SUSTAINABILITY OF LESSON STUDY IN TEACHING AND LEARNING MATHEMATICS: A CASE OF SELECTED SCHOOLS IN LUSAKA DISTRICT OF ZAMBIA

By

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(M. Ed-Mathematics)

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DECLARATION

I **Gilbert Sinkala**, do hereby declare that this dissertation is my own work, and that all the works of other persons used have been duly acknowledged, and that it has never been previously submitted for a degree at the University of Zambia or any other learning institution.

Signature: ……

Date: ……..……..

CERTIFICATE OF APPROVAL

This dissertation of **Gilbert Sinkala** is approved as partial fulfillment of the requirements for the award of the degree of Master of Education in Mathematics Education (M. Ed-Mathematics) by the University of Zambia.

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ABSTRACT

The purpose of the study was to investigate the long-term sustainability of lesson study in teaching and learning mathematics in selected schools in Lusaka district, Zambia. The study utilized a qualitative case study and was based on social constructivism. Six purposively selected teachers of mathematics at two different junior secondary schools were involved in lesson study cycles. At the first school, four teachers participated in teaching a single Grade eight class while at the second school two teachers took part in teaching a Grade eight class. Data were collected through questionnaires, semi structured-interviews and lesson observation. Thematic analysis was employed to analyse the data from the three sources. In line with the understanding of lesson study, the study revealed that most teachers had a correct understanding and they defined it as a process involving planning, teaching, observation, and reflection. It was further defined as a systematic inquiry into teaching and learning, where teachers collaborate to plan, conduct, observe, and reflect on research lessons to enhance the teaching and learning process. Nevertheless, teachers portrayed both positive and negative attitudes towards lesson study in teaching and learning mathematics. On the negative attitudes, it was revealed that some participants viewed lesson study as time-consuming and challenging while on the positive attitudes, it was found that some participants viewed lesson study as a way to improve teaching practices in class. It was discovered that some negative attitudes towards lesson study by some teachers were as a result of some factors that impacted the sustainability of lesson studies in teaching and learning Mathematics. For example, lack of resources such as materials used in lesson study activities, perceived benefits of lesson study, appropriate implementation of lesson study activities, time constraints and lack of continuous support from some organizations such as Non-governmental organizations and the government itself. Based on the negative attitudes, it was suggested that headteachers should continuously orient and remind teachers that lesson study is not time-consuming and challenging but beneficial to them and the learners. It was also suggested that the government should continuously provide resources and advise headteachers to ensure that they include lesson study program on the time table for it to be a success. It was recommended that the government should continuously support teachers through providing incentives such as allowances for their transport and lunch to encourage them to be participating in lesson study activities to boost teacher confidence in delivering lessons to the learners.

DEDICATION

This work is dedicated to my children, Vow Tasheni Sinkala and Ezra Zewelanji Sinkala. Their presence gave me hope and encouragement both spiritually and emotionally during the study. To my Lovely Wife, Leaster Bwalya Mutale Sinkala, I will always remember the encouragements and hope you gave me, especially when you allowed me to proceed with my studies. You stood in the gap for me and always prayed for God to guide me during my studies. Thank you for your prayers and for believing in me that I can make it. To my late mother, Esther Mwape Ngoyi, and my late father, Peter Penga Penga Sinkala, may your souls rest in eternal peace. Without you, I wouldn't have been here. To my mother-in-law, Idah Lungu Mutale, and my father-in-law, Nelson Chanda Mutale, thank you for your encouragement and your prayers.

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LIST OF ABBREVIATIONS AND ACRONYMS

CPD	Continuing Professional Development
DEBS	District Education Board Secretary
ECZ	Examination Council of Zambia
GRZ	Government of the Republic of Zambia
LS	Lesson Study
MOGE	Ministry of General Education
SBCPD	School Based Continuing Professional Development
SEARS-MT	South-East Asia Regional Standards for Mathematics Teachers
SPRINT	School Program of In-service Training for the Term
UNZA	University of Zambia
ZPD	Zone of Proximal Development

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter contains the background of the study, statement of the problem, the purpose of the study, research objectives of the study and research questions. It further contains the significance of the study, theoretical framework, the conceptual framework, and also provides delimitations and limitations of the study, operational definitions of key terms and the summary of the chapter.

1.1 Background to the study

Lesson Study is originally a common practice among Japanese teachers to share and improve their knowledge and skills. In 1999, United States researchers wrote a book entitled "The Teaching Gap," which asserted that the key to Japanese students' high performance in Mathematics was the Lesson Study practice of teachers. This assertion sparked interest in the practice from researchers and officials in many countries, leading to its adoption in over 50 countries worldwide. Lesson Study is now globally recognized as one of the methods and strategies teachers can use to enhance their teaching and learning programs, thereby improving learners' academic performance (Lewis, 2002). The term "Lesson Study" was coined by Yoshida, derived from the two Japanese words "Jugyo Kenkyu," where "Jugyo" means lesson and "Kenkyu" means study or research. Hence, Lesson study can be referred to as a research lesson. The origins of Lesson Study in Japan can be traced back as far as the 1920s. According to Stigler and Hiebert (1999: 125), "teachers in Japan, where Lesson Study is practiced, see themselves as developing their profession as well as themselves." Japan's teaching success has been largely attributed to the use of Lesson Study as a professional development model (Stigler & Hiebert, 1999; Yoshida, 1999). Due to the success of this professional development model in Japanese schools, interest in the practice of Lesson Study is growing in the United States and other countries (Chokshi & Fernandez, 2004).

Tukombe, Banda, and Nakai (2017) reported that Lesson Study, known as a practice by teachers to improve their knowledge and skills in teaching or to conduct research related to teaching and learning in the classroom, was introduced in Zambia in 2006 with technical assistance from the Japanese government. It was not the direct introduction of the Japanese Lesson Study practice to Zambia but rather an experimental experience for Zambian educators to adapt the practice to the Zambian school context. For instance, the practice was not introduced as a mere program or project but as a tool expected to be integrated into the existing Continuing Professional Development (CPD) program at the school level, known as the School Program of In-service Training for the Term (SPRINT). This alignment of Lesson Study enabled educators to utilize human resources, financial resources, and administrative structures within the existing SPRINT for the practice's implementation. Moreover, the process itself was reviewed, leading to the creation of a Zambian model of Lesson Study consisting of eight steps as one cycle. Currently, Lesson Study in Zambia is conducted through the following process: (1) Defining problems, (2) Planning a lesson, (3) Conducting the lesson, (4) Reviewing the lesson, (5) Planning the lesson again, (6) Conducting the revised lesson, (7) Reviewing the lesson again, and (8) Compiling learning. This process aims to provide teachers in schools with more opportunities to prepare and conduct lessons together as a learning community. In order to manage this, the study focused on sustainability of lesson study in teaching and learning mathematics.

Lesson study was introduced as a government initiative to enhance classroom instruction quality and student achievement specifically in mathematics and science. Following this, some secondary school teachers of science have been engaging in Lesson Study activities at the school level as part of their Continuing Professional Development (Mubanga, 2012). The Japan International Co-operation Agency and the Government of the Republic of Zambia collaborated to incorporate Lesson Study into the Zambian context, in response to the Zambian government's request for assistance in improving the School Program of In-service for the Term (SPRINT), the existing system for in-service teacher training in the country (Ministry of Education, 2015). Lesson Study in Zambia is built on a bottom-up approach to finding positive solutions to enhance education quality, deepen teachers' understanding of learner-centered teaching, and develop their abilities to implement learner-centered lessons (Baba, 2015).

Zambia has now formalized the lesson study program, making it part of the curriculum; all secondary school science instructors are mandated to conduct lesson studies at their schools as part of the School Based Continuing Professional Development (SBCPD) program (Ministry of Education, 2015). Every month, teachers gather by grade level or subject to collaborate on identifying classroom challenges, developing lesson plans to address them, and practicing lesson delivery while receiving feedback from peers. This teacher-led Plan-Do-See technique underscores the importance of self-critique and learning from mistakes (MoGE, 2010). The implementation of the lesson study regimen has been carried out in phases. By the conclusion of phase 1, the lesson study program had reached 425 grade 8–12 mathematics and science teachers in 200 schools in Central Province. Two years later, nearly 2,000 instructors from Grades 8 through 12 were utilizing it in various schools, beyond just science and mathematics (Ministry of Education, 2010). During phase two, which commenced in 2008, lesson study was expanded to two additional provinces in Zambia, and by the onset of phase three in 2011, it had engaged 14,000 teachers in over 1,000 classrooms across all three provinces. In phase 3, the program was extended to encompass all the remaining provinces in the country, reaching almost 46,000 instructors by 2015 (Nakai, 2016).

Regarding student outcomes, an internal monitoring and evaluation study conducted in 2010 revealed that after three years of implementing Lesson Study in Central Province, students' pass rates in physics and chemistry increased by 12.4% and 19.2%, respectively, compared to schools in other provinces (Ministry of Education, 2010). Additionally, the Ministry of Education's impact assessment of the program in the three Phase 2 provinces (Central, Copperbelt, and Northwestern Provinces) indicated continuous improvement in students' science pass rates (from 53% in 2009 to 63% in 2013) and in mathematics (from 40% in 2009 to 49% in 2013), a subject that had shown minimal improvement in the 2010 study due, in part, to the program's implementation for mathematics teachers in 2008 compared to science teachers (Ministry of Education, 2010). In 2006, out of 3,982 Grade 9 pupils who took Mathematics exams, 1,776 passed, representing a 44.6% pass rate (Mtonga, 2015). In 2007, 3,859 students sat for the Mathematics exams, and 1,675 passed, representing a pass rate of 43.4% (Mtonga, 2015). In 2009, 5,676 students took the Mathematics exams, with 2,742 passing (48.3% pass rate) (Mtonga, 2015). The following table shows the year, raw data, total number of the pupils who sat for each

examination and the percentages obtained for pupils in Central Province during the implementation of lesson study.

Year	Raw data	Total	Percentage
2006	1,776	3,982	44.6%
2007	1,675	3,859	43.4%
2009	2,747	5,676	48.4%

Table 1.0. The mathematics pass rate for final examination in central province

The results from the table indicate an improvement in the Mathematics pass rate (Ministry of Education, 2015). Moreover, higher levels of Lesson Study implementation in schools consistently correlated with increased student performance on national tests, as per the 2015 impact evaluation (MoGE, 2015).

Prior to incorporating the approach into national development plans, the gradual expansion of lesson study nationwide resulted in observable benefits, such as enhanced teaching skills among instructors and improved mathematics and science pass rates for students. Despite Japan International Cooperation Agency's expanded official support for Lesson Study up to phase 4 of pre-service education, in-service teachers in Zambia are continuing to implement Lesson Study under the government guidance and support, with the aim of reaching 90,000 instructors in 9,500 schools by 2023 (Nakai, 2016). Tukombe, Banda, and Nakai (2017) noted that after being practiced in Zambian schools for a decade, Lesson Study has proven to be a very user-friendly and effective tool over a long term, allowing for widespread teacher participation in cycles within their schools, either in Teacher Group Meetings or departmental meetings. It also represents a cost-effective method of teacher professional development, as training and learning take place within the school premises, eliminating the need for teachers to attend external training sessions. With consistent practice, Lesson Study is demonstrated to be a sustainable approach to enhancing teacher professional development, empowering teachers as key participants and relying heavily on head teachers with strong managerial skills, including In-Service Training Management skills.

1.2 Statement of the problem

Sustainability is a key factor in the success of education of any educational initiative, including lesson study in teaching and learning mathematics. Lesson study is a professional development strategy that involves teachers collaboratively identifying a problem, planning, teaching, observing, and reflecting on a single lesson to improve their teaching practices and student positive outcomes. The study has shown a positive impact on learners' academic performance in mathematics(Mubanga, 2012). However, the impact appears to be limited, as other studies indicate that student performance remains below average in the national mathematics examinations despite the claims of the continuous implementation of lesson study(MoGE, 2015) . Learner performance in mathematics has been unsatisfactory for years (ECZ, 2016). For instance, in the year 2010, out of 7,136 pupils who took Mathematics examinations, only 2787 passed, representing a pass rate of 39.1%, which was below average (Mtonga 2015). It was discovered that the implementation of the lesson study by teachers is slowly declining in some schools and it could have contributed to the subject (Mathematics) to have consistently recorded high failure rates over a prolonged period (ECZ, 2015, 2016). Many learners fail the subject at both grade 9 and grade 12 examinations, with some candidates even scoring zero (ECZ, 2017) despite its proven effectiveness in improving instructional practices in various educational settings. There are challenges to its sustainability such as lack of time, lack of institutional support, financial resources, lack of professional development opportunities, resistance to change by some teachers and in-depth understanding of the study by some teachers (Fernandez, C., & Yoshida, M.,2004). These challenges created a gap in understanding the long-term sustainability of lesson study programs, particularly in terms of its continued implementation, teacher participation, and its impact on both teaching and student learning mathematics which needed answers through a thorough investigation into the sustainability of lesson study in teaching and learning mathematics in the selected schools of Lusaka Province, Zambia.

1.3 Purpose of the study

The aim of this study was to investigate the sustainability of lesson study in teaching and learning mathematics in selected schools of Lusaka District, Zambia.

1.4 Research Objectives of the study

The objectives of this study were:

1. To investigate teachers' understanding of lesson study.
2. To establish the attitudes of teachers of mathematics have towards lesson study activities.
3. To identify factors that could impact the sustainability of lesson study in mathematics.

1.5 Research Questions of the study

To achieve the objectives above, the study attempted to answer the following specific questions:

1. What do teachers understand by the term lesson study?
2. What attitudes could teachers of mathematics have towards lesson study activities?
3. What factors could impact sustainability of lesson study in teaching and learning mathematics?

1.6 Significance of the study

It was hoped that the findings of the study would contribute to the regularity of lesson studies in schools. Furthermore, sustainable lesson studies could lead to more effective teacher instruction and improved learner achievement in mathematics classrooms. The study was also likely to make a significant contribution to the existing literature on the sustainability of lesson studies in the context of teaching and learning mathematics in selected schools of Lusaka district and other schools across the country. Additionally, the results may help guide teachers and policy makers in Zambia on the extent to which lesson studies could be sustained in the teaching and learning of mathematics. In particular, the study could raise teachers' awareness of the existence and importance of lesson studies and encourage them to become more involved in the lesson study process and its implementation. The findings of the study could inform both theory and practice regarding the sustainability of lesson studies in teaching and learning mathematics.

1.7 Theoretical Framework

This study was informed by Lev Vygotsky's (1896-1934) Social Constructivist Theory which informs the study by emphasizing on social interactions among the teachers as learners. The theory posits that cognitive functions initially develop through social interactions, emphasizing that learning is not merely absorbed but rather achieved through a collaborative process.

Vygotsky considered peer interaction as an effective means of skill and knowledge development. Learners construct their knowledge based on their experiences, with teachers acting as facilitators who focus on guiding their efforts toward specific tasks at any given time. Teachers also jointly plan lessons as they conduct lesson study with one volunteering to teach a lesson and as they are collaboratively conducting lesson study, they can design collaborative activities for students to work together to solve mathematical problems. Vygotsky theory was incorporated into the study to encourage social interaction and collaborative lesson study among teachers to enhance their professional skills and knowledge, potentially leading to improved learning outcomes. The interactive nature of the theory aimed for learners to create their own understanding through collaboration, while teachers assumed a facilitator role during lesson presentations. Collaborative work allowed learners to benefit from each other's knowledge and skills, while teachers also gained insights from colleagues' expertise during lesson studies. Social constructivist theory offers guidance on establishing active participation through interaction in implementing lesson study. Therefore, teachers should engage actively with other educators to enhance their knowledge and skills in teaching and learning mathematics. This theory steered the researcher in exploring the sustainability of lesson study in mathematics education.

1.8 Conceptual Framework

To come up with the conceptual framework that suits the study, a related literature review was incorporated and figure 1.1 shows a conceptual framework which helps us to comprehend the study. According to Adom, Hussein and Agyem (2018), a conceptual framework is a structure which the researcher believes would best explain the natural progression of the phenomenon to be studied. The conceptual framework for the lesson study revolves around a collaborative process where teachers work together to identify a problem, then plan, teach, observe, analyze, and revise lessons with the goal of improving teaching and learning (Fernandez, C., Cannon, J., & Chokshi, S., 2003). One area where lesson study has the potential to have a significant impact is in the study of sustainability in teaching and learning mathematics. By incorporating sustainability principles into lesson study, it can allow educators to share best practices, ideas, and resources for teaching learners.

In order to understand the conceptual framework, related literature review explained the stages of the lesson study cycle. The stages of the cycle are problem definition, collaboratively planning a lesson, implementation of a collaborative planned lesson, reflection of the lesson, revise the

lesson, teach the revised lesson, reflect on the revised lesson and compile the findings. Problem identification stage is a stage when teachers collaboratively identify a problem or challenge that almost everyone encounters then they collaboratively plan a lesson that is then presented by one teacher to the pupils with the whole team of teachers as observers of the lesson. There after, they meet to discuss the development of the lesson. The group discusses how their lesson evolved because understanding how the lesson evolved helps the group to deeply understand what they observed and improve it. Further, teachers re-plan the lesson and a volunteer teacher presents the re-planned lesson as entire group observes again then they all reflect on the taught lesson and, compile and file the findings. The figure below shows the lesson study cycle which is also a conceptual framework of the lesson study.

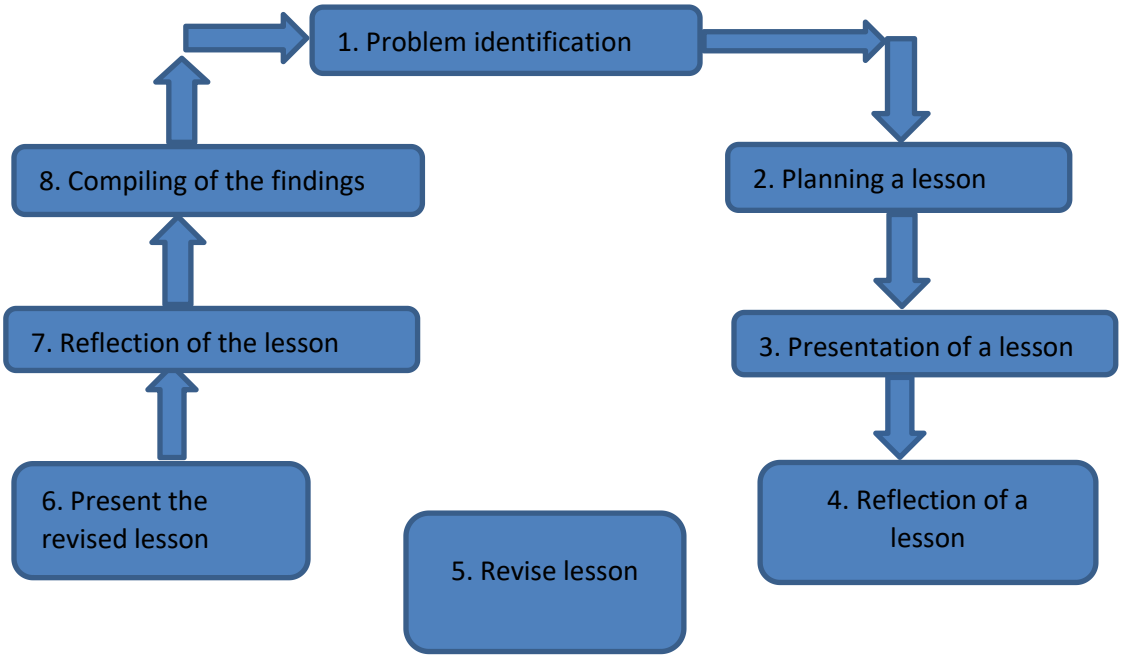


Figure 1.0 Conceptual Framework of the study (From Lewis et al. 2006, p.4)

1.9 Delimitation of the study

The study was restricted to selected schools in Lusaka district of Zambia, where mathematics teachers were practicing lesson study in teaching and learning mathematics. Lusaka district was chosen because the schools were in close proximity to each other, making it more convenient to conduct research within the same area.

