, future research should include the study of the modifications that have been made to Lesson Study implementation in Zambia and the effects that these changes have had on teacher knowledge and skills and on the sustainability of this professional development process. There is also need to study the acquisition of new Mathematical knowledge and the increase in teachers' pedagogical-content knowledge through observational studies. Lastly, investigation is needed to establish if a sustainable model of teacher education which incorporates the key features of Lesson Study can be developed in teacher education institutions in Zambia.

REFERENCES

Allen, J. M. (2009). Valuing Practice over Theory: How beginning Teachers re-orient their Practice in the Transition from the University to the Workplace. *Teaching and Teacher Education*, (5), 647–654.

Allen J. M. & Peach D. (2007). Exploring Connections between the in-field and on Campus components of a Pre-Service Teacher Education Programme: a Student Perspective. *Asia-Pacific Journal of Cooperative Education*, (1), 23-36.

Álvarez Á. C. (2015). Can Teachers Bridge the Theory-Practice Gap? An Ethnographic Study of a Teacher. *US-China Education Review B*, 5, 4, 233-244.

Amineh R. J. & Davatgari A. H., (2015). Review of Constructivism and Social Constructivism. *JSSLL Journal*. (1), 9-16.

Anthony, G., & Walshaw, M. (2009). Characteristics of Effective teaching of Mathematics: A view from the West. *Journal of Mathematics Education*, (2), 147-164.

Applefield J. M., Huber R., & Moallem M., (2002). *Constructivism in Theory and Practice: Toward a better Understanding*. Education Research. The University of North Carolina. Wilmington, USA.

Ball D. L., & Bass H. (2000). *Interweaving Content and Pedagogy in Teaching and Learning to Teach: Knowing and using Mathematics*. Westport, CT. Ablex.

Ball, D. L., & Phelps, G. (2008) 'Content Knowledge for Teaching What Makes It Special?' *Journal of Teacher Education*, (5), 389-407.

Banda B., Mudenda V., Tindi E., & Nakai K. (2011). *Lesson Study Practice of Science Teachers in Zambia: Its Effects, Enhancing and Hindering Factors*. International Conference. New Perspective in Science Education 3rd edition. Lusaka, Zambia.

Bartholomew, J. (1976) 'Schooling Teachers: The Myth of the Liberal College' in Whitty, G. & Young, M., (eds), *In Exploration in the Politics of School Knowledge*, 114-124.

Best, J.W & Kahn, J.V. (2009). *Research in Education, 10th (Ed)*: New Delhi, India. Prentice-Hall of India Private LTD.

Burns, N & Grove, S. K. (1997). *The Practice of Nursing Research: Conduct, Critique, and Utilization.* 3rd (ed). Philadelphia: Saunders.

Burroughs, E. A., & Lubeck, J. (2010). Pre-Service Teachers in Mathematics Lesson Study. *The Montana Mathematics Enthusiast,* 7, 391-400.

Brouwer, N. & Korthagen, F. (2005). Can Teacher Education make a Difference? *American Educational Research Journal,* (1), 153–224.

Carpenter, T. P., Fennema, E., & Franke, M. L. (1996). Cognitively Guided Instruction: A Knowledge Base for Reform in Primary Mathematics Instruction. *The Elementary School Journal,* (1), 3-20.

Carroll, C. (2013). *Exploring the Impact of Lesson Study on the Theory-Practice Gap in Pre-service Teacher Education*. Master in Education thesis. Mary Immaculate College, University College Limerick. Ireland.

Chassels, C. & Melville, W. (2009). Collaborative, Reflective, and Iterative Japanese Lesson Study in an Initial Teacher Education Program: Benefits and Challenges. *Canadian Journal of Education* 32, 4, 734-763

Cheng, M. M. H., Cheng, A.Y. N. & Tang, S. Y. F. (2010) 'Closing the Gap between the Theory and Practice of Teaching: Implications for Teacher Education Programmes in Hong Kong', *Journal of Education for Teaching: International Research and Pedagogy,* (1), 91-104.

Chokshi, S., & Fernandez, C. (2005). Reaping the Systemic Benefits of Lesson Study. *Phi Delta Kappan,* (9), 674.

Clarke, P. A. J., Thomas, C. D. & Vidakovic, D. (2009). Pre-service Mathematics Teachers' Attitudes and Developing Practices in Urban Classroom: Are they "winging" it? *Research and Practice in Social Science,* (1), 22-43.