1.10 Limitation of the study

The limitation of this study is that at one of the schools one participant suddenly dropped out due to the school not paying the teacher as the teacher was not on government payroll and so he decided to resign . The resignation affected the study negatively as it was not completed because one teacher can not conduct lesson study.

1.11 Operational Definitions of key Terms

Attitudes- refers to the person's overall evaluation of someone**.** It is also a feeling about something (Cherry, K., 2023)

Effective teacher instruction- it involves a continually reflecting of teachers on the practices and seeking feedback from other teachers in order to provide regular feedback to students on their progress. (National Education Association, 2021)

Learners-These are people who acquire knowledge, skills and values in order to add to the knowledge they already have. (Dweck, C. S., 2006)

Learner Achievement-Refers to the measurable outcomes that demonstrate a learner's success in acquiring knowledge, skills and competences. (Dweck, C. S., 2006)

Study cycle-it is a comprehensive approach to studying that incorporates goal setting, time management, active learning, organization, effective study techniques, self-assessment, seeking help, practice and repetition,reflection, and consistency. (Ames, C., & Archer, J., 1988)

Sustainability-Is often defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. (WCE., 1987)

Teachers-These are individuals who share knowledge and skills with others, typically in a formal educational setting. (Darling Haamond, L., 2017).

Teacher development-involves providing teachers with the necessary knowledge and skills for students to benefit from them. Dhiorbháin, A, N., et al. (2024).

Teacher Professional Growth-is the continuous learning and development that helps teachers sharpen their teaching skills and classroom management techniques. (Bahous, J., 2006).

Zone of Proximal Development-is the difference between a learner's independent ability and their potential ability with the guidance and support of a teacher. (Vygotsky, L. S, 1978).

1.12 Chapter summary

This chapter presented the background of the study which was the brief outline of the study, the statement of the problem which indicated the need to conduct the current study, aims of the study, the objectives and the research questions that gives a guidance of the study and the theoretical framework that supported the study as well as the conceptual framework which revealed the researcher's comprehension of the problem at hand. Other aspects included the significance of the study, operational definitions of the terms, delimitation and limitation of the study.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.0. Overview

The whole of this chapter acknowledges the works of some scholars then the gap comes out of it. It has reviewed the related literature of the study. The review of literature was done in themes such as the Concept of Lesson Study, teachers' understanding of lesson study, attitudes of teachers of mathematics towards lesson study activities and factors that impact sustainability of lesson study in mathematics. The themes emanated from research objectives and research questions of the study with the rationale that it has suggested to provide better understanding of various concepts of the study. The literature was selected based on its relevance to the current study and concluded with a summary of the whole chapter.

2.1 The Concept of Lesson Study

The concept of Lesson Study has been defined differently by various scholars, but they all point to the same understanding. For example, Fuji (2016) defined Lesson Study as a Japanese model of teacher-led research in which a triad of teachers work together to address an identified area for development in their students' learning. Using existing evidence, participants collaboratively research, plan, teach, and observe a series of lessons. They engage in ongoing discussion, reflection, and receive expert input to track and refine their interventions. Working in a small group, teachers collaborate, meet to discuss learning goals, plan an actual classroom lesson (referred to as a "research lesson"), observe how their ideas work in live lessons with students, and then report on the results for other teachers' benefit. However, it is not just a collaboration but there is need also to necessitates a study on the sustainability of Lesson Study in teaching and learning mathematics.

During lesson study, teachers work collaboratively for a reason as is it a reflective teaching approach, where teachers work together to examine teaching and learning in the classroom. Susan and Micki (2009) in agreement with Fuji (2016) defined Lesson Study approach as a method of professional development that encourages teachers to reflect on their teaching practice through a cyclical process of collaborative lesson planning, lesson observation, and examination of student learning. Despite the cyclical process, there was still need to conduct a research just to

be aware of the sustainability of lesson study in teaching and learning of mathematics in the selected schools of Lusaka district, Zambia as the study has not clearly mentioned things to do with the sustainability of lesson study.

The result-oriented professional development model is an ideal vehicle for improving instructional practice in middle schools. A middle school is a school for students in grades six through eight, and is a time of transition from elementary to high school. These schools are popular in a broad range of countries around the world and have been growing in some countries. They are valued as an important bridge between the single classroom-based world of primary education and the subject specialism of upper secondary schools. Some countries such as Australia, New Zealand, and others have adopted the middle school model in their attempts to address perceived underachievement in the middle school age pupils within two tier education systems (Nigel,2022). Middle schools are characterized as (a) learning communities where teachers and students engage in active learning, (b) places with high expectations for every member of the community, and (c) organizational structures that support meaningful relationships (National Middle School Association, 2003). Middle school teachers need to know their students well, understand who they are, how they learn best, and utilize this information when planning instruction and assessing student performance during a lesson study cycle. While most teacher planning focuses primarily on teacher actions rather than on student results (Ornstein, 1997), the Lesson Study approach provides an opportunity for middle school teachers to work together to strengthen the link between instructional planning and student learning.

Lesson Study is also defined as a "comprehensive and well-articulated process for examining practice (Fernandez, Cannon, Chokshi, 2003:171)." The Lesson Study approach reflects how Japanese teachers have studied their practice for decades. Educators from the United States who investigated Japan's high scores in mathematics concluded that Japan's success could be attributed to their professional development model. Observing that Japanese teachers had developed a way to examine student achievement, which Yoshida (1999) translated as "lesson study," Stigler and Hiebert (1999) introduced Lesson Study to teachers in North America in their book about international instructional methods. Lesson Study is now one of the fastest-growing approaches to professional development in the United States (Lewis, Perry, Hurd, O'Connell, 2006).

Lesson Study involves groups of teachers meeting regularly over a period of time, ranging from several months to a year, to collaborate on the design, implementation, testing, and improvement of one or several "research lessons" (Stigler & Hiebert, 1999). These research lessons are actual classroom lessons, taught to one's own students, focused on specific teacher-generated problems, goals, or visions of pedagogical practice. They are carefully planned, usually in collaboration with colleagues, observed by other teachers, recorded for analysis and reflection, and discussed by the lesson study group members, colleagues, administrators, and/or an invited commentator. Even though Stigler & Hiebert (1999) explained about lesson study involving teachers who meet regularly to conduct lesson study, they have not mentioned anything about the sustainability of the study. There is need for scholars to state the extent of the sustainability of the lesson study to enable teachers to conduct a complete study cycle.

During a three-year investigation of Japanese education, Lewis (2002) found that Japanese teachers successfully shifted their approach to teaching science from "teaching as telling" to "teaching for understanding" through intensive studying and sharing during lesson study. Japanese teachers believe that time spent studying their lessons will subsequently improve their teaching, with research lessons being credited as key to individual, school-wide, and national improvement in teaching. Instead of working individually, Japanese teachers use a collaborative approach in sustained lesson study.

Lesson Study is a school-based collaborative activity characterized by a continuous cycle of meticulous planning, prudent demonstrations, and perceptive lesson improvement. It involves small groups of teachers with varying levels of ability but a shared interest in working collaboratively towards specific objectives for lesson planning. This process is where teachers strive to enhance their teaching methods progressively by examining and critiquing each other's teaching techniques. Even though Lesson Study has been utilized by Japanese schools for over four decades, it was only brought to the attention of the international education community in the 1990s by the Third International Mathematics and Science Study (Stiegler and Hiebert 1999). It has since spread and been practiced in many countries, including the United States, Australia, Kenya, Malaysia, and South Africa.

Fernandez (2002) mentioned that Lesson Study "brings together groups of teachers to discuss lessons that they have first jointly planned in great detail and then observed as they unfolded in actual classrooms." Lesson Study assists teachers in learning from their own practice through reflection although it is not enough as there is need to know how the study is sustained in teaching and learning mathematics in the selected schools of Lusaka district.

The purpose of Lesson Study is to allow teachers within a specific discipline to collaborate in identifying a common problem that students struggle to solve and develop a unified lesson that addresses the issue. Teachers critique each other on the delivery of the lesson to students, reflect, and modify the lesson plan for improved effectiveness before re-teaching the material to a different group of students. Lesson Study Method, as stated by Lewis et al. (2006), helps teachers acquire new knowledge, enhance their commitment to teaching, and improve necessary resources for lessons, making it an excellent mechanism for professional development. However, Fernandez et al (2017) argued that some teachers may not fully understand lesson study because they lack the necessary support resources to implement it effectively. Others may not understand lesson study because they may lack awareness of the research behind the study.

Lesson study is a collaboration-based teacher professional development approach that originated in Japan (Fernandez and Yoshida 2004; Lewis and Tsuchida 1998; Stigler and Hiebert 1999). According to Murata, A. (2011), Lesson study attracted the attention of an international audience in the past decade, and in 2002 it was one of the foci for the Ninth Conference of the International Congress on Mathematics Education (ICME). It subsequently spread to many other countries and more than a dozen international conferences and workshops were held around the world in which people shared their experiences and progress with lesson study as they adopted this new form of professional development in their unique cultural contexts (e.g., Conference on Learning Study 2006; Fujita et al. 2004; Lo 2003; National College for Educational Leadership 2004; Shimizu et al. 2005).

2.2 Teachers' understanding of lesson study

According to Lewis. C, et al (2019), the goals of lesson study as it is practiced in Japan are much broader than is often appreciated in the West. For example, in Japan, lesson study is expected not only to improve teaching but also to strengthen professional community among teachers (Lewis

et al. 2010; Sato 2008), help teachers make sense of changes in national standards (Takahashi and McDougal 2014), build more coherent instruction across classrooms (Matsuzawa Elementary School 2011), and connect individual teachers' daily instruction to the shared long-term vision for students embraced by the school (Takahashi and McDougal 2016).

Lesson study was defined also by Lewis, C, et al (2019) as a translation of the Japanese term "jugyou kenkyuu," and it is a professional inquiry approach practiced in more than 90% of schools in Japan (National Education Policy Research Institute 2011). Although lesson study is sometimes misconstrued as focusing primarily on lesson planning, it consists of four stages of cyclical activity, as shown at the left side of Fig. 1. However, even though the lesson study cycle has been demonstrated in the figure, not all teachers understand it and its meaning as some do not manage to define it and this is one of the reasons why it is important to look at the title of the study ''sustainability of lesson study teaching and learning mathematics.'' In Japan, lesson study cycles typically take place in the context of school-wide collaborative lesson research, in which lesson study teams throughout a school build and share knowledge around a research theme that captures long-term goals for students and testable ideas about how to reach those goals (Takahashi and McDougal 2016). Some eminent researchers lay out six phases of lesson study (Fujii 2016; Takahashi and McDougal 2016), in order to emphasize goal-setting at the outset and to separate the post-lesson discussion and subsequent reflection on learning, but we have opted for simplicity.

It is very important for teachers to understand lesson study and in this case the researcher needed to establish their understanding of the study. Shuilleabhain (2015) conducted a study with the aim of investigating a model of in-school professional development that would support mathematics teachers in their practices and learning, set against a backdrop of curriculum reform. The research identified lesson study as a professional development model that could facilitate teacher collaboration within and outside the school although not all teachers have a clear understanding of what lesson study entails and this can hinder their ability to fully participate in the process when it offers teachers' opportunities to engage with the curriculum, adapt and create curriculum materials, observe classroom practices, reflect on teaching and learning, and enhance their knowledge through active participation in the study. So for teachers to take part in a lesson study they should first understand it through the professionally development training although all

teachers participate in the study because not all understand it. In the professional development, teachers have to learn and understand lesson study for them to practice it.

Initially, in the first cycle of lesson study, the group of teachers overlooked the definition of the study addressing students' prior knowledge and potential difficulties they might encounter with the lesson content. Consequently, during the post-lesson discussion, teachers expressed dissatisfaction as many students were already familiar with the topic, and the activities were not suitable for their learning needs. As the cycle progressed, teachers incorporated students' prior knowledge into their lesson plans and shifted the focus towards how students would respond mathematically to the activities within the lesson. Subsequently, teachers began to explicitly analyze student strategies and discussions in their post-lesson reflections.

Stutchbury, Gallastegi, and Woodward (2019) conducted a study aligned with lesson study principles. Their research described lesson study as an ongoing process of practical evaluation, allowing for early determination of effective strategies in various contexts, thereby informing continuous project planning. They highlighted how open learning features have been innovatively developed to provide school-based professional development for teachers in Zambia.

Furthermore, Baba and Nakai (2015) observed the impact of more than three years of lesson study implementation in upper basic and high schools. They noted significant positive changes in teaching practices, with more teachers now writing clear lesson plans, setting precise objectives, enhancing interactivity during lessons, and increasing learning activities. Changes also extended to children, as evidenced by increased engagement, participation, and collaborative discussions during lessons.

In another study, Shuilleabhain and Clivaz (2017) aimed to analyze the knowledge assimilated by mathematics teachers through their involvement in lesson study. By employing a comprehensive theoretical framework of mathematics teacher knowledge, they examined teachers' collaborative conversations during lesson study. The study gathered data from case studies in the Republic of Ireland and Switzerland, detailing the knowledge articulated by teachers during the planning and reflection stages of a research lesson. The findings indicated that teachers who conducted lesson study effectively utilized their mathematical knowledge for teaching across all levels of teacher activity, showcasing a holistic integration of knowledge in planning and reflecting on research lessons.

Alshwaikh and Adler (2017) conducted a study examining researchers and teachers as learners in lesson study activities. The participating teachers, purposefully selected, spent a few hours collaborating as a team of six to eight teachers to share ideas and experiences through planning, teaching, reflection, revision, and re-teaching to enhance the teaching and learning of mathematics in schools. Some teachers in the study had varying teaching experiences and were relatively new to the lesson study when they also had limited relationships with each other and the learners. This is because some teachers have no interest in the study as they have no much information about it. Aligned with the project's broad aim, the teachers identified an area of difficulty in mathematics and, as a group, developed a broad aim and planned lessons to achieve a specific goal in teaching and learning mathematics. Initially, it was noted that participants were given a lesson study template to observe, enabling them to make observations, reflect, and offer suggestions before an actual lesson preparation and during the reflection stage. Consequently, they planned their lessons (interventions) based on learners' responses, observing errors, mistakes, and misconceptions commonly encountered during teaching, learning, and assessment. The group collaborated to plan their first lesson, and subsequent lessons were refined by individual groups and presented by individual teachers within each group. During the study, one participant teacher in each group taught the meticulously planned lesson while others observed to gain a genuine understanding of the lesson and its impact on their learners. However, undergoing through this cycle was not the only thing that was needed to be done during lesson study cycle, there was also need for teachers to know the sustainability of the study as without the sustainability of lesson study, it is difficult for teachers to conduct it. So when understanding the lesson study, teachers should consider the sustainability of lesson study in teaching and learning mathematics.

Helgevold et al (2021) conducted a study aiming to deepen the understanding of how lesson study (LS) challenges teachers' perspectives on mathematics teaching and learning. This study is part of an ongoing project to enhance primary mathematics teaching in Malawi through teachers' professional development using lesson study model. The focus is on teachers' written reflections and lesson plans, analyzed through qualitative content analysis. Initially, Malawian primary teachers held traditional views on mathematics teaching and learning. Following a lesson study cycle, they recognized the necessity of involving and creating space for learner participation in

mathematics lessons and emphasized the importance of learners discovering mathematics on their own.

According to Dudley, P. (2014), lesson study (LS) is a highly specified form of classroom action research focusing on the development of teacher practice knowledge. It has been in use in Japan since the 1870s. LS therefore pre-dates action research as we know it in the West, by some 70 years. Lesson study involves groups of teachers collaboratively planning, teaching, observing and analyzing learning and teaching in 'research lessons'. They record their findings. Over a cycle of research lessons they may innovate or refine a pedagogical approach which will be shared with others both through public research lessons, and through the publication of a paper outlining their work. Lesson Study has been used successfully in this country to improve teaching techniques and pupil progress in core subjects in primary and secondary universities and to develop. Dudley, P. (2014) also explained that lesson study helps experienced as well as inexperienced teachers to learn. Because, through the processes of joint planning, joint observation, joint analysis we have to imagine learning together, we get to see aspects of pupil learning through the eyes of others as well as our own and we compare actual learning observed in the research lesson with the learning we imagined when we planned it. This forces us to become conscious of things we would normally not be conscious of either because we would filter it out or because it would be dealt with through our tacit knowledge system. Many people who have used Lesson Study have said that focusing on and thus becoming more aware of the learning needs and behaviors of individual case pupils somehow makes them more aware of the individuality of all their pupils. So instead of teaching to a 'middle' with groups of high and lower achieving pupils on either side, Lesson Study helps teachers to be more aware of the needs of individuals in their subsequent teaching but seemingly without being overwhelmed by the experience.

2.3 Attitudes which teachers of mathematics could have towards lesson study activities.

In his study, Banda (2007) found that teachers tend to show negative attitudes towards Continuing Professional Development (CPD) due to low salaries, inadequate skills, low working morale, and other factors. They have also not been seeing the benefits of CPD. Most teachers teach subjects in which they are not competent, largely due to the factors mentioned. Geographically seconded teachers are expected to be facilitators, but they exhibit signs of

insufficient skills for effective critiquing. This is one of the factors that has caused teachers not to participate in the lesson study because they have no knowledge about the study. There is also a lack of material and information necessary for teachers to use as tools to improve their competencies. Although teachers are encouraged to maximize the use of existing resources like locally-available materials and books, some schools, especially those in remote areas, still lack adequate materials and up-to-date information. This study is related to the current study since it identified a factor affecting the sustainability of Lesson Study. However, the extent to which attitudes affected the sustainability of lesson study was not known, hence the need for the current study. Lomibao (2016) investigated the impact of Lesson Study on the quality of mathematics teachers at Bulua National High School in terms of SEARS-MT dimensions. In the study, a mixed-method research design was employed. Results showed that Lesson Study effectively enhanced mathematics teachers' quality and promoted their professional development. Teachers perceived Lesson Study positively as beneficial for improving their teaching skills. However, it is not all the teachers that portrayed a picture of positive attitude during the study. Some had negative attitudes and did not even attend the lesson study. This paragraph serves as the basis for the study on the sustainability of lesson study in teaching and learning mathematics in selected schools in Lusaka district, Zambia.

Tachie (2022) conducted a study to explore teachers' perceptions of collaborative work in designing lessons as a team and how it helped them identify threshold concepts in teaching foundation phase mathematics in Motheo district of Education. The study used a qualitative approach with a case study design, combining data from observations, focus group discussions, interviews, and group task sheets. Classroom observation was conducted during a workshop by a subject advisor from Motheo district of Education in collaboration with the researcher. Teachers were purposefully selected from seven schools in the Motheo district based on cluster sampling to enhance their professional development in mathematical teaching skills. Seven mathematics teachers, one from each school, were interviewed during the workshop. The study revealed that peer collaboration was essential in identifying challenging mathematical concepts and teaching them effectively at the foundation phase level. Collaborative work by teachers of mathematics was deemed necessary to address the lack of global mathematics teaching skills for early childhood mathematics, enhance learners' understanding of mathematical concepts, and boost their interest in the subject. The study recommended promoting structured collaborative work

among teachers to address content gaps in their respective areas of specialization. However, it was not clear on how it was going to be done and also it cannot easily be done if teachers have a negative attitude towards the study. Teachers who are perceived to have a negative attitude tend to influence others to join them.

Imhoff (2016) conducted a study aiming to scale-up Peer-to-peer learning by in-service teachers for primary and post-primary levels. The shift from traditional chalk and talk instructional methods to an inquiry-based, learner-centered approach integrating hands-on activities was observed due to changes in teaching approaches. After three years of improved teaching skills in the target province, there was a correlation with increased student pass rates on the Grade 12 national exam. For instance, students in the target province scored 12.4 percent higher on the science exam and 19.2 percent higher on the biology exam compared to students in non-target provinces.

Impressed by the effectiveness of Lesson Study, Ministry of Education officials established a Master Plan in 2010 to expand the program throughout Zambia. Though some teachers and head teachers harbor negative attitudes toward continued professional development through the Lesson Study practice, considering it an additional burden, others now recognize the value of ongoing training in their careers. The latter group of teachers has experienced a significant cultural shift in how they view learning as a lifelong process, a noticeable change from their earlier belief that they had learned everything necessary during their time at teachers' college. Additionally, this group of teachers is more likely to possess higher levels of intrinsic motivation to engage in Lesson Study activities, having directly observed the improvement in their students' performance.

Moradi (2023) conducted a study to explore teachers' attitudes towards the impact of lesson planning and its effects on classroom management. The questionnaire comprised two parts, each with six items, and was administered randomly. Data analysis was carried out using Statistical Package for the Social Sciences (version 21) to determine the mean and standard deviation. The findings highlighted the significant role of lesson planning on classroom management, with key points emphasizing the importance of planning skills and preparation for teachers to create successful learning environments and minimize class management issues.

Nkwabi (2020) conducted a study investigating teachers' attitudes towards the impact of lesson planning on classroom management in public pre-schools in Ilemela Mwanza, Tanzania. The

study aimed to examine teachers' lesson preparation and planning practices, implementation of lesson plans in classroom management, and their overall attitudes towards the contribution of lesson planning to classroom management. The Assertive Discipline Approach by Lee Canter in the 1970s guided the study, which employed both qualitative and quantitative data collection and analysis methods. The study revealed that 78.3% of teachers plan and prepare their lessons before teaching, and 8.3% face challenges during plan implementation. Furthermore, 87.0% of teachers believe that lesson planning significantly contributes to effective classroom management in public pre-schools. The study concluded that pre-primary teachers acknowledge the importance of lesson planning in classroom management and recommend additional support for teachers to enhance their knowledge and skills in lesson preparation and implementation. However, during this study, it was revealed that due to lack of some necessary resources for lesson study and professional training for teachers which emphasizes on the importance of lesson study to enhance teaching knowledge, some teachers in the selected schools developed a negative attitude towards the study.

2.4 Factors that could impact sustainability of lesson study in mathematics.

Banda (2014) conducted a study to assess the effectiveness of the Lesson Study practice and identify factors that enhance or hinder its implementation. The study revealed that insufficient finances can hinder the implementation of lesson study activities in teaching Mathematics, making it challenging to sustain lesson study practices. The findings indicated that in the central province, the teaching skills of science teachers improved, and students' pass rates in national examinations increased in science, compared to provinces not implementing the Lesson Study. The survey also pointed out that support from school managers and the allocation of well-trained lesson study facilitators were enhancing factors, while heavy teacher workloads and high pupil-teacher ratios were hindering factors. Banda's study is related to the current study in that it focused on lesson study, but they differ in that the previous study focused on teaching science while the current study evaluates the sustainability of lesson study in teaching mathematics, expecting distinct findings.

Lomibao (2016) investigated the impact of Lesson Study on Bulua National High School mathematics teachers' quality level in terms of SEARS-MT dimensions. A mixed method of research design was employed, revealing that Lesson Study effectively enhanced mathematics

teachers' quality and promoted their professional development. Teachers perceived Lesson Study positively as beneficial for improving their teaching skills.

The study "Sustainability of Lesson Study in Teaching and Learning Mathematics: A Case of Selected Schools in Lusaka District of Zambia" builds on these ideas. In Zambia, teachers of mathematics at secondary school level have been engaged in Lesson Study activities as part of their in-service Continuing Professional Development, initiated by the government. .Lesson Study involves a problem-solving process carried out in real classroom settings, focusing on planning, conducting, and discussing lessons for improvement. The study highlighted that in the central province of Zambia, where Lesson Study was implemented since 2006, science teachers' teaching skills improved, leading to increased student pass rates in science compared to provinces without Lesson Study. Support from school managers and well-trained facilitators were seen as enhancing factors, whereas heavy workloads and high pupil-teacher ratios were hindering factors. Additionally, Baba (2015) analyzed teachers' participation in a lesson study project, emphasizing that quality education should be the ultimate goal for all countries. Lesson study aims to facilitate quality education by encouraging collaboration and autonomy among teachers. It acknowledges that lesson study has limitations as it cannot force collaboration and proactiveness, serving more as a platform for potential development.

Moreover, Mabena et al (2021) explored factors contributing to poor learner performance in Mathematics. The qualitative case study revealed learner-related factors, such as ill-discipline and language barriers, as well as teacher-related factors including a lack of pedagogical knowledge and training. The study provided recommendations for learners, teachers, schools, school management teams, parents, and the national education ministry to improve learner performance in mathematics. Even though all these factors were mentioned by different scholars, there was still need for the study "Sustainability of Lesson Study in Teaching and Learning Mathematics: A Case of Selected Schools in Lusaka District of Zambia"

Tembo et al (2018) also conducted a research which looked at the support mechanisms that the head teachers give to their teachers in the process of carrying out Lesson Study in the schools and their implications on the professional leadership of the school. The study was conducted in randomly selected five (5) primary schools in Central province of Zambia. Data was collected from School In-service Record Book, CPD files, Interviews with School In-Service Coordinators

and it was analyzed then interpreted. SPRINT is the implementation framework of the Continuing Professional Development Policy of the ministry of General Education. The successful implementation of SPRINT activities in the school depends upon the level of guidance and support of the School head teacher. Since 2006, Lesson Study has become the main form of activity implemented in the framework of SPRINT. Its legislative and institutional structure has gotten rooted in the schools. Over the years, it has been observed that as much as the SPRINT system was a policy that must be adhered to, the actual backing of this policy by some education leaders, especially at school level, is weak. This impacts negatively on the teachers and ultimately affecting the quality of Lesson Study practice as a tool for teacher professional growth. The findings revealed that many writings by head teachers were just signatures or superficial comments which showed that there was less commitment and support to teacher professional development. The implication of this finding was that it has the potential to negatively affect the professional growth of the teachers. That is the more reason why the study "Sustainability of Lesson Study in Teaching and Learning Mathematics: A Case of Selected Schools in Lusaka District of Zambia" was needed. It was to find out the extent of sustainability of the study and also the causes of its gradual and the loss of strength in terms of the implementation.

Tukombe et al (2017) conducted a study whose aim was to discuss the milestones and emerging issues surrounding the policy and practices in the Lesson Study voyage over a decade in order to organize important assumptions and implications for future development of the Lesson Study practice as well as other programs related to teachers‟ professional growth especially at school level. Zambia is among the first countries in Africa that adapted Lesson Study as a medium for its teachers‟ Professional Growth in a quest to improve classroom performance. Since its inception, practices have now been conducted for over a decade. A blend riding on an in-country’s indigenous frame known as School Program of In-service for a Term (SPRINT) has emerged in the area of policy and practices among educators and practitioners. The practice has attracted several mission visits from within and outside Africa. At the same time, it has received recognition resulting now in offering Knowledge Co- Creation Training for other African Countries. The findings show that for teachers to grow professionally there was need to grow policy and practices as well, there was need for strong leadership which is able to develop a conducive environment supporting the practices as well as seeing to it that sustained growth

takes place, there tends to be a struggle in learning and unlearning previous ways of seeing practices, also the practice of lesson study contributed to strengthening the SPRINT program which is the main in-service platform for the country, the practice required time to enter the main stream hence it was at conflict with those intervention requiring quick fix of learners passing examination and lastly educators who are involved in this practice were able to train other educators from within and outside the countries. The implication is that the Lesson study practice, though still in infancy stages of sustained practice shows possibilities of being one of intervention that would lead to quality teaching and learning in Africa.

In addition, Morimoto (2016) reported that with the initiative of the government, science teachers at the secondary school level have been conducting Lesson Study activities at school as their In-service Continuing Professional Development activity. This usually includes planning a lesson, conduct of the planned lesson in a class, and discussing the lesson for further improvement. They usually plan a science lesson on a particular topic as a group of science teachers at school and one of the group members conducts the lesson for their students. After the lesson, teachers in the group hold discussions to improve the lesson together with knowledge and skills sharing on teaching science. This shows that teachers of science and mathematics are practicing Lesson Study in their schools. However, the extent of the sustainability of lesson study in the selected schools remains unclear, especially in the District. Therefore, the researcher investigated the sustainability of lesson study in teaching mathematics: a case of selected schools in Lusaka District of Zambia.

2.5. Chapter Summary

This chapter reviewed literature which is related to the current study. It presented a number of issues based on risen themes that emanated from the research questions of the study. The themes of the study such as the concept of Lesson Study, teachers' understanding of lesson study, attitudes of teachers of mathematics towards lesson study activities and factors that impact sustainability of lesson studies in mathematics were the main target that could help find answers to the research questions.

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Overview

This chapter describes the methodology that was utilized in the study which included: research paradigm, research design and approach, study site, target population, sample size, sampling technique, data collection instruments, validity, reliability, trustworthiness, data collection procedure, data analysis and lastly of this section was ethical considerations. These are strategies that ware useful in carrying out the study. The chapter also contains its summary.

3.1 Research Paradigm

There are several research paradigms depending on the research a researcher intends to conduct. A research paradigm "is an assumption a researcher makes about reality, how knowledge is obtained, and the methods of gaining knowledge". It is also defined as an organizing structure, a deeper philosophical position relating to the nature of social phenomena and social structures (Feilzer, 2010). The research paradigm adopted in the study was constructivism. Constructivism holds that "truth and meaning do not exist in some external world" but are created by the subject's interactions with the world. Constructivism suggests that a learner should not be passive but an active participant in the learning process. The paradigm was adopted because the teacher was going to be a facilitator and learners were going to be constructors of their own knowledge. It also applied to teachers during lesson study, where each time they met, they constructed their own knowledge through interactions so as not to be passive but to be active participants in the learning process.

3.2 Research Approach

Research approaches are plans and procedures that guide research from broad assumptions to detailed methods of data collection, analysis, and interpretation. The chosen research approach for this study was qualitative. According to Kombo and Tromp (2006), a qualitative design allows researchers to conduct studies in natural settings and relies on flexible and interactive research strategies. In qualitative research, the focus is on how individuals interpret and

comprehend their experiences and surroundings, allowing exploration of their behavior, perspectives, feelings, and experiences. This exploration can involve questionnaires, interviews, and observations.

3.3 Research design

The research design, according to Kumar (2011), provides a roadmap for researchers to follow when collecting and analyzing data. Designs, as described by Creswell (2009), encompass three key elements: philosophical assumptions, strategies of inquiry, and specific research methods. While these elements are essential, they are not thoroughly examined in this study. Therefore, it is crucial to clearly define how and when data will be collected and analyzed, a task for which the research design is instrumental. Kombo and Tromp (2006) characterized a research design as a detailed plan outlining how a study will be conducted. It is the blueprint for scientific research, guiding every step from inception to conclusion (Achola and Bless 1988). In this study, employing a qualitative method approach, a case study was chosen to delve deeply into teachers who diligently implemented lesson study and to evaluate the sustainability of lesson study in teaching and learning mathematics.

3.4 Study site

The study was conducted at the selected junior secondary Schools of Lusaka district of Zambia. Lusaka was sampled because the researcher resided there and it was easy to conduct a study from as schools were close to each other.

3.5 Target Population

Mugenda and Mugande (1999) define the target population as the members of a real or hypothetical set of people, events, or objects from which the researcher will generalize the results of the study. Kasonde-Ng'andu (2013) defines a population as a group of individuals or objects from which samples are taken for measurement. It is a complete set of elements (persons or objects) that possess common characteristics defined by the sampling criteria established by the researcher. The target population were teachers of mathematics from the selected two Junior

Secondary Schools in Lusaka district of Zambia. I chose this district due to lack of enough resources and other logistics for visiting the schools outside the district.

3.6 Sampling Techniques

According to Kombo and Tromp (2006), sampling is defined as "a process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group." Sampling is that part of the research plan that indicates how cases are to be selected for the study. It is a process a researcher uses to gather people, places, or things to study. In this study, a purposive sampling technique was used to select respondents. Purposive sampling means that respondents are chosen based on their knowledge of the information desired. Participants for this study were chosen based on their knowledge of lesson study and this helped the researcher to come up with the sample size.

3.7 Sample Size

According to Best & Kahn (2009), a sample can be defined as a group or subset of the total population selected for observation and analysis. It consists of a relatively small number of units chosen in a way that they accurately represent the study population and can provide a high probability of reflecting the sampling population being studied (Kumar, 2011). Cohen, Manion & Morrison (2000) point out that the information gathered from a sample representative of the total population under study will be utilized in the research. In this study, the researcher intended to have four teachers of mathematics at each school although six (6) became the sample size instead of eight (8) because one school had only two teachers and the other one had four (4) teachers of mathematics The number reduced from four participants to two at one school because they were just two from that department at that school and most of the schools that I visited had one or no teachers of mathematics but just volunteers. This means that in one school, a lesson study was conducted with all four (4) participants, while the other school had only two (2) participants. The total number of participants that was purposively selected was found to be six (6) for both schools in Lusaka district of Zambia.

3.8.0 Research Instruments

Questionnaires, semi-structured interview guide and lesson observation schedule were utilized as research instruments. The three were employed for the sake of comparing the results as triangulation with various data collection instruments was essential to guarantee the study's validity and reliability. These three tools gathered qualitative data to investigate the study's research questions, each serving specific purposes. As mentioned by Kothari and Garg (2014), that these instruments are employed to prevent data distortion and bias that might have arisen from relying solely on a single instrument.

3.8.1 Questionnaires

Blair and Czaja (2014) assert that if the questionnaire is not well developed, there is a high probability of the researcher collecting inaccurate data. In this study, questionnaires were used as one of the instruments and distributed to all selected participants. The completed questionnaires were collected five days after distribution, allowing participant's time to respond. The choice of questionnaires was based on the need to gather the opinions and views of the respondents. Kumar (2011) defines a questionnaire as a written list of questions that respondent's record. Ghosh (1992: 241) also describes a questionnaire as "a list of questions sent to a number of persons for them to answer." Kombo and Tromp (2006) argue that questionnaires are effective research instruments as they save time and maintain respondents' confidentiality. The questionnaire in this study consisted of open-ended questions. Ghosh (1992) suggests that open-ended questions aid researchers in discovering new facts by allowing respondents to freely express their views and ideas. The questionnaires were included in the appendices.

3.8.2 Interview Guide

The use of interview guides in this study was necessary for collecting qualitative data from participants. Ritchie, Lewis, Nicholls and Ormston (2013) suggested that an interview guide is particularly valuable in qualitative research because it assists researchers in obtaining detailed information crucial for understanding a specific phenomenon. According to Kombo and Tromp (2006), interviews are well-suited for exploring and confirming ideas, providing detailed insights into specific cases of interest. To ensure successful interviews, permission was obtained from the

participants who answered the questionnaires to record the interviews. This study utilized semi-structured interviews and conducted face-to-face interviews on the same day of collecting questionnaires from the teachers, as an effective method for gathering qualitative data. These interviews enabled the researcher to collect specific information and make comparisons with the data obtained from the questionnaires. The main objective of using this guide was to acquire more information on the sustainability of lesson study in teaching and learning mathematics: a case study of selected schools in Lusaka District, Zambia.

3.8.3 Lesson observation schedule

An observation schedule is one of the most important research instruments in a study. It is a more natural way of collecting data, and data collected through observation is more authentic and accurate. This means that the researcher records exactly what happens on the actual day of an activity. An observation is a method in which the researcher takes field notes on the behavior and activities of individuals at the research site (Creswell, 2012). When a lesson study is being conducted at that specific school, the researcher's role is to observe and record its activity. In the study, the researcher intended to focus on the lesson study cycle to observe the interaction patterns in a particular situation. The researcher then collected data using a guide and closely observed the behaviors of teachers and pupils.

3.9.0 Quality assurance

For the researcher to have credibility of the research findings in this study, quality assurance was ensured by emphasizing the aspects of validity, reliability and trustworthiness. This helped the researcher gain the relevance of the research outcomes. In this area, the researcher explained how the study ensured the aspects of validity, reliability and trustworthiness.

3.9.1 Validity

According to Mulenga (2015), validity refers to the extent to which results obtained from data analysis accurately represent the phenomenon being studied. This means that the results obtained in the research study are as expected. Achieving validity requires the use of multiple methods of data collection. Brewer and Patton (1990) explained that combining methods complements each

other by addressing overlapping flaws. Furthermore, through a process known as triangulation, where methods are combined, inconsistencies are addressed, resulting in valid and reliable data (Patton, 1990). The researcher planned to rely on data triangulation, believing that this approach would resolve any inconsistencies. To ensure validity in the study, the researcher distributed questionnaires to the participants, followed by conducting audio-recorded face-to-face interviews with their permission, ensuring that the data considered reflected the actual responses of the participants. The researcher made it certain that the responses used were validated for the findings and conducted follow-up inquiries for clarification on any unclear points. The researcher aimed to compare the findings from the questionnaires, interview guides, and lesson observations to prevent overlooking any relevant aspects of the phenomenon under study.

3.9.2 Reliability

According to Mugenda and Mugenda (1999) reliability is defined as the degree to which a research instrument yields consistent results or data after repeated trials. It is also the accuracy precision of a measurement procedure of research instruments commonly known as reliability (Mugenda & Mugenda, 1999 and Creswell, 2012). It is the quality of being trustworthy or performing consistently. To ensure reliability, the researcher used triangulation through combining data for questionnaires, interviews and lesson observation. Questionnaires were distributed to the participants and interviews were conducted separately to see if the same research results were were going to be yielded and to ensure consistency in the instruments that were used for data collection.

3.9.3.0 Trustworthiness

This is a degree of confidence in data interpretation and the methods used to ensure quality of a research findings. In this research study, the concepts such as credibility, dependability and transferability were used to describe various aspects of trustworthiness (Patton, 1990). Each of these components played a vital role in ensuring trustworthiness.

3.9.3.1 Credibility

Credibility can be obtained by using the same topic but using different methods to see to it if the findings will be the same. Kombo and Tromp (2006) defined credibility as the credence involved in establishing the results of the research findings. To ensure credibility, the researcher distributed the questionnaires then interview to the same participants who answered questionnaires. To achieve this, the researcher used methods of data triangulation. The importance of ensuring credibility could be drawn from the need to establish that the findings of the study were correct. In this regard, the researcher ensured credibility through the use of various methods for data collection.

3.9.3.2 Dependability

Dependability, as outlined by Cohen, Manion and Morrison (2007), is one way of ensuring trustworthiness in a study. Dependability refers to the stability of the findings over time. It is also concerned with whether the same results obtained by the researcher could observe the same results twice. Dependability ensures that the research findings are consistent and could be repeated. This implies that each process to be used can be described in detail so that further research on the same subject can yield similar results. To ensure dependability, the researcher gave a detailed description of a phenomenon. Dependability was achieved by conducting an audit inquiry, necessitated by the qualitative data to be obtained. Carcary (2009) noted that it was necessary to conduct an audit inquiry in a qualitative research so as to ensure that the research methodological and analytical processes were dependable.