Clements, M. A., & Ellerton, N. F. (1996). *Mathematics Education Research: Past, Present and Future,* Bangkok, Thailand. UNESCO

Cohan, A. & Honigsfeld, A. (2007). Incorporating 'Lesson Study' in Teacher Preparation'. *The Educational Forum,* (1), 81-92.

Cohen, D. K., & Ball, D. L. (1999). *Instruction, Capacity and Improvement.* Philadelphia: Consortium for Policy Research in Education.

Dana, N. F., & Yendol-Silva, D. (2003). *The Reflective Educator's Guide to Classroom Research: Learning to Teach and Teaching to Learn through Practitioner Inquiry.* Thousand Oaks: Corwin

Dawson E. (2013). *Lesson Study: Improving Teachers' Conceptions of Students' Understanding in Place Value.* Education Research.

Darling-Hammond, L., & Baratz-Snowden, J. (2007). A Good Teacher in every Classroom: Preparing highly Qualified Teachers our Children Deserve. *Excerpted in Education Horizons, (2), 111-132.*

Elmore, R., & Burney, D. (2000). Staff Development and Instructional Improvement. In D. Burney (Ed.) (pp. 1-39): *Consortium for Policy Research in Education.* The Albert Shanker Institute.

Fatimah N (2012). *Challenges in Implementing Lesson Study at Higher Education.* Universitas Ahmad Dahlan, Yogyakarta.

Fernandez, C. & Yoshida, M. (2004). *Lesson Study: A Japanese Approach To Improving Mathematics Teaching and Learning,* New Jersey: Lawrence Erlbaum.

Fernandez, C., & Cannon, J. (2005). What Japanese and U.S. Teachers Think About When Constructing Mathematics Lessons: A Preliminary Investigation. *The Elementary School Journal,* (5), 481-498.

Fernandez, M. L. (2008). Developing Knowledge of Teaching Mathematics through Cooperation and Inquiry. *Mathematics Teacher,* (7), 534-538.

Frick, L., Carl, A. & Beets, P. (2010). Reflection as Learning about the Self in Context: Mentoring as Catalyst for Reflective Development in Pre-Service Teachers', *South African Journal of Education,* 30, 421-437.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. S., & Yoon, K. S. (2001). What Makes Professional Development Effective? Results from a National Sample of Teachers. *American Educational Research Journal,* 38, 4, 915-945.

Goodson, I. F. (2001). Social Histories of Educational Change', *Journal of Educational Change,* (1), 45-63.

Guskey, T. R. (2000). *Evaluating Professional Development*, Thousand Oaks, Ca: Corwin Press.

Guskey, T. R., & Sparks, D. (2002). *Linking Professional Development to Improvements in Student Learning. Thousand Oaks:* Corwin Press, Inc.

Hiebert, J., Gallimore, R. & Stigler, J. W. (2002). A Knowledge Base for the Teaching Profession: What Would It Look Like and How Can We Get One? *Educational Researcher,* (5), 3-15.

Hiebert, J., & Stigler, J. (2000). A Proposal for Improving Classroom Teaching: Lessons from the TIMSS Video Study. *The Elementary School Journal,* (1), 3-20.

Hiroshi I. (2015). *A Study on Change of Mathematics Teachers in Zambia: Focus on Lesson Planning on Teachers' Group Discourse in the Lesson Study*. Hokkaido University of Education, Japan.

Joram, E. & Gabriele, A. (1998). Preservice Teacher's prior beliefs: transforming obstacles into opportunities', *Teaching and Teacher Education,* (2), 175-191.

Kennedy, M. M. (1999). Form and Substance in Mathematics and Science Professional Development. *National Institute for Science Education Brief,* 3, 2.

Kessels, J. P. & Korthagen, F. A. (1996). 'The Relationship between Theory and Practice: Back to the classics', *Educational Researcher*, (3), 17-22.

Khakbaz, A. S. (2008). *Professional Development for Mathematics Teachers through Lesson Study.* Shahid Beheshty University (National University), Iran.

Klein, M. F. (1992) 'A Perspective on the Gap between Curriculum Theory and Practice', *Theory into Practice,* (3), 191-197.

Kombo, D. K., and Tromp, D. A. (2006). *Proposal and Thesis Writing. An Introduction*: Nairobi, Kenya. Poulines Publications Africa. Palgrave.

Korthagen, F. A. J. (2007). The Gap between Research and Practice Revisited, Educational Research and Evaluation: *An International Journal on Theory and Practice,* (3), 303-310.

Korthagen, F. A. J. (2010). How Teacher Education can Make a Difference', *Journal of Education for Teaching, (4), 407-423.*

Korthagen, F. A. J. (2011). *Making Teacher Education Relevant for Practice: The Pedagogy of Realistic Teacher.* VU University. Amsterdam.