3.9.3.3 Transferability

Transferability is the degree to which the results of qualitative research can be transcribed to other contexts with other participants Denzin, N. K. (2005). It is the interpretive equivalent of generalization. It is also defined as the ability to transfer knowledge, skills, qualifications or experiences gained in one context to be applied in another context and this was demonstrated by using a detailed description to show that the study's findings could be applied to other similar contexts, situations or circumstances.

3.10 Data Collection Procedure

When schools were re-opened in the third term of the year 2023 , the researcher visited the sites to make arrangements through the school headteachers who made arrangements with the participants to meet the researcher. Data collection could not start there and then but started in the third week of the term because during the first two weeks, participants were settling down and doing revisions.

The researcher started by distributing the questionnaires to all the participants of both schools and agreed with them when to collect them and interview them on the same day of collecting the questionnaires. Participants from one school with two participants agreed to finish answering the questionnaires after a month because they had a lot of work to do as the term just begun. The other participants agreed to be interviewed after three weeks.

After three weeks, the researcher went to collect the questionnaires and interviewed the participants upon collection of the questionnaires. A lesson observation for the lesson study cycle was scheduled to start three weeks after the interviews were conducted. An observation was done from the first stage of the cycle of the study to the eighth stage.

The researcher went for the other school with two participants and collected questionnaires. The participants were then interviewed and scheduled for a lesson study cycle. They suggested to start the study cycle after a month. Then a study cycle begun with the first stage which is identifying a problem then planned a lesson. Then one participant dropped out as he was a trained teacher but not employed by the state so he decided to be just a volunteer. Remaining participant went to the next stage which was presentation of the lesson and the researcher was an observer as was recording activity. The cycle was not complete due to the one who dropped out. After data collection, the next stage was to conduct analysis.

3.11 Data Analysis

Data analysis involves uncovering underlying structures; extracting important variables, detecting any anomalies and testing any assumptions" (Kombo and Tromp, 2006: 117). Data analysis was done first by familiarization and then by editing, coding and tabulation of data

according to the research questions. Analysis means ordering, categorizing, manipulating and summarizing of data to obtain answers to research questions. The data was obtained through questionnaires, interviews and lesson study observation then analyzed thematically. It was then read through, easily understood, and recorded and then transcribed . Data was manually sorted out, edited and coded. The data was analyzed using coded themes of the research questions to meet the objectives of the study that followed the already adopted design where the data was then later interpreted.

3.12.0 Ethical Considerations

According to Kumar, (2011) the term ethics or ethical are principles of conduct that are considered correct especially those of a given profession or group. An 'ethic' is a moral principle or a code of conduct that serves as a guide to what people do. In a research study, if there are any risks, indicate them. Certain behaviour in research such as causing harm to individuals, breaching confidentiality, using information improperly and introducing bias are regarded as unethical. In this study, ethical clearance was obtained from the ethics committee of the University of Zambia then permission was granted by the District Education board Secretary before going out for data collection in the schools. As a researcher, you must ensure that responses of the respondents must be treated with maximum confidentiality especially if the questions are extremely sensitive as the data will purely be used for academic purposes. In this case the researcher considered safety of the respondents due to health concerns such as matters of confidentiality of the respondents, reciprocity, voluntary participation, as well as informed consent to conduct this study. For this reason, ethical clearance was obtained from the committee of the University of Zambia.

3.12.1 Informed Consent

As earlier alluded to under ethical consideration, ethics must be considered to be very important. So permission was sought from Lusaka District Education Board Secretary(DEBS) in order for the researcher to freely interact with any selected participant in the selected schools. The permission informed the participants what the study was all about and their benefits. It was communication between the researcher and the participants who decided freely on their own whether to participate in the study or not. During this stage, participants were informed that they

were free to withdraw from the study whenever they wanted to do so. For the questionnaires, participants were given ample time approximately five days to fill them in and leave them with the head teacher for the researcher to find them for collection.

3.12.2 Confidentiality

Respondents were told not to write their names and schools on the questionnaires. In any research study, the researcher is charged with the duty of ensuring that the privacy of research participants is guaranteed and upheld (Patton, 1990). In this study, the researcher ensured that participants did not write their names and that of their schools on the research instrument to guarantee them of the confidentiality. Therefore, every response concerning the study was treated with a high level of confidentiality and only used for academic purposes although the researcher had to introduce him/ herself to the participants.

3.12.3 Voluntary Participation

After the informed consent, the researcher informed participants of the study that the study was voluntary. According to Gakuu Kidombo and Keiyoro (2016), voluntary participation entails that it is the subject's choice to be or not to be part of a study. Appendix 1 gives details on the informed consent.

3.12.4 Reciprocity

Some researchers are tempted to compensate participants which should not be the case. The issue of whether or not to compensate research participants in cash or kind as a way of reciprocity is controversial because compensation can affect the level and quality of data (Creswell, 2009, Patton, 1990). Reciprocity refers to the relationship between the researcher and the research participants in which the participants are expected to devote some time and effort towards contributing to the research study. For this study, the researcher ensured that no compensation in any way was given to the participants in order to avoid an unauthentic research data.

3.13 Chapter summary

In summary of this chapter, the researcher employed constructivism as a research paradigm. The paradigm holds that "truth and meaning do not exist in some external world" but are created by the subject's interactions with the world. It also suggests that a learner should not be passive but an active participant in the learning process. The chapter also contains a qualitative research approach, the research design characterized as a detailed plan outlining how a study was conducted, target population which looked at the population as a group of individuals or objects from which samples are taken for measurement, sampling techniques, sample size which was defined as a group of the total population selected for observation and analysis. Sample size is further defined as a relatively small number of units chosen in a way that they accurately represent the study population and can provide a high probability of reflecting the sampling population being studied (Kumar, 2011). Chapter three also mainly focused on research instruments such as questionnaires, semi-structured interviews and lesson observation that were utilized to collect data. Data collection procedure, data analysis and ethical issues were also part of chapter three. After identifying the methodology to be used, the next chapter will present the findings or results of the study.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.0 Overview

The previous chapter outlined the methodology used to generate the research findings that were presented in this chapter. These findings are based on the data collected through the instruments such as questionnaires, interviews and lesson study observations. Data was gathered by administering questionnaires to teachers of mathematics, conducting interviews with the same teachers and observing lesson study although at one school there was an incomplete lesson study. Themes emerged from the collected data through the instruments that were administered. Data analysis, however, was specifically guided by the information that provided answers to the following research questions:

1. What do teachers understand by the term lesson study?
2. What attitudes could teachers of mathematics have towards lesson study activities?
3. What factors could impact the sustainability of lesson study in teaching and learning mathematics?

4.1 Demographics of Participants

This is a brief background information about the respondents who participated in the research for data analysis purposes. The participants were teachers of mathematics from the selected Junior Secondary schools. In the study, four teachers were sampled from one school and two teachers from the other school, making a total of six (6) participants. The initial plan was to have eight participants in total, but this was not possible because one of the schools had only two teachers of mathematics. Firstly, questionnaires were administered to all the six teachers and they were given ample time to answer them. Semi- structured interviews followed. The two participants from the other school responded to the questionnaires and interviews although they did not complete the entire lesson study cycle. They started it and reached the second stage, which was observed. The reason for not completing the cycle was that one teacher, was a volunteer at that school and he decided to resign when they were both supposed to demonstrate a lesson. The

lesson study was then observed at the first school that had four (4) teachers. The four participants responded to the questionnaires, interviews, and also conducted lesson study. The table below shows a summary representation of the percentage distribution of participants by gender.

Gender	Frequency	Percentage (%)
Male	4	67
Female	2	33
Total	6	100

Table 4.1 shows a summary representation of the percentage distribution of teachers by gender

The table above shows 67 % of male participants which represents four (4) teachers and 33% of females representing two (2) female teachers. In total, they were six (6) teachers who participated in the study which represented 100%.

In the presentation of the findings, only the relevant responses from the questionnaires, interviews and lesson study observations were included. These responses were selected based on the data that was collected and the emerging themes that included teachers' understanding of lesson study, teachers' attitudes towards practicing lesson study, the causes of these attitudes, factors to overcome these attitudes, factors that support teachers' participation in lesson study, factors that sustain lesson study in teaching mathematics, challenges of conducting lesson study in teaching mathematics, factors that have prevented the practice of lesson study in some schools, benefits of implementing lesson study, and factors that impact the sustainability of lesson study in teaching and learning Mathematics in response to the study questions.

4.2.0 Teachers' understanding about the concept of lesson study

The first research question was to investigate teachers' understanding about the concept of lesson study. This is because it is widely believed that the successful implementation of any policy or initiative depends on the implementers' level of understanding. In order to establish teachers' understanding about lesson study, questionnaires were distributed to the participants who

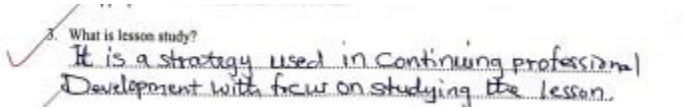
answered them, then interviews were conducted after a month and lastly lesson study was conducted by the teachers and the researcher observed the study.

4.2.1 Teachers' understanding about lesson study

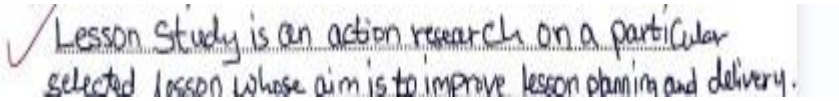
When participants responded to the questionnaires about their understanding about the lesson study, some participants described it as a collaborative approach to professional development in education. It was also explained in the interviews that lesson study brings professionals together to discuss and plan a lesson that should be taught by a volunteer teacher in the normal class of learners while colleagues observe the lesson. For instance, the research results showed that **T1** as the fist participant to be interviewed understood about lesson study and confidently said that:

> *Lesson study is a process that typically involves planning, teaching, observation and reflection.*

According to the definition, it shows that **T1** understood about the lesson study as it is defined as the process that involves the stages such as collaboratively identifying a problem, planning a lesson, teaching, discussing and vise-versa. So the participant defined the study which is simply the definition of the lesson study.**T1** further explained that Lesson study is a strategy used in Continuing Professional Development (CPDs) with focus on studying the lesson. The response was recorded as shown below although all the responses are shown in the appendices **(appendix 5**):


3. What is lesson study?
It is a strategy used in Continuing professional Development with focus on studying the lesson.

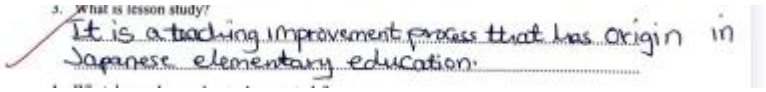
Another participant**(T2)** added that:


Lesson Study is an action research on a particular selected lesson whose aim is to improve lesson planning and delivery.

> *The above response was recorded as Lesson study is an action research on a particular selected lesson whose aim is to improve lesson planning and delivery. However, the ultimate is teacher professional growth.*

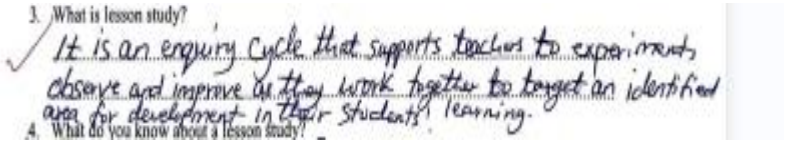
A third participant **(T3)** also indicated that:

> *Lesson study is a teaching improvement process that has origin in Japanese elementary education. It is an inquiry cycle that supports teachers to experiment, observe and improve lessons.*
>
> This response was recorded as shown below:

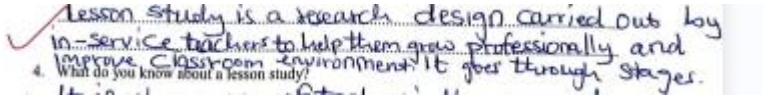


Another participant (T**4)** was recorded and said that:

> *Lesson study is an inquiry cycle that supports teachers to experiment, observe and improve as they work together to target an identified area for development in their students' learning. Lesson study usually follows a plan or process of activities conducted by and educators.*
>
> This was a response by participant number 4 and it was recorded against question one below as:



Another participant(**T5)** added as shown that:



> *Lesson study is a research design carried out by in-service teachers to help them grow professionally and improve classroom environment. Lesson study goes through stages.*

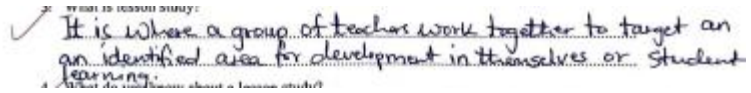
T5 added although was not sure that:

Lesson study is where a group of teachers in the same department or teaching the same subject carry out an eight stages lesson research to improve classroom lesson delivery and teacher growth

It was further revealed by **T6** that:

Lesson study is where a group of teachers work together to target an identified area for development in themselves or student learning. In other words, Lesson study is where teachers get together, work together, identify a problem and then solve it.

This response was recorded from the response below:



However, comparing the information and responses that were given by the participants (**T1, 2,3,4,5 and 6**), we may conclude that they were all confident to define the lesson study although not everyone was able to define it correctly.This was also demonstrated during the study itself and revealed that many teachers understand and know what lesson study is all about. It indicates that they are aware of lesson study and what is involved in it. The study reveals that many teachers have much information about the study because almost everyone defined it study except a few.

4.3.0 Attitudes which teachers of mathematics could have towards lesson study activities

The second research question was establishing teachers' attitudes towards lesson study. In order to establish the attitudes that teachers could have towards lesson study activities, participants responded through the questionnaires and interviews that were conducted by the interviewer who is a researcher in this case. They were asked to state their view or views and how they felt about the implementation of lesson study. The study revealed that teachers had both negative and positive attitudes. The following were some of the responses as shown in the appendices.

The first response came from the **Head of Section (HoS)**, who is also a teacher of mathematics, he was asked in an interview to state the attitudes that teachers of Mathematics could have towards practicing lesson study. As the immediate supervisor and organizer of lesson study, the HOS provided the following response:

> *There are both positive and negative attitudes. The positive part is that some teachers appreciate its existence and practice. The negative part is that others feel it delays their syllabus coverage and others feel it is tiresome. It is also donor imposed* (**HoS-T1)**.

According to the response given by the head of section who was T**1** at one school**,** it was explained that during the organization of lesson study as a supervisor,the study revealed that there are both positive and negative attitudes which teachers of mathematics could have towards lesson study cycle.

Another participant **(T2)** added that:

> *For me, I think it's time consuming, it is very expensive and not really beneficial in Zambian setting* **.**

A third participant **(T3*)*** indicated that:

> *I have welcomed the study although some colleagues find it hard to finish the cycle. So it's discouraging sometimes when only few teachers have adequate knowledge of the study.*

Another participant(**T4)** said that:

> *With me, lesson study is a welcome approach of improving teaching and learning. When teaching and learning improves, the performance of learners improves too.*

T5 added that:

> *I feel good about lesson study activities because it is problem solving in nature. It also helps in terms of improving teaching methods. Like for me, I have been in service for 20 years and the teaching methods we learnt in our time, keep on changing. So, through lesson study we get to learn new ways of teaching mathematics.*

T6 further indicated that:

> *For me, I would say I have a positive attitude, but there are some teachers who take it as a shire waste of time and some have a positive attitude towards it. Some feel they have no challenges in their teaching and see no reason to collaborate*

In summary on the attitudes that teachers of mathematics could have towards the study activities, it was revealed that there are both positive and negative attitudes which teachers have towards practicing lesson study. Those participants who welcomed the study are the ones who have positive attitudes towards lesson study. The study further revealed that teachers have positive attitudes such as it improves teaching and learning, it is problem solving in nature, it also helps in terms of improving teaching methods and through lesson study teachers learn new ways of teaching mathematics. These are the same participants who appreciated the existence of the study and its practice as shown in the appendices. However, on the negative attitudes, it was revealed by some teachers who did not welcome lesson study that the study just delays their coverage of the syllabus, it is tiresome to conduct it, it is time consuming, to some teachers it is a shire waste of time, some feel they have no challenges in their teaching and see no reason to collaborate, it is very expensive and it was also revealed that lesson study is not really beneficial in Zambian setting and only few teachers have adequate knowledge of the study.

4.3.1 Causes of the negative attitudes which teachers could have towards lesson study activities

When attitudes which teachers could have towards lesson study activities were revealed, the focus became on the causes of negative attitudes that teachers had towards lesson study. Participants were asked about the causes of the attitudes towards lesson study activities and each participant responded as follows:

For example, **T1** said that:

> *Inferiority complex from teachers, Low levels of pedagogical content knowledge, time and workload constraints, overall culture and climate within schools.*

Another participant (**T2**) added that:

> *Inadequate understanding of lesson study, poor introduction of lesson study in schools, persistent poor performance among learners and laziness by teachers.*

A third participant(**T3)** indicated that:

> *Lack of knowledge on the study by the teachers and the process takes a lot of time.*

Another participant (**T4)** said that:

> *Some teachers do not like joining in collaborative lesson preparation or open classroom workshops.*

Another participant (**T5)** added that:

> *There is lack of proper structure for lesson study, poor support from management, lack of motivation to those teachers who show seriousness and most teachers do not appreciate benefits of lesson study.*

It was further mentioned by **T6** that:

> *Some teachers feel that there should be an incentive attached to it, some feel that it should be concluded within the working hours and lack of support from the supervisors or administrators.*

In conclusion on the causes of the negative attitudes teachers have towards lesson study, the study revealed that teachers needed to be given incentives of which they are not given for them to be motivated to take part in the study. It was also revealed that schools lack proper infrastructure as venue for lesson study and teachers lack support from the management as a results they avoid lesson study. Lack of knowledge about lesson study by some teachers is one of the causes of the negative attitudes they have towards the study. The study also revealed that some teachers do not like joining in collaborative lesson preparation or open classroom workshops.

4.3.2 Factors which could be used to overcome teachers' attitudes towards lesson study activities

When participants were interviewed on how to overcome the attitudes which teachers have towards the lesson study activity, each participant responded as follows:

For example, **T1** said that:

> *Peer support and collaboration, can help teachers manage and overcome their attitudes they have towards lesson study activities.*

Another participant ***(*T2*)*** added that:

> *The government should make it a policy that all teachers must do lesson study, practice it in the correct way and must re-introduce it in an efficient and effective way.*

A third participant ***(*T3*)*** indicated that:

The ministry should provide information on the lesson study to the teachers of mathematics.

Another participant (**T4)** said that:

Teachers must be educated on the importance of the lesson study through workshops.

Another participant added (**T5)** that:

Serious structure for lesson study such as timetabling has to be available, improved support from school management system and certification of award giving to outstanding performance teachers.

The last participant **(T6)** indicated that:

The ministry must sensitize teachers on the importance of lesson study for them to realize where they are not performing well.

Upon knowing the causes of the negative attitudes some teachers have towards lesson study activities, some factors to overcome them were revealed. It was revealed that support from the management, peer support and collaboration can help teachers manage and overcome their negative attitudes they have towards lesson study. The ministry should also provide continuous information about lesson study and also make a policy that all teachers must practice the study in a correct way. The government through the ministry of education should provide incentives to motivate teachers to conduct lesson study without fail. It was revealed that the incentives are not given to them.

After identifying the reasons behind teachers' attitudes towards lesson study, a follow-up question was posed to determine whether they supported the idea of continuing lesson study in schools. Each participant was asked whether they believed lesson study should continue to be conducted in schools, and here are their responses:

Yes, it is a good idea to continue conducting lesson study to enhance teacher confidence, to have reflective practice, increased student engagement and enhance pedagogical skills (**T1).**

Yes, lesson study should be reinvigorated (revamped) for improved quality of teachers in lesson planning and delivery (**T2).**

Lesson study should continue because we share ideas and work out the lesson together at the end of the day the lesson becomes every bodies lesson (T**3**).

Lesson study ensures that teachers have skills for enhancing active learning resulting in learners who can think critically, actively and analytically to it is important that it becomes an ongoing activity **(T4).**

As for me, I feel lesson study should continue being conducted because teachers graduate from different institutions with different approaches. Teachers have to continue developing each other as iron sharpens iron (**T5).**

*It is a very good move in the sense that as teachers we help each other to improve in areas we may not have been well. Learners have good content from a teacher with adequate content so it has to continue (***T6).**

To conclude on whether lesson study should be continued in schools or not, some participants said that it should be continued as the majority of the participants like the idea. This means that to them lesson study has benefits as one of the participants said that the study enhances teacher confidence, reflective practice, increased student engagement and enhance pedagogical skills. Therefore, it should be revamped to improve quality of teachers in lesson planning and delivery and this can only be managed by teachers sharing ideas and work out the lesson together. Some teachers said that the study should not continue as it delays the syllabus. Lastly, lesson study ensures that teachers have skills for enhancing active learning resulting in learners who can think critically, actively and analytically.

4.4.0 Factors which could impact sustainability of lesson study

The third research question was about investigating the factors that could impact sustainability of lesson study. One of the factors that could impact the sustainability of lesson study is teacher collaboration. Teachers have to work together to plan,observe and reflect on lessons and if they are not collaborating effectively, the sustainability of lesson study may be compromised and declined. There is need for teachers to collaborate and engage in lesson study just like some participants mentioned that they felt the need to engage in lesson study due to the poor performance of learners. Others emphasized the significance of consistency in teaching Mathematics as a factor that influences the sustainability of lesson study. One participant expressed uncertainty and stated that they had no idea. Different responses were recorded depending on each of the following sub-headings.

4.4.1 Availability of Materials for lesson study activities

It was found that the availability of resources such as time and materials can have both positive and negative impacts on sustainability of lesson study in teaching and learning mathematics. If teachers do no have access to these resources, it may be difficult for the study to be sustained and be implemented. Participants clearly stated the specific materials required for a successful lesson study cycle. For instance,

T2 said that:

> *As teachers, we need Stationary Lesson study guide, curriculum, and observation tools for collecting data and furniture to conduct lesson study*.

Other participants added that materials needed to conduct lesson study effectively include:

> *Lesson plan, teaching aids technology tools, Markers, Manilla papers, text books and other materials as the topic may require* (**T3**).
>
> *Lesson plans, teaching aids and text books* (**T4**).

Flip charts or Manilla papers, markers, pens, text books, syllabus, laptops, projector and lunch (T**5**).

T6 further mentioned that factors which impact sustainability of lesson study include:

Availability of lesson study materials and teachers' positive attitude towards pedagogical change.

T1 added that:

Access to resources matters a lot. Also, access to professional/learning communities, research and evidence determines the sustainability of lesson studies. For example, if you have access to teaching resources, it is much easier to conduct effective lesson studies.

From the responses given by the participants, it can be concluded that there are key factors that could impact the sustainability of lesson study in teaching and learning mathematics. As already mentioned, the availability of resources such as time, materials and professional development opportunities can positively impact the study's sustainability in teaching and learning mathematics in schools. The other key factors that could be impact the sustainability of lesson study can also be stationary, lesson study guide, curriculum, observation tools for collecting data, Lesson plan, teaching aids, technology tools, Markers, Manila papers, text books and other materials as the topic may require, flip charts, markers, pens, syllabus, laptops, projector, lunch and teachers' positive attitude towards pedagogical change. Another factor that could impact sustainability of lesson study is the support from school administrators, school and district leaders, incentives, resources needed by teachers to engage in the study on a regular basis and there is also need for commitment and collaboration of educators within the school. This enables educators to be willing to work together, share ideas and reflect on the teaching practice. Lastly, teachers need to be equipped with necessary knowledge and skills to effectively plan through professional development opportunities and training.

4.4.2 Provision of materials required to conduct lesson study.

Conducting lesson study in teaching and learning mathematics in schools requires a variety of materials for its effectiveness. These materials were mentioned under the availability of materials **(4.4.1**) and the provision of lesson study materials to the teachers is another important factor because it promotes an ongoing effective study that enhances teacher collaboration which also enhances student learning outcomes in mathematics. During lesson study cycle, teachers rely on these materials and it became evident as the participants shared details about how they obtained their materials when conducting the study. When they were asked about the availability of materials and how they obtained them, their responses are as follows:

> *The school provides the materials and sometimes it's just teachers' resourcefulness* (**T1**).
>
> *The School provides (***T2**).
>
> *The institution, teachers and an organization like Japan International Corporation Agency provides materials* (**T4**).

Another participant added that materials were provided by:

> *The school and individual members themselves create their own lesson study materials* (**T5**).

Another one indicated that:

> *Japan International Cooperation Agency (JICA) is one of the organizations which provides materials like Markers, Manila papers, text books and other materials which we normally use for lesson study* (**T6**).

From the responses given by the participants, the resources that are required to conduct lesson study can be obtained from different sources and participants mentioned some of them and how they obtain them. They revealed that materials can be given by the school and the organizations through the ministry of education.

Organizations often provide free or low cost resources for teachers. Teachers have to collaborate with colleagues to know and obtain lesson study materials in teaching and learning mathematics. By working together with colleagues, teacher share ideas on how and where to collect the materials from for conducting lesson study. So obtaining materials for a lesson study, can be done through a variety of methods, including reaching out to educational organizations.

4.4.3 Benefits of Lesson study in teaching and learning mathematics

Lesson study is beneficial to both teachers and students in that it promotes teacher collaboration and professional growth through sharing ideas. Participants indicated that the perceived benefits of lesson study are among the factors that positively impact and sustain lesson study activities. When asked about the benefits for teachers who implement lesson study in mathematics, each participant provided the following responses:

T1 said that:

> *Research based teaching sir deepens content and pedagogical knowledge which leads to improved instructional practices.*

T1 further explained that:

> *On the side of pupils, due to lesson studies, there is improved learning outcomes, confidence, self-efficacy and enhanced problem solving skills.*

T1 further said that:

> *Learners tend to concentrate more when there are a number of teachers during a lesson. This is because during the implementation of lesson study, teachers enhance their teaching skills, within or among themselves without being away from class, the practice happens in the real class so it is more effective and teachers tend to look forward to more lesson studies*

Another participant added that:

> *Not only does lesson study lead to enhanced teaching materials, but also enhanced capacity to plan and deliver lessons and improved learning outcomes. In return Pass rate and conceptual understanding for learners improve* (**T2**).

A third participant indicated that:

> *The collaboration normally imparts knowledge to the teachers. It also provides a platform to correct wrong methods. Apart from that, teachers tend to understand that lesson study is about helping a learner improve in performance. There is also strong togetherness among teachers due to lesson studies (***T3***).*

Another participant said that:

> *It produces positive results of teachers' teaching skill. It also improves learners' performance in the National Examination. Pass rate changes learners behaviour and attitude* (**T4**).

T4 further stated that:

> *Learners become active in lesson participation and performance. Seeing other teachers come to their classes to observe them encourages learners to be active and participate in class activities*

Another participant added that:

> *Teachers get to share information on topics, pupils' attitudes and preparation of summative assessments. Teachers work in harmony with common schemes of work and lesson plans. Teachers also tend to take ownership of the challenges in teaching mathematics* (**T5**).

The other participant indicated that lesson study:

*Helps teachers to improve where they may be facing challenges. Learners benefit as teachers will have gained more knowledge through lesson study. Learners pass rate improve lesson study is in full force (***T6***).*

Lesson study is a professional development strategy that has gained popularity worldwide in recent years. It is a strategy that has helped educators to improve teaching practices and student performance. In every lesson study, teachers collaborate with their peer to identify a problem, plan, observe a lesson and analyse it in order to make improvements as participants mentioned above. Most of educators further explained that lesson study helps them to improve where they face challenges. Lesson study has *is* improved learning outcomes, confidence, self-efficacy and enhanced problem solving skills, learners also benefit as teachers will have gained more knowledge and learners pass rate improve. The other benefit of lesson study is that teachers get to share information on topics, pupils' attitudes and preparation of summative assessments. Teachers work in harmony with common schemes of work and lesson plans. Teachers also tend to take ownership of the challenges in teaching mathematics. So the responses given by some participants are a sign that most teachers understand lesson study and what is involved in it.

4.4.4 Appropriate implementation of Lesson study activities

Implementation of lesson study by teachers in teaching and learning mathematics involves a number of things such as choosing a team of teachers to foster collaborative learning environment and reflecting on the lesson study process to enehance teachers' professional practice and improve student learning outcomes in mathematics. It was found that implementing lesson study effectively can have a significant impact on sustainability, particularly when lesson study cycles are completed. When asked about their completion of the lesson study cycles, the following were their responses:

We do complete the cycle. And generally, a lesson study cycle in mathematics involves planning, pre-lesson discussion, lesson implementation, post lesson discussion, analysis or reflection and revision and iteration ***(T1).***

In a Lesson study cycle, there is collaborative identification of a problem, lesson planning, one teaches, discusses, re-teach and compile conclusion. There is a lot, so we rarely complete the cycle. Each teacher is very busy trying to finish the syllabus, making it very difficult to finish the cycle ***(T3).***

We don't complete the cycle because we don't have enough time and materials to complete the lesson study cycle **(T4).**

Sometimes it is completed especially in mathematics. Many times lesson study cycle is not completed due to lack of time or not properly planned by teachers (**T5**).

Sometimes it not completed because the process is quiet hectic hence teachers falling off in the process. However, a well-structured schedule of activities such as what should be done, a time tabled lesson study cycle activities with known day and time, a good support system from supervisors such as head teachers and deputy head teachers and a sense of togetherness and cooperation among colleagues and administration can lead to a successful implementation of a lesson study cycle **(T6).**

Practicing lesson study in a correct way is one factor which impact the sustainability of lesson study effectively. Teacher creativeness and innovativeness is also vital. But above all, Policy consistency is key. Some education policies may not be consistent, hence affecting the implementation of lesson studies (**T2).**

Although most teachers understand the lesson study and its benefits, some do not complete the lesson study cycle. Those who complete the cycle explained that practising the study in a correct way is one of the factors which impact the sustainability of lesson study effectively. It was revealed that teachers do complete the cycle and generally, a lesson study cycle in mathematics involves planning, pre-lesson discussion, lesson implementation, post lesson discussion, analysis or reflection and revision and iteration. However, those who never completed the study gave their

own reasons and it revealed that some education policies may not be consistent, hence affecting the implementation of lesson study. Each teacher is very busy trying to finish the syllabus, making it very difficult to finish the cycle. It was also stated that teachers do not have enough time and materials to help them complete the lesson study cycle.

4.4.5 Time constraints

Challenges faced during lesson study generally have a negative impact on its sustainability. Participants often mention time constraints as a crucial factor that hinders the implementation of lesson study. Here are some of the responses given regarding this issue:

> *Time constraints is one of the factors affecting the lesson study cycle (***T1).**
>
> *Time to gather and plan collaboratively is not enough, and some environments are hard to conduct lesson study in a large class* (**T2**).
>
> *Some challenges are lack of time, lack of institutional support and insufficient instructional materials (***T3***).*
>
> *Time is not enough to complete the cycle, lack of knowledge on lesson study and the stages of the lesson study are too many (***T6).**

In conclusion, it was revealed that time is also a factor that affects the lesson study cycle if it is not well handled. It affects the study because time for teachers to gather and plan collaboratively is not enough. This reveals that time is very important and is also a necessity in conducting lesson study.

4.4.6 Attitudes

Attitudes were found to be factors that impacted the sustainability of lesson study. The study observed both positive and negative attitudes. It was revealed that sustainability depended on attitudes. For example, one participant stated that:

> *Mostly, our motivation to implement lesson study as teachers depends on the knowledge of its benefits or future. For example effective*

implementation must lead to capacity building, collaboration and peer support (**T1**).

Poor attitude from the teachers, lack of coordinated action plans and weak supervision determines the implementation of lesson study (**T4**).

The idea that there is no certification or immediate external reward, makes some teachers develop negative attitudes because they feel like it is a shire waste of time (**T5**)

*Negative attitude by some teachers not wanting to see the need to continue learning **(T6)***

Through participants**'(T1,2,3,4,5 &6**) responses, it can be concluded that there are both positive and negative attitudes teachers have. Positive attitudes came from those participants who said that lesson study is a good and welcome approach that helps teachers to understand and know how to handle difficult topics before they face pupils. The idea that there are no certificates or rewards given to the teachers, enables them to develop negative attitudes because they feel it is a waste of time to practice lesson study without any incentive. In conclusion, both positive and negative attitudes depend on the knowledge teachers have towards conducting lesson study.

4.4.7 Lack of support

A participant **(T3)** revealed that there is a lack of ownership of the practice, high teaching workloads, and a lack of administrative support. Consequently, it is difficult to successfully implement lesson study practice.

4.4.8 Mitigation of lesson study challenges

It was found that, among other factors, mitigation of pedagogical challenges can have a positive impact on the sustainability of lesson study. Here are some of the responses given by the participants:

We need to involve ourselves in Peer teaching so that we can address the instructional challenges. Sometimes even just sharing information on challenging or new topics, new trends such as Information Communication Technology in mathematics, Examinations Council of Zambia marking trends, poor performance at National Examinations in mathematics and sciences and poor support system to teachers of mathematics in schools. This can help (**T4**)

For us to overcome learners' poor performance during examinations, we need to share ideas on challenging topics and need to avail each other with new teaching techniques (**T5**)

As a group, there is need to create enough time required to complete all the stages of the lesson study and motivate some teachers to be willing to cooperate with fellow teachers. **(T2).**

There is need for the ministry through school managers to be strictly about implementation of the lesson study, ensuring that things are done in a right way **(T4).**

We need experts to explain the concept of lesson study clearly because many times lesson study is not properly explained especially what it is to be achieved. So implementers of lesson study feel forced or threatened to do it, no perceived benefits to teachers who feel they don't need it and poor support system **(T5).**

The negative attitudes teachers have towards lesson study leads to poor performance in delivering a lesson by a teacher in class. The attitudes also lead to poor performance of pupils because some teachers do not have knowledge to deliver certain lessons due to lack of practising lesson study. To overcome the poor performance, it was revealed that teachers need to share ideas on the challenging topics through the study.

4.5.0 lesson study observation

Lesson study cycles were planned and observed for both schools. The first school conducted the study and went up to the third stage because one participant resigned as he was just a volunteer in that department at that school.The teachers planned a lesson on the topic Mensuration and its sub-topic was total surface area. The lesson was demonstrated. However, the teacher did not have a fellow participant to observe the lesson because he resigned before the lesson was demonstrated but the researcher observed the lesson and the class activities were recorded.

The second school conducted a study as they planned and completed all the stages although with some challenges. The researcher collected data for the second school by observing every activity of the lesson study as shown in the appendix. The stages included problem identification, planning, lesson demonstration, reflection on the lesson, re-planning, re-teaching, and finally, the final reflection and file conclusion.Questionnaires were initially distributed to the participants to collect data. Subsequently, interviews were conducted, during which participants responded and their answers were transcribed. This was done for the second school, which had four (4) teachers. The lesson observation guide had two columns: the first column was for stages and the second one for comments. The stages as shown in the appendix included Problem identification, Planning, Teaching aid preparation, Lesson demonstration, Reflection on the lesson, Re-planning, Re-teaching, and, finally, the final reflection and file conclusion.

4.5.1 Problem identification and Planning of the lesson

The researcher observed that the identification of the problem, which was social and commercial arithmetic with its sub-topic being compound interest, was done collaboratively. However, some teachers arrived late and joined the group after the lesson study activity had already started. Initially, one teacher arrived and started waiting for the colleagues who arrived later. This occurred on the first day of the meeting when the problem was identified. On that same day, after the teachers collaboratively identified the problem, they planned the lesson in preparation for teaching as shown in the **appendices.**

4.5.2 Lesson demonstration and reflection of the lesson

This was the second stage of the lesson study cycle. The lesson was demonstrated in one of the classes, with some colleagues initially absent from observing a lesson. The demonstration took place on the same day with the reflection. All teachers who observed the lesson took part in the reflection.

4.5.3 Re-planning of the lesson

Based on the lesson that was demonstrated and the performance of the learners, the lesson was re-planned using the same topic that was taught in the first stage. This was the 6th stage of the study cycle although some teachers at this stage had a negative attitude towards it by some not coming on time and others who observed the first lesson not attending the study stage of the cycle. The sample of the lesson plan is attached in the **appendix 11)**.

4.5.4 Re-demonstration of the lesson.

The planned lesson was re-demonstrated on a different day by the same teacher in the same in a different class. This was a 7th stage of the study cycle.

4.5.5 Final reflection and compiling of the discussion

Final reflection and compilation of the discussion took place on a different day. On this day, teachers reflected on the re-taught lesson and concluded by compiling the notes, although some teachers were not present.

4.6 Chapter summary

This chapter presented the findings of the study. It focused on the responses which were given by the participants on the themes that emerged from the research instruments such as on the concept lesson study, the attitudes teachers have towards the activities of lesson study, causes of the negative attitudes that teachers of mathematics could have towards conducting lesson study, factors that were used to overcome teachers' attitudes towards lesson study, factors that impact sustainability of lesson studies, and availability of materials for lesson study activities. The chapter also included the provision of materials required to conduct lesson study, benefits of

lesson study, time constraints and lack of support. It was revealed that most teachers understood lesson study as a collaborative process used to identify pedagogical problems and find solutions.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Overview

This chapter discusses the findings which were presented in chapter four. It is an important chapter of the dissertation because it brings out the findings of the study based on the research objectives and questions, the theoretical framework or conceptual framework and on the existing review of related literature presented in chapter two. Hofstee (2006) also said discussion of the findings is an important part of the dissertation which brings the findings to reality by giving reference to the existing knowledge. The findings will be presented in accordance to the research objectives, research questions and the themes which emerged from the research questions.

Research question 1

What do teachers understand by the term lesson study?

5.1 Teachers' understanding about lesson study

The first objective was about determining teachers' comprehension of lesson study. One participant elucidated that lesson study is a process encompassing planning, teaching, observation, and reflection. This discovery aligns with Shuilleabhain's (2015) definition, which asserts that lesson study involves a systematic inquiry into teaching and learning, where teachers collaborate to plan, examine, conduct, observe, and reflect on research lessons. Lesson study does not aim to create a "perfect" mathematics lesson or analyse lessons in detail rather it seeks to foster discussions among teachers regarding their pedagogical practices.

Another participant added that lesson study involves action research, implying that a component of the lesson study stage includes research to identify the existing issue. All the responses to the **research question one** by the participants reveal that teachers or participants have a deep understanding of lesson study because they were able to define and explain about it when it was asked in the questionnaire as well as when they were interviewed. This means that almost everyone is aware of the study, what it means and the stages involved in the lesson study cycle. The participants know that lesson study is a teacher-led initiative for improving instruction, focusing on enhancing students' learning by iteratively refining instructional strategies. It is crucial for teachers of mathematics to participate in the study if they do not have a

comprehensive understanding of lesson study which enables them to recognize its advantages and implement it effectively as a policy requires. Understanding the key components like research lesson, lesson planing, lesson observation and reflection of lesson study is essential for successful implementation (Stigler, J.W.,& Hiebert, J.,1999). We must remember that implementing a policy without a thorough understanding of it is arduous, if not nearly impossible. Nonetheless, this study revealed that most teachers grasp the essence of lesson study.

Research question 2

What attitudes could teachers of mathematics have towards lesson study?