Korthagen, F. & Lagerwerf, B. (2001). Teachers' Professional Learning: How does it Work? In F. A. J. Korthagen, J. Kessels, B. Koster, B. Lagerwerf, & T. Wubbels. *Linking Practice and Theory: The Pedagogy of Realistic Teacher Education (pp. 175–206).* Mahwah: Lawrence Erlbaum Associates.

Korthagen, F. A. J. & Kessels, J. P. A. M. (1999). Linking Theory and Practice: Changing the Pedagogy of Teacher Education. *Educational Researcher*, (4), 4–17.

Leikin, R. & Levav-Waynberg, A. (2007). Exploring Mathematics Teacher Knowledge to explain the Gap between Theory-Based Recommendations and School Practice in the use of Connecting Tasks', *Educational Studies in Mathematics*, (3), 349-371.

Lewis, C. & Tsuchida, I. (1998). A Lesson is like a swiftly flowing River: Research Lessons and the Improvement of Japanese Education. *American Educator,* 14-17 & 50-52.

Lewis, C. (2000, April). *Lesson Study: The Core of Japanese Professional Development.* Paper presented at the American Educational Research Association Annual Meeting, New Orleans.

Lewis, C., Perry, R. & Murata, A. (2006). How Should Research Contribute to Instructional Improvement? The Case of Lesson Study, *Educational Researcher,* (3), 3-14.

Lewis, C., Perry, R., Friedkin, S., Roth, J., Baker, E. McGrew, J. (2012). *Lesson Study Cycle.* [Image online], available: http://www.lessonresearch.net/lessonstudycycle.pdf [accessed 14 Dec 2015]

Lewis, C., Perry, R., Hurd, J., & O'Connell, M. P. (2006). Lesson Study Comes of Age in North America. *Phi Delta Kappan,* (4), 273-281.

Long, F., Hall, K., Conway, P. & Murphy, R. (2012). *Novice Teachers as 'invisible' Learners, Teachers and Teaching:* Theory and Practice, 18(6), 619-636.

Ma, L. (1999). *Knowing and Teaching Elementary Mathematics: Teacher's Understanding of Fundamental Mathematics in China and the United States.* Mahway: Lawrence Erlbaum.

Masaiti, G. & Manchishi, P. C. (2011). The University of Zambia Pre-Service Teacher Education programme: Is it Responsive to Schools and Communities' Aspirations? *European Journal of Educational Studies* (2), 2011.

Mensah, J. K., Okyere, M. & Kuranchie, A. (2013). Student attitude towards Mathematics and Performance: Does the Teacher Attitude Matter? *Journal of Education and Practice, 4, 3.*

Meyer R. D. (2005). *Lesson Study: The Effects on Teachers and Students in Urban Middle Schools.* Education Research. Springer Science, Business Media B.V

Meyer R. D. & Wilkerson T. L. (2011). *Lesson Study: The Impact on Teachers' Knowledge for Teaching Mathematics.* L. C. Hart et al. (eds.), Lesson Study Research and Practice in Mathematics Education, DOI 10.1007/978-90-481-9941-9_2, Springer Science, Business Media B.V. 2011

Ministry of Education, (2010). *School Based Continuing Professional Development through Lesson Study*. Lusaka, Zambia. MoE/JICA.

Morrison, K. L. & Marshall, C. S. (2003). Universities and Public Schools: Are We Disconnected?' *Phi Delta Kappan*, (4), 292-297.

Mullens, J. E. (1995). *Classroom Instructional Processes: A Review of Existing Measurement Approaches and their Applicability for the Teacher follow-up Survey*. Washington, DC: National Center for Education Statistics.

Nakawa, N. (2011). "Investigation on Students' Learning Process and their Challenges from Grade 5 Lessons of number bricks in the Central Province in Zambia", *Journal of JASME Research in Mathematics Education,* (1).pp.9- 15.

Nakawa, N (2012). Growth and Challenges to Basic School Teachers under the Practice of Lesson Development based on Substantial Learning Environment (SLE) in the Republic of Zambia, *Journal of JASME Research in Mathematics Education*, (2), 13-21.

National Council of Teachers of Mathematics, (2000). *Principles and Standards for School Mathematics:* NCTM Publication Department. USA.

National Mathematics Advisory Panel. (2008). *Foundations for Success: The Final Report of the National Mathematics Advisory Panel.* Washington, DC: U.S. Department of Education.

Noddings, N. (1995). *Philosophy of Education.* Oxford: Westview Press.

Nonaka, T. (2013). Current Status and Issues of Child-centeredness of Mathematics at Basic Education in Zambia, *Journal of JASME Research in Mathematics Education*, (2) pp.45-52.

Orodho, A. &Kombo, D. (2002). *Research Methods*. Nairobi: Kenyatta University Institute of Open Learning.

Phillips, G. W. (2007). *Chance favors the Prepared Mind: Mathematics and science Indicators for Comparing States and Nations.* Washington, D.C.: American Institutes for Research.

Posthuma, A.B. (2012). *Mathematics Teachers' Reflective Practice within the Context of adapted Lesson Study.* Pythagoras, 33(3), Art. 140, 9 pages.

Robinson, V. M. J. (1998). Methodology and the Research-Practice Gap. *Educational Researcher,* (1), 17-26.

Rock T. C. & Wilson C. (2005). *Improving Teaching through Lesson Study*. University of North Carolina. North Carolina. USA.

Schoenfeld, A. H. (2007). Problem solving in the United States, 1970-2008: Research and Theory, Practice and Politics. *Mathematics Education,* 39, 537-551.

Shulman, L. S. (2004). *The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach.* San Francisco: Jossey-Bass.

Sims, L. & Walsh, D. (2009). Lesson Study with Pre-service Teachers: Lessons from Lessons, *Teaching and Teacher Education*, (5), 724-733.

Sparks, D., & Hirsh, S. (2000). *A National Plan for Improving Professional Development National Staff Development Council.* Retrieved from ERIC database (Doc. No. ED4427798)

Spencer, S. S. & Logan, K. R. (2003). Bridging the Gap: A School Based Staff Development Model that Bridges the Gap from Research to Practice, *Teacher Education and Special Education,* (1), 51-62.

Stepanek, J. (2001). A New View of Professional Development. *Northwest Teacher Magazine, Spring*, 2001, 1-8.

Stigler, J., & Hiebert, J., (1999). *The Teaching Gap*. New York: The Free Press.

Valsiner, J. ((2006). *Qualitative and Quantitative Developmental Research Methods in their Historical and Epistemological Contexts.* New York: McGraw-Hill.

Van Sickle, J. A. (2011). *Lesson Study's Impacts on Teacher Perception of Efficacy in Teaching. Education thesis.* The Faculty of Humboldt State University.

Watanabe, T. (2002). Learning from Japanese Lesson Study. *Educational Leadership*, 36-39.

White, A. L. & Southwell B. (2004). *Lesson Study: A Model of Professional Development for Teachers of Mathematics in Years 7 to 12.* University of Western Sydney. New South Wales.

White, C. J. (2005). *Research, A Practical Guide*. Ithuthoko Investment Publishers.

Wittmann, E. C. H. (2001). Developing Mathematics Education in a Systemic Process, *Educational Studies in Mathematics,* (1), 1-20.

Yamnitzky G. S. (2010). *Elementary Teachers' Perspectives on the Impact that Lesson Study Participation had on their Mathematical Content and Pedagogical-Content Knowledge.* Education Research. University of Pittsburgh.

Appendices

Appendix 1

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

SCHOOL OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY, SOCIOLOGY AND SPECIAL EDUCATION

QUESTIONNAIRE FOR SECONDARY SCHOOL TEACHERS OF MATHEMATICS IN MONZE DISTRICT

STUDY TOPIC: EFFECTS OF LESSON STUDY ON THEORY-PRACTICE GAP IN MATHEMATICS TEACHING PRACTICES IN SELECTED SECONDARY SCHOOLS OF MONZE DISTRICT

INTRODUCTION

This questionnaire is designed to collect information from concerned stakeholders like you on the above cited topic. The major aim of the study is to find out the effect of the Lesson Study on theory-practice gap in Mathematics teaching practices in secondary schools in Monze District. You have been identified as one of the key respondent in the study. Therefore, your willingness and honest responses and contributions will help in the establishment of the effects of the Lesson Study on theory-practice gap in Mathematics teaching practices.

Your response will be treated with strict confidentiality and you will remain anonymous.

INSTRUCTIONS

Do **not** write your name on the questionnaire. Respond by putting a tick in brackets [ ] or writing the response in the spaces provided.