5.2.0 Attitudes which teachers of mathematics could have towards lesson study activities

To determine these attitudes, teachers were asked in an interview to express their views and feelings towards the implementation of lesson study. In mathematics education, teachers' attitudes towards lesson study have indicated a mix of positive and constructive perceptions. For example, this study discovered that few teachers appreciate lesson study due to its collaborative nature, which allows them to share insights and refine their instructional practices. This was supported by Baba and Nakai (2015) who stated that when teachers acknowledge improvements in their skills through lesson study, their willingness and proactiveness towards lesson study increase. Attitudes may differ based on the factors such as school culture, individual teaching styles, and prior experiences with professional development and the study revealed that for some teachers, it was found that they may initially resist lesson study because of time constraints or concerns about being observed. Many teachers feel practicing lesson study delays their syllabus coverage and they also find it tiresome. These factors make it difficult for a lesson study cycle to be conducted and completed in the school.

If there are several positive teachers of mathematics in the school, teamwork and positive attitudes among the faculty members are enhanced, leading to a positive impact on the entire faculty. In this case it was revealed that it is the other way round. Many negative teachers in the school have negative attitudes towards practicing lesson study and do not like team work because it just delays their covering of the syllabus. For a lesson study to be successfully conducted, there is need for many teachers to be positive minded and have positive attitudes towards the study. Fernandez (2003) argues that lesson study is a process that facilitates the exchange of ideas and

pedagogical strategies, contributing to professional growth. However, some teachers may initially find the concept of collaborative lesson planning and observation challenging, as it involves sharing instructional practices and receiving feedback. So mainly negative attitude has made successful implementation of lesson study to fail in the schools.

The study revealed that some teachers have welcomed the lesson study initiative but face challenges because some colleagues struggle to complete the cycle due to a lack of adequate knowledge about the study. Thus, it is disheartening when some group members lack sufficient knowledge about lesson study, as it is a collaborative initiative that cannot be carried out by one person. This is supported by a study conducted by Lomibao (2016), who investigated the impact of Lesson Study on Bulua National High School teachers of mathematics. The analysis of results showed that Lesson Study significantly enhanced mathematics teachers' quality and promoted teachers' professional growth. Teachers viewed Lesson Study positively as it helped them become better teachers of mathematics, indicating that positive attitudes are dependent on perceived benefits.

5.2.1 Causes of the attitude which teachers of mathematics could have towards lesson study activities

Teachers of Mathematics play a vital role in shaping students' attitudes towards teaching mathematics. Teachers' attitudes towards lesson study in teaching and learning mathematics can either impact the outcome of learning positively or negatively and attitudes are caused by some factors. When participants were interviewed about the causes of teachers' negative attitudes towards lesson study activities, the responses indicate that some teachers have low levels of pedagogical content knowledge and some avoid lesson study activities due to the fear of appearing incompetent.

Some teachers also have inadequate understanding of lesson study, poor introduction of lesson study in schools and persistently poor learner performance towards lesson study. This is one of the primary causes of the teachers' negative attitudes towards lesson study.

The other cause of the negative attitude of teachers towards the study is that many teachers are not given incentives. Incentives play a role in motivating teachers to participate in lesson study

as an approach that involves collaborative problem identification, lesson planning, presentation, observation and reflection among educators. The incentives include financial rewards, leadership opportunities and career advancement opportunities. By providing teachers with the necessary incentives and support , lesson study can continue to be implemented in teaching and learning mathematics.

Time constraints is also one of the causes of negative attitudes teachers have towards lesson study. Teachers often face time challenges in their daily teaching responsibilities which makes it challenging for them to participate in lesson study activities and this affects the coverage of the curriculum (Fernandez, C.,Cannon,J., & Chokoshi,S., 2003).

The study also revealed that lack of resources is a factor when teachers of mathematics want to participate in lesson study activity. A lack of resources, such as funding, time, or access to professional development opportunities, can hinder teachers participation and implementation of lesson study.

In conclusion, on the causes of the negative attitudes that teachers of mathematics have towards lesson study in teaching and learning mathematics, there are a variety of factors that influence the study including lack of awareness, time constraints, lack support, fear of judgement, lack of motivation, resistance to change, lack of resources and many more. If these issues are addressed, they will assist in promoting positive attitudes of teachers of Mathematics towards teaching and learning of mathematics and they will prevent the study from declining but will enhance teachers' professional development and student outcome learning outcomes in mathematics education.

5.2.2 Factors which could be used to overcome teachers' negative attitudes towards lesson study activities

There are various factors that can help teachers overcome their negative attitudes towards lesson study in teaching and learning mathematics. The study revealed that peer support is one of the factors. Also collaboration as teachers, assistance from management for effective time management and provision of incentives and recognition can be beneficial.

Providing peer support and training is important for teachers to feel and have confidence with engaging in lesson study. This can be achieved through offering professional development opportunities, resources and also guidance on how to effectively conduct lesson study in teaching and learning mathematics. For example, Continuing Professional Development (CPD) and other workshops can help teachers of mathematics to enhance knowledge and develop skills for them to engage in lesson study activities effectively.

Then teacher collaboration is another factor that could help teachers of mathematics to overcome their negative attitudes towards lesson study in teaching and learning mathematics. Teacher collaboration is key to overcoming teachers' negative attitudes towards the study. By sharing ideas with colleagues can help foster a positive attitude towards lesson study. It is the teachers themselves that should see the value of lesson study because it improves their teaching practices.

The other factor that helps teachers to overcome the negative attitudes towards the study is the promotion of teacher teamwork. Teachers must be encouraged to work together for the betterment of their professional growth and support from each other in the continuous lesson study process.

Involving teachers in the decision- making process is very important because it gives them the ownership of the lesson study which helps them overcome the negative attitudes. By Allowing teachers to interact with colleagues and have a say in the lesson study stages, it encourages teachers of mathematics to have a sense of ownership in the study which increases a continuous participation in the study.

The Ministry of education should continuously provide information on lesson study to teachers of mathematics to educate them on its importance through training as it helps teachers implement appropriate teaching methods and techniques. Apart from implementing appropriate teaching methods and techniques, every teacher must be taught how to use learner centered approach which many think it's not easy to use when there are many students in a class. Learners should be encouraged to develop their unique strategies for problem-solving, a goal that can be achieved through lesson study implementation by teachers. A structured approach to lesson study, including scheduling on a termly or yearly basis at every school, improved support from school management systems, and certification or awards for outstanding teachers, must be in place.

It was suggested that lesson study should be revitalized to enhance the quality of teachers in lesson planning and delivery. Some participants mentioned that lesson study should continue because it fosters idea-sharing among teachers and collaborative lesson preparation. The activity ensures that teachers possess the skills to promote active learning, resulting in students who can think critically, actively, and analytically, making it an essential ongoing practice.

There are numerous reasons why teachers advocate for the continuation of lesson study. According to Kihwele (2023), studies have highlighted the role of lesson study in advancing teachers' continuous professional development. Lesson study promotes collaboration and self-reflection among participating teachers, allowing them to experiment with pedagogical innovations. Evidence shows that lesson study deepens teachers' understanding of the subject matter, boosts their confidence, and improves classroom teaching practices.

In conclusion on the factors, the negative attitudes of teachers towards lesson study can be indeed a barrier to its effective implementation. However, many factors that can help overcome such negative attitudes have already been mentioned. Factors such as the provision of adequate support and resources to motivate teachers so that they don’t resist lesson study. By providing teachers with necessary support, time and materials, they will develop a positive experience with lesson study. Other factors are inculcating positive school culture, effective communication, offering continuous professional learning opportunities, imposing peer participation and observation, giving out certificates and incentives and many more. Through these factors, teaching skills will be improved and ultimately enhance student learning outcomes.

Research question 3

What factors could impact sustainability of lesson study in teaching and learning mathematics?

5.3.0 Factors which could impact sustainability of lesson study

The third research objective aimed to determine the factors that could impact the sustainability of lesson study. The study revealed that the availability of materials for lesson study activities, provision of materials required for conducting lesson study, perceived benefits of lesson study, appropriate implementation of lesson study activities, as well as attitudes, time constraints, and lack of support are some of the factors that could impact the sustainability of the lesson study initiative in teaching and learning mathematics.

5.3.1 Availability of Materials for lesson study activities

It was found that the availability of materials can impact sustainability either negatively or positively. Participants indicated the materials needed for lesson study activities, which include: Lesson study guide, school curriculum, observation tools for collecting data, lesson plan, flip charts or Manila papers, markers, pens, textbooks, syllabus, laptops, and projector. The study further revealed that the availability of lesson study materials and teachers' positive attitude towards pedagogical change are key factors that determine the effectiveness of lesson study activities.

Teachers' access to resources was also highlighted as significantly important as access to professional/learning communities, research, and evidence determines the sustainability of lesson studies. For example, if one has access to teaching resources, it is much easier to conduct effective lesson study. Kihwele (2023) conducted a study, and the findings revealed that the availability of learning materials influenced pre-service teachers in sustaining lesson study practices. These materials have always been provided although not all of them and every time lesson study is being conducted. So the ones that are not provided make the lesson study fail to take place and some teachers develop a negative attitude towards the study. In other words, some of the causes of the negative attitudes that teachers have towards lesson study and its slowly dying in some schools is due to lack of necessary materials.

The study revealed that teachers need to have a solid understanding of the lesson study for them to conduct it effectively. Understanding of lesson study helps teachers to fully conduct the study in order for them to develop a positive attitude towards the study in teaching and learning mathematics.

5.3.2 Provision of materials which are required to conduct lesson study.

Providing of necessary materials for a successful lesson study at the right is very important. The questions are who provides these materials and if the materials are not provided, what happens? When participants were interviewed and during the questionnaire session, it was revealed that the provision of lesson study materials is another factor that impacts the sustainability of lesson study. Participants explained how they sourced their materials, stating that the school and individual teachers provided the lesson study materials although not all of them could be sourced which is a challenge. Other participants mentioned that some organization like Japan

International Cooperation Agency (JICA) provided some materials through the Ministry of Education, such as writing markers, manila papers, textbooks, laptop and other materials commonly used for lesson study. These materials are crucial due to the nature of lesson study. This means that without the necessary materials mentioned, it is difficult and challenging to conduct lesson study and therefore the study is likely to decline due to lack of sponsors because not all resources can be provided. Hunter and Back (2011) highlight that lesson study involves a group of teachers collaboratively planning a lesson known as the 'study lesson' over a series of meetings. One of the teachers in the group then teaches this lesson, which is video-recorded or observed by the entire team, focusing especially on student responses. The video- recorded camera is one of the materials that is necessary and should be provided to make the study successful. It also makes work easy and boosts teachers' positive attitude towards the study.

5.3.3 Perceived Benefits of Lesson study

Lesson study has many benefits and participants indicated that the perceived benefits of lesson study are some of the factors that may positively impact the sustainability of lesson study activities in teaching and learning mathematics. When participants were asked about the benefits of implementing lesson study in teaching and learning mathematics, they revealed that Lesson Study approach as a form of Continuing Professional Development (CPD), has proved to be a beneficial model for in-service teachers. This approach allows for the simultaneous development of teachers' and managers' capacities, ultimately enhancing the quality of teaching and learning mathematics.

Lesson study is not just beneficial to the teachers but also to the students through the teachers who practice the study. Through implementing lesson study in teaching and learning mathematics, there are improved learning outcomes, confidence, self-efficacy, and enhanced problem-solving skills for students. The study does not only enhance teaching materials but also improves teachers' capacity to plan and deliver lessons, resulting in better learning outcomes. As a result, pass rates and learners' conceptual understanding improve.

Collaboration among teachers leads to knowledge-sharing and provides a platform for correcting ineffective methods. Teachers understand that lesson study aims to help students improve their performance, fostering unity among teachers. Additional perceived benefits include improved teaching skills and enhanced learner performance in National Examinations. Hunter and Back

(2011) found in their study that collegiality and reflection are among the perceived benefits reported by teachers from various groups. The study provides opportunities for teachers to collaborate, enhancing their understanding of the topic, teaching methods, and students' learning processes. Collaborative work allows teachers to exchange information on topics, students' attitudes, and the preparation of assessments. Teachers work together using common schemes of work and lesson plans, taking ownership of challenges in teaching mathematics. Lesson study helps teachers address areas where they face difficulties, ultimately benefiting learners who experience improved pass rates when lesson study is fully integrated.

As Matoba (2007) suggests, lesson study promotes collaborative research on classroom activities, facilitating the exchange of experiences between teachers, collaborative planning, participatory learning, improved professional dialogue, and teachers' reflection. Active learner participation and performance are encouraged, as teachers observe each other's classes, motivating students to engage actively in class activities. Learners demonstrate increased focus when multiple teachers are present during lessons. Lesson study enhances teachers' skills through real classroom practice as one teacher presents a collaborative lesson while others observes.

5.3.4 Appropriate implementation of Lesson study activities

It was found that the appropriate implementation of lesson study can significantly impact sustainability of lesson study in teaching and learning Mathematics, especially when lesson study cycles are completed. Teachers usually struggle to complete the study cycle in teaching and learning mathematics due to various reasons.

However, to assess if lesson study cycles were implemented correctly, the researcher inquired about the completion of the cycles. Upon asking if the cycles were finished, some participants disclosed that they had not completed the cycle due to time constraints and lack of necessary materials. Lack of time has been making it a challenge for teachers to dedicate enough time and effort to participate in lesson study and complete the cycle effectively. To maintain higher quality in the implementation of lesson study by teachers in schools leads to improved performance by students and this can only be possible if teachers can have sufficient time for lesson study as observation by Imhoff (2016) indicated a positive correlation between the pass rate of examinations and the quality level of lesson study implementation.

Enhancing factors for the quality implementation of lesson study, such as providing trained facilitators and upgrading the study environment, should be considered to enhance the practice of the lesson study. On the other hand, hindering factors identified in the research, like heavy workloads for teachers and high pupil-teacher ratios, could serve as topics for discussion in management boards to enhance teachers' lesson study activities and students' learning.

Some teachers never complete a cycle because they lack necessary support and resources to engage in lesson study cycle. The support should be a guidance, training and access to necessary materials. Without guidance, training and access to necessary materials,teachers feel unprepared and they end up not successfully complete lesson study cycle.

According to Lewis,C., Perry, R., & Hurd, J. (2009), another barrier to completing the lesson study cycle is that teachers may feel overwhelmed by the complexity of the lesson study process, which involves multiple stages such as planning, implementing, observing and reflecting on lessons. The detailed lesson study can be hectic for some educators especially those who lack experience with collaborative enquiry practices.

Furthermore, some participants stated that they consistently complete the cycle, outlining the different stages involved in a mathematics lesson study cycle. Others mentioned that they only occasionally complete the cycle, attributing this to factors such as time constraints and curriculum pressures. Kihwele (2023) observed that lesson study is essential for teachers' professional development, with some countries emphasizing its implementation for pre-service teachers. Despite its benefits, lesson study faces various constraints in implementation, which may hinder expected learning outcomes.

To ensure proper implementation and completion of lesson study, teachers should establish a well-structured activity schedule, including a timetable for the cycle's activities, support from supervisors, and a spirit of collaboration among colleagues and administrators. Matoba (2007) argued that participatory lesson study workshops should start with identifying and sharing problems encountered during daily lessons. Implementing lesson study correctly is crucial for its sustainable impact, with teacher creativity and policy consistency being key elements as inconsistencies in educational policies can impede the successful implementation of lesson study.

5.3.5 Time Constraints

Ono and Ferreira (2010) embracing lesson study practices offers a sustainable opportunity for teachers to continue with the professional development through collegial collaboration. However, every educational initiative tend to face some challenges even when there are perceived benefits. However, it was found that challenges faced during the implementation of lesson study in teaching and learning mathematics normally impact the sustainability of lesson study negatively. Among other challenging factors, participants mentioned time constraints as one of the factors which impact the sustainability of lesson study activity, resistance to change and limited resources. Participants explained that there is no enough time to gather, plan, impliment and collaboratively discuss the lesson outcomes, and some environments are hard to conduct lesson study in a large class. Others said that lack of time affects the implementation of lesson study in teaching and learning mathematics.

5.3.6 Attitudes that teachers of Mathematics could have towards lesson study

It was revealed that the idea that there is no certification or immediate external reward, teachers feel it is a sheer waste of time. Negative attitude by some teachers not wanting to see the need to continue learning affects the effective implementation of lesson study in teaching and learning mathematics. Continuation of learning by teachers through lesson study is very important as the study enhances professional growth. Negative attitude can only be changed into positive through training such as lesson study and continuing professional development(CPD).

The mindset changes gradually, the feeling and sense of responsibility increases in the support of School-Based CPD." It can be deduced that new programs always tend to be received with mixed feelings. In the long run, when the majority have seen the benefit of the lesson study, everyone gets to accept the study and begin to continuously participate in it. Furthermore, Kihwele (2023) said that the participants reported that the teachers who were implementing lesson study for the first time found that it was not as smooth as planned. After two rounds of implementation, the second round showed more promising signs of sprouting critical learning. Pre-service teachers took time to grasp the lesson study approach's real meaning and central purpose toward teacher professional development. The findings showed that despite teachers'

low participation in teaching that results from seclusion behavior, they gradually accommodated the collaborative nature of lesson study.

5.3.7 Lack of support

The study revealed that lack of administrative support and knowledge of lesson study is another factor that impacted the sustainability of lesson study for the study to fully conducted and implemented, there is need for the support from the school leaders. The support needed is for them to organize for workshops and training where they will facilitate and briefly explain about lesson study so that teachers are reminded of the benefits of the study and how it is implemented. School leaders also ensures that necessary resources are available before the study begins. However, this perspective contradicts what has been observed by some scholars. Some scholars have reported that support for lesson study is readily available. For example, Tukombe, Banda, and Nakai (2017) reported that the implication of lesson study practice, although still in the early stages of sustained practice, shows possibilities of being an intervention that could lead to quality teaching and learning in Africa. This is because the structure to support teacher professional growth is available and operational. On the other hand, lesson study practice is gaining momentum and is now improving pedagogical content knowledge in lesson practices. In an effort to sustain the practice, the Master Plan for Strategic Expansion of School-Based Continuing Professional Development (2010 – 2023) has transitioned to the Master Plan for Enhancing Teacher Professional Growth through SBCPD (2010 – 2030). This shift aligns with the move from a quantitative perspective to a qualitative perspective where the focus is on enhancing teacher professional growth.

5.3.8 Mitigation of lesson study challenges

From the challenges that were revealed during the study,one of them is time constraints. This is one of the challenges/ factors that has hindered the sustainability of lesson study in teaching and learning mathematics. It was further emphasized that creating enough time to complete all stages of lesson study, motivating teachers to cooperate with one another, and having school managers ensure adherence to correct practices are important. Additionally, teachers need clear explanations of the concept of lesson study to understand what is to be achieved. However, the study revealed that some teachers often have challenges to collaborate and conduct lesson study

cycle effectively. To address these challenges, every school must mandatory allocate time for lesson study during the school time and it should not interrupt the learning process.

The other challenge mentioned during the study was the hesitance of teachers to change. It was revealed that some participants were unable to be adaptive to new practices with colleagues. To address this challenge, school leaders should be facilitating in the study in order to promote the benefits of lesson study. By promoting the benefits, it will encourage teachers to embrace lesson study as a very important professional development.

The study revealed that there was also lack of resources such as access to materials,technology and other professional development opportunities. Teachers may need an ongoing access to materials in order to effectively conduct lesson study and complete its cycle. To overcome the challenge, the government and other organizations through the schools can be providing an ongoing funding for the materials and other resources. Additionally, schools can be partnering with higher institutions to hold workshops and training sessions with them about how to effectively practice lesson study.

Sustainability of lesson study is another challenge itself. Many schools may struggle and fail to maintain long-term engagement and commitment to the process. It is important for schools to introduce structures that support the ongoing practice of lesson study. Apart from this, schools can provide ongoing training and support for lesson study leaders who should incorporate lesson study into professional development initiatives. If sustainability is prioritized, lesson study will not decline but it will be an ongoing study.