SECTION A: GENERAL INFORMATION

1. Teachers' Gender

   Male [ ]　　　　Female [ ]

2. Teacher's Professional Qualification

   Secondary Teacher's Diploma [ ]　　　　Bachelor of Education Degree [ ]

   Master of Education Degree [ ]　　　　Others (Specify)

   …………………..…

3. Teacher's Age (years)

   Less than 30 [ ]　　　　Between 30 and 40 [ ]

   More than 40 [ ]

4. Teacher's Teaching Experience (years)

   Less than 5 [ ]　　　　Between 5 and 10 [ ]

   More than 10 [ ]

SECTION B: LESSON STUDY PARTICIPATION

5. For how long have you participated in a Lesson Study group?

   ____

6. During the time you spend participating in Lesson Study, do you collaborate with your colleagues from the same school?

   Very much [ ]　Somewhat [ ]　Very little [ ]　Not at all [ ]

7. Do you share your new Mathematical knowledge with your colleagues?

   Very often [ ]　Often [ ]　Sometimes [ ]　Rarely [ ]　Never [ ]

8. Did Lesson Study as a professional development help you become a better Mathematics teacher?

   Strongly agree [ ]　Agree [ ]　Disagree [ ]　Strongly disagree [ ]

9. Is Lesson Study an effective way to continue as a professional development process?

   Strongly agree [ ]　Agree [ ]　Disagree [ ]　Strongly disagree [ ]

10. Do you wish to continue participating in Lesson Study as a professional development?

    Yes [ ]　No [ ]

As a result of participating in Lesson Study:

11. Do you understand the core Mathematical concepts pupils are expected to learn?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
12. Do you understand the connections between Mathematical concepts?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
13. Do you understand the cognitive demands of Mathematical concept?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
14. Do you feel prepared to teach Mathematical concepts rather than Mathematical procedures?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
15. Do you feel prepared to effectively plan for Mathematics instruction?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
16. Do you understand how children learn Mathematics?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
17. Do you use high level Mathematical tasks?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
18. Do you use alternate strategies and explanations for your struggling pupils?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
19. Do you pose open-ended questions?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
20. Do you pose real world Mathematical problems to all of your pupils?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
21. Do you feel prepared to provide opportunities for your pupils to investigate to solve Mathematical problems?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
22. Do you feel prepared to develop your pupils' conceptual understanding of Mathematics?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]
23. Do you feel prepared to identify your pupils' misconceptions of Mathematical concepts?
Very often [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ]

24. Do you feel prepared to identify your pupils' preconceptions of Mathematical concepts?

    Very often [ ]   Often [ ]   Sometimes [ ]   Rarely [ ]   Never [ ]

25. Is the size of your group of challenge/enabling factor to successfully implement Lesson Study?

    Major challenge [ ]   Challenge [ ]   Enabling factor [ ]   Major enabling factor [ ]

26. Is the amount of time devoted to Lesson Study of challenge/enabling factor to successfully implement Lesson Study?

    Major challenge [ ]   Challenge [ ]   Enabling factor [ ]   Major enabling factor [ ]

27. Is scheduling time to meet as a group of challenge/enabling factor to successfully implement Lesson Study?

    Major challenge [ ]   Challenge [ ]   Enabling factor [ ]   Major enabling factor [ ]

28. Is understanding of the Lesson Study process of challenge/enabling factor to successfully implement Lesson Study?

    Major challenge [ ]   Challenge [ ]   Enabling factor [ ]   Major enabling factor [ ]

29. Are the steps in the Lesson Study process of challenge/enabling factor to successfully implement Lesson Study?

    Major challenge [ ]   Challenge [ ]   Enabling factor [ ]   Major enabling factor [ ]

30. Is the amount of administrative support received of challenge/enabling factor to successfully implement Lesson Study?

    Major challenge [ ]   Challenge [ ]   Enabling factor [ ]   Major enabling factor [ ]

THANK YOU FOR PARTICIPATING

Appendix 2

INTRODUCTION AND CONSENT LETTER

Dear Respondent,

I am (Hangoma Edgar - Computer No: 2015130694) a post graduate student of Educational Psychology at the University of Zambia. I am exploring professional development practices that inform Mathematics instruction and am most interested in Lesson Study as a professional development practice. It is my understanding that you are, or have, participated in Lesson Study.

The purpose of this study is to establish the effect of Lesson Study on theory-practice gap in Mathematics teaching practices through a survey. Your participation in this study is voluntary. There are no foreseeable risks associated with this study, nor are there any direct benefits to you. This research is purely meant for my academic fulfilment.

The information you are going to provide in the questionnaire will be treated with a high degree of confidentiality thus; you are not supposed to indicate your name anywhere except your signature to show your consent. You are kindly requested to answer the questions honestly.

Respondent's signature…………………………….