It is important for teachers to understand the benefits of lesson study, as indicated by Stutchbury, Gallastegi, and Woodward (2019), who argued that lesson study is designed to support the pedagogic change required to implement the new curriculum. Lesson study aims to encourage teachers to explore possibilities within their own classrooms, develop practices that challenge and support learners, and cultivate new attitudes in line with the revised school curriculum and practices within their context.

Kihwele (2023) further highlighted that lesson study offers a platform for internalizing pedagogical skills through collaboration and teamwork. It provides constructive feedback to

teachers for self-reflection and improvement. Through this approach, teachers develop essential skills such as project-based learning, new technologies, collaboration, innovative pedagogy, social networking, critical thinking, and integrating social artifacts in the learning process. For teachers unwilling to participate, administrators should provide necessary materials for conducting lesson studies. Schools may consider organizing incentives like drinks and snacks to motivate teacher participation in lesson study cycles.

Findings established that mitigating pedagogical challenges can positively impact the sustainability of lesson study. This indicates the need for a collective or individual effort to overcome perceived lesson study challenges. To improve the situation, they needed to engage in peer teaching to address instructional challenges. Sometimes, just sharing information on challenging or new topics, such as Information Communication Technology in mathematics, can be beneficial.

5.4 Lesson study observation guide for the first school

The lesson study cycles were carried out in two schools, where the researcher observed and recorded the activities involved in the lesson study separately.

The lesson study cycle was planned for the first school, which had two teachers of mathematics. The researcher collected data by observing only the first, second stages and third stages of the lesson study cycle, as shown in the appendices. The written lesson plan is also in the **appendix 11** as lesson plan A. The teachers developed a lesson plan on the topic of Mensuration, focusing on the sub-topic of Total Surface Area and the lesson was demonstrated. However, the lesson could not be discussed because one teacher resigned, as he was only a volunteer at that school. It is essential for the lesson study cycle to involve at least two teachers for it to be effectively conducted as William. C & Bryan. K, (2006) explained that lesson study teams usually consist of 3 to 4 instructors from the same discipline although there could be interdisciplinary teams. Lewis, C.C et al (2016) added that the minimum number of teachers needed to conduct lesson study is three. This finding supports some of the interview results where participants mentioned that lesson study cycles often remain incomplete due to lack of enough teachers in the school. This underscores the importance of consistent participation from colleagues in lesson study.

5.5 Lesson study observation guide for the second school

As observed in the study of the first school, the second stage involved problem identification, where teachers identified a problem. This step is crucial in the lesson study cycle as it sets the tone for how effective the teaching process will be. According to Imhoff (2016), a group of teachers gather to identify and discuss a problem or challenge related to a specific lesson, teaching technique, or classroom issue that will serve as the focus of the Lesson Study for the month. The results of the study indicated that the problem identification was done collaboratively, although some teachers joined the group late and others completely missed the event, which could impact the sustainability of the lesson study negatively due to lack of punctuality.

In the lesson study cycle, lesson planning is essential. Moradi (2019) emphasized the importance of lesson planning for several reasons. Planning the lesson helps organize the teaching and learning process for both teachers and students. The lesson planning stage was the second step in the lesson study cycle and the written lesson plan the topic 'social and commercial arithmetic' is shown on the **appendix 12** for the school as lesson plan B. After the lesson was planned, it was demonstrated in a class when some participants were not there to observe. The demonstration was followed by immediate reflection by all teachers. During reflection, teachers analyzed the lesson and made suggestions for improvement. The lesson was then re-planned based on the feedback, marking the sixth stage of the lesson study cycle. This phase indicates progress in the teaching and learning process. However, it was observed that not much focus was given to teaching approaches during reflections, indicating a more formal approach to the lesson study cycle rather than delving into the details of each stage.

In re-planning the lesson, teachers should consider different approaches tailored to individual learners' needs. According to Moradi (2019), activities should vary based on the learners' age and level, with young learners benefiting more from games, songs, and physical activities, while adult learners may prefer discussions and presentations. Subsequently, the re-planned lesson was taught on a different day with the presence of colleagues and pupils, providing an opportunity for further evaluation and improvement.

In the final stage of the lesson study cycle, reflections and suggestions from previous steps are compiled and recorded for reference and reporting purposes. Teachers reflect on the re-taught lesson and compile notes, which serve as a basis for a periodic report. In this study, the reflection

and documentation were completed on a separate day. However, some teachers were not present during the reflection leading to potential delays in the process which may also lead to in-completing the cycle.When colleagues are absent, there is a negative attitude that is usually there and it makes serious teachers to start feeling lazy to participate like it was observed. The study was even rescheduled to another date when everyone was present. This delayed the completion of the cycle.

In conclusion, combining the results from the two schools, the study indicated that from the first stage to the last stage of the lesson study cycle, some teachers joined the group late and others could be absent from the study, which could impact the sustainability of the lesson study negatively due to lack of punctuality and absenteeism respectively. In the study, it was revealed that some teachers used to be absent at every stage of the cycle leading to potential delays in the process which may also lead to in-completing the cycle. At one of the schools, a lesson could not even be discussed after the demonstration because one teacher resigned as he was just a volunteer at that school. It is essential for the lesson study cycle to involve at least two teachers for it to be effectively conducted. This finding supports some of the interview results where participants mentioned that lesson study cycles often remain incomplete due to lack of many teachers in the school.

5.6 Chapter summary

This chapter has discussed the findings as presented in chapter four. It was discussed that teachers understood the concept of lesson study. Teachers of mathematics collaborate to conduct lesson study. The chapter also discussed the attitudes teachers have towards lesson activities, causes of the attitudes and factors to overcome teachers' attitudes towards lesson study activities. Both negative and positives attitudes were mentioned. It was discovered that with negative attitudes of teachers towards lesson study, it is a waste of time while others had a positive outlook towards it. Some believed they faced no challenges in their teaching and thus saw no need to collaborate with other teachers through lesson study. However, it was discussed that lesson study is beneficial and not a waste of time. The study revealed that the availability of materials for lesson study activities, provision of materials required for conducting lesson study, perceived benefits of lesson study, appropriate implementation of lesson study activities, as well as attitudes, time

constraints, and lack of support are some of the factors that influence the sustainability of the lesson study initiative. Based on the findings, suggestions have been made on how lesson study could be improved and sustained to improve lesson planning and delivery. It was suggested that government should be giving incentives to teachers for them to be motivated to be participating in lesson study. The next chapter will now give the conclusions and recommendations based on this study.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.0 Conclusion

Chapter four was presented and the research findings were later discussed in chapter five to ensure that research questions raised in the first chapter are addressed. This chapter looks at the conclusion and recommendation of the study based on the presentation and the findings that were discussed in chapter four and five to help investigate the sustainability of lesson study in teaching and learning mathematics in the schools of Zambia.

6.1 Teachers' understanding about lesson study

Concerning the first objective which is to investigate teachers' understanding of lesson study, it was found that some teachers did not fully understand the concept of lesson study. However, those teachers who understood about the study, viewed lesson study as a process that involves planning, teaching, observation, and reflection and this view is inline with the meaning of lesson study which is the systematic inquiry into teaching and learning, where teachers collaboratively plan, conduct, observe, and reflect on research lessons. Lesson study cycle involves eight stages and these are collaborative problem identification, planning, demonstration, discussion, re-planning, re-demonstration, discussion and filing the conclusion of the study cycle.

6.2 Attitudes which teachers of mathematics could have towards lesson study activities.

The second objective was on attitudes which teachers of mathematics could have towards participating in lesson study. The reason for the objective was to establish the attitudes which teachers of mathematics could have towards lesson study activities. The study noted both positive and negative attitudes towards problem identification and lesson planning until the last stage of the lesson study cycle. Some participants found lesson study to be time-consuming and hectic, leading to negative attitudes. Others welcomed lesson study as a means to improve teaching practices leading to positive attitudes. To them lesson study has helped them to improve results of the pupils due to the fact that their teaching was professionally improved. The negative attitudes were found to have factors that impacted sustainability of lesson study.

6.3 Factors that could impact sustainability of lesson study in mathematics

To identify factors that impact the sustainability of lesson study in mathematics was the third objective. Regarding this objective, the study identified factors like the availability of materials for lesson study activities, provision of necessary resources, perceived benefits, appropriate implementation, as well as attitudes, time constraints, and lack of support, which all influence the sustainability of the lesson study initiative.

6.4 Recommendations

Based on the research findings, discussions and conclusions drawn in this study, the following recommendations are proposed:

- The government, through the Ministry of Education, should continue providing incentives to teachers in order to encourage them to be participating in a lesson study, along with awarding certification at the end of each term upon completion of the lesson study cycle.
- School leaders must ensure that Lesson study must continuously be part of the school program.
- The school management should ensure that the lesson study be ongoing by first explaining the benefits of it for the sake of teacher professional growth.
- The Ministry of Education must ensure that necessary materials must continuously be provided and distributed into schools in order to have an ongoing lesson study in schools.
- Lesson study should be enhanced by providing materials and support from the administration and sponsors to improve the quality of teachers in lesson planning and delivery.
- The government should emphasize on making lesson study implementation mandatory for teachers in both private and public schools to benefit learners.
- The government should employ at least two teachers of mathematics at every school for them to conduct and complete the lesson study cycle as three is the recommended number.

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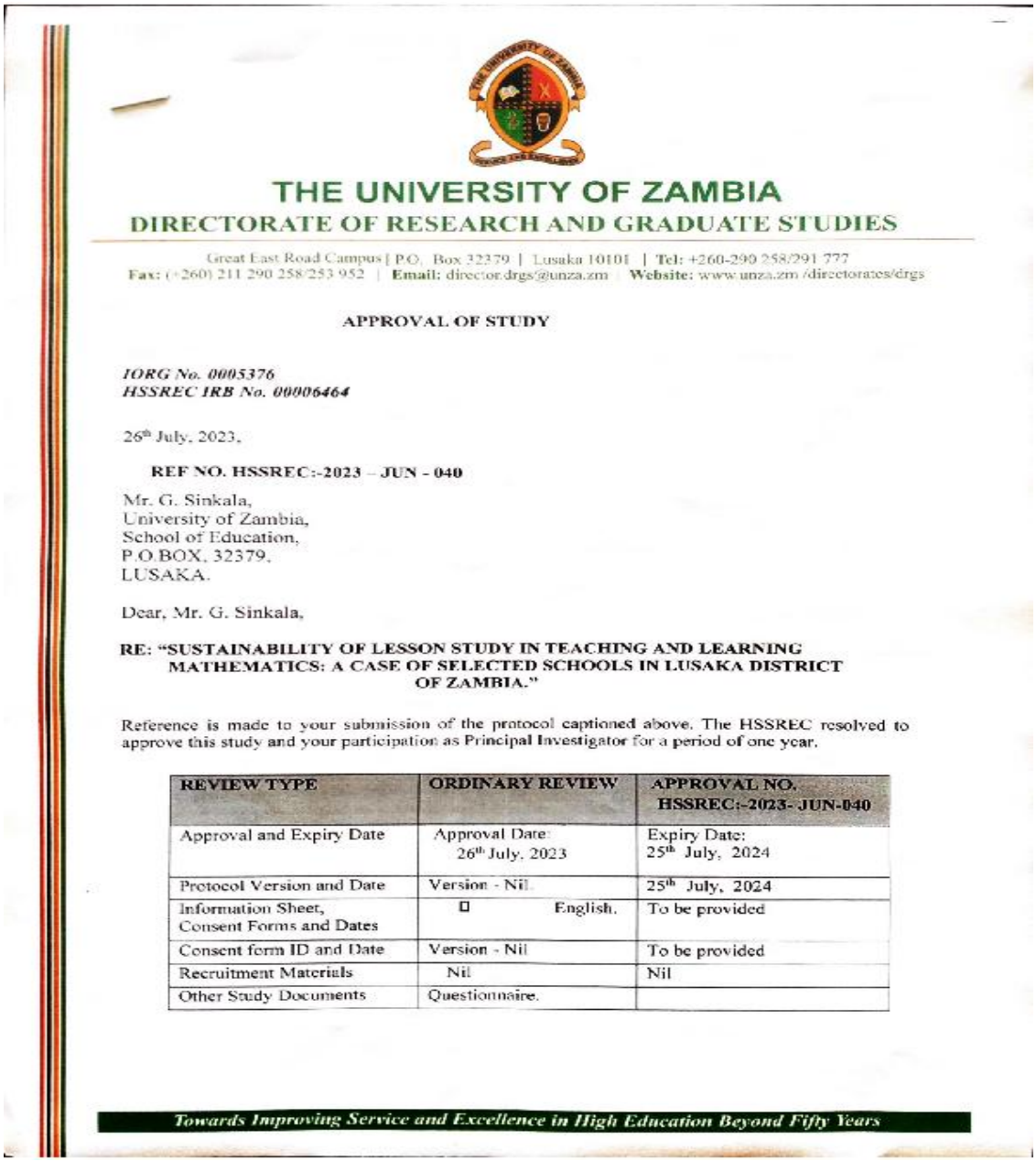
APPENDIX 1

Approval of Study



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DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

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APPROVAL OF STUDY

IORG No. 0005376
HSSREC IRB No. 00006464

26th July, 2023.

REF NO. HSSREC:-2023 – JUN - 040

Mr. G. Sinkala,
University of Zambia,
School of Education,
P.O.BOX, 32379,
LUSAKA.

Dear, Mr. G. Sinkala,

RE: "SUSTAINABILITY OF LESSON STUDY IN TEACHING AND LEARNING MATHEMATICS: A CASE OF SELECTED SCHOOLS IN LUSAKA DISTRICT OF ZAMBIA."

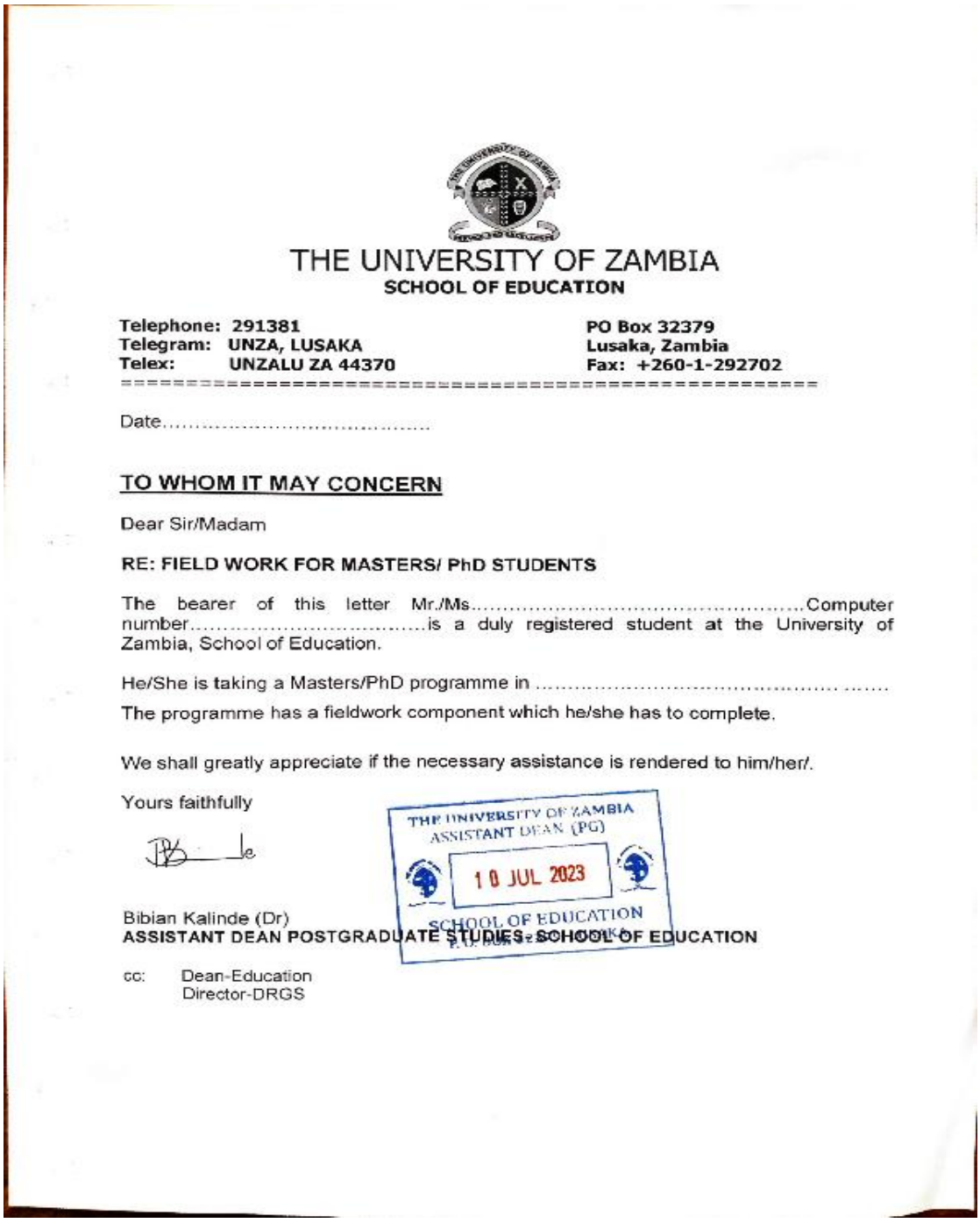
Reference is made to your submission of the protocol captioned above. The HSSREC resolved to approve this study and your participation as Principal Investigator for a period of one year.

REVIEW TYPE	ORDINARY REVIEW	APPROVAL NO. HSSREC:-2023- JUN-040
Approval and Expiry Date	Approval Date: 26th July, 2023	Expiry Date: 25th July, 2024
Protocol Version and Date	Version - Nil	25th July, 2024
Information Sheet, Consent Forms and Dates	☐ English.	To be provided
Consent form ID and Date	Version - Nil	To be provided
Recruitment Materials	Nil	Nil
Other Study Documents	Questionnaire.	

Towards Improving Service and Excellence in High Education Beyond Fifty Years

APPENDIX 2

Field Work



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Date.....

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: FIELD WORK FOR MASTERS/ PhD STUDENTS

The bearer of this letter Mr./Ms.....Computer number.....is a duly registered student at the University of Zambia, School of Education.

He/She is taking a Masters/PhD programme in .....

The programme has a fieldwork component which he/she has to complete.

We shall greatly appreciate if the necessary assistance is rendered to him/her/.

Yours faithfully

THE UNIVERSITY OF ZAMBIA
ASSISTANT DEAN (PG)
10 JUL 2023
SCHOOL OF EDUCATION

Bibian Kalinde (Dr)
ASSISTANT DEAN POSTGRADUATE STUDIES, SCHOOL OF EDUCATION

cc: Dean-Education
Director-DRGS

APPENDIX 3

Informed Consent

Dear participant,

This serves to inform you about the purpose of this study and what will be followed in the process of conducting this research. You will be requested to sign this form to indicate that you have willingly volunteered to participate in this exercise. Please, kindly respond as truthful as possible to the items in the instrument by a tick (√) or a brief explanation in the spaces provided. The information you will give will be treated with the utmost confidential and will only be used for the sole purpose of this particular study.

1. Description of the study: This is a purely academic education research where all respondents will not be identified in person for their participation. The researcher is a University of Zambia student pursuing a Master of Education in Mathematics Education.

2. Purpose: To investigate about the sustainability of Lesson study in the context of teaching and learning Mathematics in selected schools in Lusaka District of Zambia.

3. Consent: Participation in this study is voluntary.

4. Confidentiality: Every information that will be collected in this study shall be treated with a high level of confidentiality. Names or identity of participants in this study shall not be revealed to anyone. In a case where the conversation is recorded, the information will be kept under key and lock and shall be destroyed after data has been analyzed.

5. Rights of participants: The rights of every participant shall be respected and protected and the researcher will ensure that no respondent shall suffer any harm as a result of their participation in this study.

6. Declaration of consent by the participant: I have clearly read and understood every detail of this document and I therefore willingly and freely agree to participate in this study.

Signature: …….

APPENDIX 4

Unswered Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

(i) Do not indicate your name on any part of the questionnaire.
(ii) Before answering any of the items on the questionnaire, read through to understand it.
(iii)Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [ ] Female [ ]

2. Pre-service [ ] in- service [ ]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?

   .....

   .....

4. What do you know about a lesson study?

   .....

   .....

5. What attitude do teachers have towards practicing lesson study?

   a).....

   b).....

   c)……..……..

6. What causes the attitudes teachers have towards lesson study activities?
   a) ……
   b) ……
   c) ……
   d) ……...
7. How can you overcome the attitudes teachers have towards lesson study activity?
   a) ……
   b) ……...
   c) ……
8. What materials do teachers need to conduct lesson study?
   a)……
   b)……
   c)……
9. Who has been providing material you have mentioned in question 7? ……
   ……
10. What are the factors that support teachers' ability to participate in lesson study activities?
    a).....
    b).....
    c).....
    d).....
11. What are the factors that sustain lesson study in teaching mathematics?
    a)……..
    b)……..
    c)……..……
12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
    a) ……..
    b) ……..
    c) ……..

13. What are the benefits of practicing lesson study to the learners?
    a)……
    b)……
14. What are the benefits of practicing lesson study to the ministry of education?
    a) ……
    b) ……
    c) ……
15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.
    a) ……
    b) ……
    c) ……
16. What are the challenges of conducting lesson study in teaching mathematics?
    a) ……...
    b) ……
    c) ……
17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle
    a) ……
    b) ……..…….
    c) ……
18. What has made lesson study not to be practiced in some schools?
    a)…..……
    b)…..……
    c)……..

Thank you for your responses, time and your willingness to participate in this study.

APPENDIX 5

Answered Questionnaires

PARTICIPANT 1

Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

(i) Do not indicate your name on any part of the questionnaire.
(ii) Before answering any of the items on the questionnaire, read through to understand it.
(iii) Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [√] Female [ ]

2. Pre-service [ ] in- service [√]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?
   It is a strategy used in Continuing professional Development with focus on studying the lesson.
4. What do you know about a lesson study?
   Lesson study is a process that typically involves planning, teaching, observation and reflection.
5. What attitude do teachers have towards practicing lesson study?
   a) The positive part is that teachers appreciate its existence and practice.
   c) The negative part is that often feel it delays their syllabus coverage and it is tiresome.
6. What causes the attitudes teachers have towards lesson study activities?

a) Inferiority Complex from teachers, low levels of
b) Pedagogical Content Know, time and workload
c) Constraints, overal Culture and Climate within
d) Schools.

7. How can you overcome the attitudes teachers have towards lesson study activity?
a) Peer support and Collaboration can help teachers
b) manage and overcome their attitudes they
c) have towards lesson study activities

8. What materials do teachers need to conduct lesson study?
a) The school provides the materials and
b) sometimes it is just teachers resourcefulness.
c)

9. Who has been providing material you have mentioned in question 8?
The school provides the materials and
sometimes it is just teachers resourcefulness.

10. What are the factors that support teachers' ability to participate in lesson study activities?
a) Collaboration of learning
b) Peer Support
c) Ongoing Continous improvement
d)

11. What are the factors that sustain lesson study in teaching mathematics?
a) Time Constraints is one of the factors affecting the lesson
b) Study. Mostly, our motivation to implement lesson study as
c) Poor teachers depends on the knowledge of its benefits or future.

12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
a) Research based teaching Sir deepens Content
b) and pedagogical knowledge which leads to
c) improved instructional practices.

13. What are the benefits of practicing lesson study to the learners?

a) On the side of pupils, due to lesson study, there is improved learning outcome, confidence, self-efficacy and enhance Problem solving skills.

14. What are the benefits of practicing lesson study to the ministry of education?

a) Learners tend to Concentrate more where there are a number of teachers during a lesson. This is because during the implimentation of lesson study, teachers enhance their teaching skills.

15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.

a) Yes, it is a good idea to continue Conducting lesson study to enhance teacher confidence, to have reflective practice, increased student engagement and enhance pedagogical skills.

16. What are the challenges of conducting lesson study in teaching mathematics?

a) Time is a Challenge

b) Lack of knowledge about lesson study.

c) Lack of materials

17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle

a) We do complete the cycles and generally, a lesson study cycle in mathematics involves planning, pre-lesson discussion, lesson implementation, post lesson discussion, analysis or reflection and revision and iteration.

18. What has made lesson study not to be practiced in some schools?

a) Lack of administrative support

b) Teachers negative towards lesson study.

c) Some teachers say it is time wasting.

Thank you for your responses, time and your willingness to participate in this study.

PARTICIPANT 2

Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

(i) Do not indicate your name on any part of the questionnaire.

(ii) Before answering any of the items on the questionnaire, read through to understand it.

(iii) Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [ ] Female [√]

2. Pre-service [ ] in- service [√]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?

   Lesson Study is an action research on a particular selected lesson whose aim is to improve lesson planning and delivery.

4. What do you know about a lesson study?

   It is teacher professional growth.

5. What attitude do teachers have towards practicing lesson study?

   a) For me, I think its time consuming, it is very expensive and not really beneficial in zambian setting.

6. What causes the attitudes teachers have towards lesson study activities?

a) Inadequate understanding of lesson study, poor
b) introduction of lesson study in schools, persistent
c) poor performance among learners and laziness
d) by teachers.

7. How can you overcome the attitudes teachers have towards lesson study activity?
a) The government should make it a policy that all
b) teachers must do lesson study, practice it in the
c) correct way and must re-introduce it in an efficient and effective way.

8. What materials do teachers need to conduct lesson study?
a) As teachers, we need stationary lesson study guide, curriculum
b) and observation tools for collecting data and furniture
c) to conduct lesson study.

9. Who has been providing material you have mentioned in question 8?
The school provides.
We provide as teachers

10. What are the factors that support teachers' ability to participate in lesson study activities?
a) The opportunity to receive feedback
b) The opportunity to continous improvement
c)
d)

11. What are the factors that sustain lesson study in teaching mathematics?
a) Time to gather and plan collaboratively is not enough and
b) some environments are hard to conduct lesson study
c) in a large class.

12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
a) Not only does lesson study lead to enhanced teaching materials, but also
b) enhanced capacity to plan and deliever lessons and improved learning outcome
c) in return pass rate and conceptual understanding for learners improve.

13. What are the benefits of practicing lesson study to the learners?

a). In return pass rate and conceptual understanding for learners improve

14. What are the benefits of practicing lesson study to the ministry of education?

a) .....

b) .....

c) .....

15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.

a) Yes lesson study should be reinvigorated (revamped) for improved quality of teachers in lesson planning and delievery.

b) .....

c) .....

16. What are the challenges of conducting lesson study in teaching mathematics?

a) .....

b) .....

c) .....

17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle

a) Practice

b) .....

c) .....

18. What has made lesson study not to be practiced in some schools?

a).....

b).....

c).....

Thank you for your responses, time and your willingness to participate in this study.

PARTICIPANT 3

Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

(i) Do not indicate your name on any part of the questionnaire.

(ii) Before answering any of the items on the questionnaire, read through to understand it.

(iii) Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [✓] Female [✓]

2. Pre-service [✓] in- service [ ]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?

   It is a teaching improvement process that has origin in Japanese elementary education.

4. What do you know about a lesson study?

   Lesson study is an inquiry cycle that supports teachers to experiment, observe and improve lessons.

5. What attitude do teachers have towards practicing lesson study?

   a) I have welcomed the study although some colleagues find it hard to finish the cycle. So its discouraging

   b) Sometimes when only few teachers have adequate knowledge of study.

6. What causes the attitudes teachers have towards lesson study activities?

a) Lack of knowledge on the study by the
b) teachers and the process takes alot of
c) time.
d) .....

7. How can you overcome the attitudes teachers have towards lesson study activity?
a) The ministry should provide information on the lesson
b) study through work shops.
c) .....

8. What materials do teachers need to conduct lesson study?
a) Lesson plan, teaching aids, markers, manila papers, text books
b) and other materials as the topic may require.
c) .....

9. Who has been providing material you have mentioned in question 8?
The ministry of education.
The school.

10. What are the factors that support teachers' ability to participate in lesson study activities?
a) Support from the ministry of education
b) Head teachers' support
c) .....
d) .....

11. What are the factors that sustain lesson study in teaching mathematics?
a) Some challenges are lack of time institutional support
b) and insufficient instructional materials
c) .....

12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
a) The collaboration normally imparts knowledge to the teachers
b) It also provides a platform to correct wrong methods. Apart
c) from that, teachers tend to understand that lesson study is about a learner improve in performance. There is also strong togetherness among teachers due to lesson studies.

13. What are the benefits of practicing lesson study to the learners?
a) Teachers tend to understand that lesson study is about
b) helping a learner improve in performance.
c) .....

14. What are the benefits of practicing lesson study to the ministry of education?
a) Results are improved in the Country.....
b) Teachers are equipped with knowledge.....
c) .....

15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.
a) Lesson study should continue because we share ideas and
b) work out the lesson together at the end of the day the
c) lesson becomes every body's lesson.

16. What are the challenges of conducting lesson study in teaching mathematics?
a) Time.....
b) Gathering is not easy.....
c) Resources.....

17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle
a) In a lesson study cycle there is collaborative identification of
b) a problem, lesson planning, one teaches, discusses re-teach and
c) compile conclusion. There is a lot so we rarely complete the cycle

18. What has made lesson study not to be practiced in some schools?
a) Some teachers think it is waste of time.....
b) There is limited time.....
c).....

Thank you for your responses, time and your willingness to participate in this study.

PARTICIPANT 4

Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

(i) Do not indicate your name on any part of the questionnaire.

(ii) Before answering any of the items on the questionnaire, read through to understand it.

(iii) Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [√] Female [ ]

2. Pre-service [ ] in- service [√]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?
   It is an enquiry cycle that supports teachers to experiments, observe and improve as they work together to target an identified area for development in their students' learning.
4. What do you know about a lesson study?
   Lesson Study usually follows a plan or process of activities conducted by educators
5. What attitude do teachers have towards practicing lesson study?
   a). With me, lesson study is a wellcome approach of improving
   b). teaching and learning.
   c). When teaching and learning improves, the performance of learners improve too.
6. What causes the attitudes teachers have towards lesson study activities?

a) Some teachers do not like joining in collaborative
b) lesson preparation or open classroom workshops.
c) .....
d) .....

7. How can you overcome the attitudes teachers have towards lesson study activity?
a) Teachers must be educated on the importance
b) of the lesson study through workshops.
c) .....

8. What materials do teachers need to conduct lesson study?
a) Lesson plans
b) teaching aids
c) text books

9. Who has been providing material you have mentioned in question 8?
The institution, teachers and organization like
Japan International Corporation Agency provide materials.

10. What are the factors that support teachers' ability to participate in lesson study activities?
a) School leadership
b) The need for studet improvement.
c) The need For professional developmet (CPD)
d) .....

11. What are the factors that sustain lesson study in teaching mathematics?
a) Poor attitude from the teachers, lack of coordinated action
b) plans and week supervision determines the implementation
c) of lesson study.

12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
a) It produces positive results of teachers' teaching skills.
b) It also improves learners performance in the National Examination.
c) Pass rate Changes learners behaviour and attitude.

a) Some teachers do not like joining in collaborative lesson preparation or open classroom workshops.

c) .....

d) .....

7. How can you overcome the attitudes teachers have towards lesson study activity?

a) Teachers must be educated on the importance of the lesson study through workshops.

c) .....

8. What materials do teachers need to conduct lesson study?

a) Lesson plans

b) Teaching aids

c) Text books

9. Who has been providing material you have mentioned in question 8?

The institution, teachers and organization like Japan International Corporation Agency provide materials.

10. What are the factors that support teachers' ability to participate in lesson study activities?

a) School leadership

b) The need for studet improvement.

c) The need For professional developmet (CPD)

d) .....

11. What are the factors that sustain lesson study in teaching mathematics?

a) Poor attitude from the teachers, lack of coordinated action plans and week supervision determines the implementation of lesson study.

12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?

a) It produces positive results of teachers' teaching skills.

b) It also improves learners performance in the National Examination.

c) Pass rate Changes learners behaviour and attitude.

PARTICIPANT 5

Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

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(ii) Before answering any of the items on the questionnaire, read through to understand it.

(iii) Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [ ] Female [√]

2. Pre-service [ ] in- service [√]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?

   Lesson study is a research design carried out by in-service teachers to help them grow professionally and improve classroom environment. It goes through stages.

4. What do you know about a lesson study?

   It is where a group of teachers in the same department or teaching the same subject carry out an eight stage lesson research to improve classroom lesson delivery and teache growth.

5. What attitude do teachers have towards practicing lesson study?

   a) I feel good about lesson study activities because it is proble
   in nature. It also helps in terms of improving teaching
   methods. Through lesson study we get to learn new ways o
   teaching mathematics.

6. What causes the attitudes teachers have towards lesson study activities?

a) ~~I feel~~ There is lack of proper structure for lesson study
poor support from management, lack of motivation to
those teachers who show seriousness and most teachers
do not appreciate benefits of lesson study.

7. How can you overcome the attitudes teachers have towards lesson study activity?
a) Serious structure for lesson study such as timetabling has to be
available, improved support from school management system and
certification of award giving to outstanding performance teachers.

8. What materials do teachers need to conduct lesson study?
a) Flip charts or manila papers, markers, pens, text books, syllabus,
b) laptops, projector and lunch.
c)

9. Who has been providing material you have mentioned in question 8?
The school and individual members

10. What are the factors that support teachers' ability to participate in lesson study activities?
a) The opportunity for collaborative learning
b) The opportunity for professional development
c) The focus on student learning
d)

11. What are the factors that sustain lesson study in teaching mathematics?
a) The idea that there is no certification or immediate external reward
makes some teachers develop negative attitudes because
they feel like it is a shire waste of time.

12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
a) Teachers get to share information on topics, pupils' attitudes and
preparation of summative assesments. Teachers work in harmony
with common schemes of work and lesson plans. Teachers also tend
to take ownership of the challenges in teaching mathematics

13. What are the benefits of practicing lesson study to the learners?

a) Teachers get to share information on topics, pupils attitudes and preparation of summative assessments.

14. What are the benefits of practicing lesson study to the ministry of education?

a) Teachers work in harmony with common schemes of work and lesson plans.

b) Teachers also tend to take ownership of the challenges in teaching mathematics.

15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.

a) As for me, i feel lesson study should continue being conducted because teachers graduate from different institutions with different approaches. Teachers have to continue developing each other as iron sharpes iron.

16. What are the challenges of conducting lesson study in teaching mathematics?

a) .....

b) .....

c) .....

17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle

a) Sometimes it is completed especially in mathematics. Many times lesson study cycle does not complete due to lack of time or not properly planned by teachers.

18. What has made lesson study not to be practiced in some schools?

a).....

b).....

c).....

Thank you for your responses, time and your willingness to participate in this study.

13. What are the benefits of practicing lesson study to the learners?

a) Teachers get to share information on topics, pupils attitudes and prepar

b) -tion of summative assessments.

14. What are the benefits of practicing lesson study to the ministry of education?

a) Teachers work in harmony with common schemes of work and lesson plans.

b) Teachers also tend to take ownership of the challenges in teaching

c) mathematics.

15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.

a) As for me, i feel lesson study should continue being conducted

b) because teachers graduate from different institutions with

c) different approaches. Teachers have to continue developing each other as iron sharpes iron.

16. What are the challenges of conducting lesson study in teaching mathematics?

a) .....

b) .....

c) .....

17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle

a) Sometimes it is completed especially in mathematics. many times

b) lesson study cycle does not complete due to lack of time or not

c) properly planned by teachers.

18. What has made lesson study not to be practiced in some schools?

a).....

b).....

c).....

Thank you for your responses, time and your willingness to participate in this study.

6

PARTICIPANT 6

Questionnaires

I am a post graduate student carrying out an academic research study where your participation is very much important for the success of this study. The study is entitled 'Sustainability of lesson study in teaching and learning mathematics: a case of selected schools in Lusaka District of Zambia'. Therefore, you are requested to respond honestly to the items below by a tick [√] or an explanation in the spaces provided. Be assured that the information that you will provide shall be treated with high level of confidentiality and will only be used for the purpose of this study.

INSTRUCTIONS

(i) Do not indicate your name on any part of the questionnaire.

(ii) Before answering any of the items on the questionnaire, read through to understand it.

(iii) Answer all questions faithfully and to the best of your knowledge.

Section A: General Information about the Respondent

1. Sex

   Male [✓] Female [ ]

2. Pre-service [✓] in- service [ ]

Section B: Appropriateness and Relevance of Content.

3. What is lesson study?

   It is where a group of teachers work together to target an an identified area for development in themselves or student learning.

4. What do you know about a lesson study?

   Lesson study is where teachers get together, identify a problem and then solve.

5. What attitude do teachers have towards practicing lesson study?

   a). For me I would say, I have a positive attitude.

   b). Some teachers take it is a shire waste of time

   c). Some say they I have no challenges in their teaching and see no reason to collaborate.

6. What causes the attitudes teachers have towards lesson study activities?

a) Some teachers feel that there ~~lack~~ should be an incentive attached to it. ~~Some feel that~~
c) Some feel that it should be concluded within ~~the~~ hours and lack of support from the supervisors

7. How can you overcome the attitudes teachers have towards lesson study activity?
   a) The ministry must sensitize teachers on the importance of the lesson study for them to realize where they are not performing well.
8. What materials do teachers need to conduct lesson study?
   a) Plain papers
   b) Rulers for the white board/black board.
   c) Projector
9. Who has been providing material you have mentioned in question 8?
   Japan International Cooperation Agency (JICA) is one of the organisations which provides materials like markers, manilla papers, text books and other materials which we normally use for study.
10. What are the factors that support teachers' ability to participate in lesson study activities?
    a)
    b)
    c)
    d)
11. What are the factors that sustain lesson study in teaching mathematics?
    a) ~~Time is not enough to complete the cycle~~
    b) Lack of knowledge on the lesson study and
    c) the stages of the lesson study are too many.
12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
    a) Helps teachers to improve where they may be facing challenges.
    b) Learners benefit as teachers will have gained more knowledge ~~the~~ through lesson study. Learners pass rate improve.

13. What are the benefits of practicing lesson study to the learners?

a) Learners benefit as teachers will have gained more knowledge.

b) Learners pass rate improve.

14. What are the benefits of practicing lesson study to the ministry of education?

a) Teachers learn alot during lesson study.

b) Better students are produced.

c) .....

15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.

a) It is a very good move in the sense that as teachers we help

b) each other to improve in areas we may not have been well.

c) Learners have good content from a teacher with adquate content so it has to continue.

16. What are the challenges of conducting lesson study in teaching mathematics?

a) Lack of time

b) Teachers have busy schedules with teaching.

c) Some teachers resist lesson study.

17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle

a) Sometimes it not completed because the process is quiet

b) hectic hence teachers falling off in the process.

c) .....

18. What has made lesson study not to be practiced in some schools?

a) Lack of incentives

b) Teachers do not like collaboration.

c) No materials.

Thank you for your responses, time and your willingness to participate in this study.

APPENDIX 6

Interview Guide

1. Sex Male [ ] Female [ ]
2. Pre-service [ ] in- service [ ]
3. What is lesson study?
4. What do you know about a lesson study?
5. What attitude do teachers have towards practicing lesson study?
6. What causes the attitudes teachers have towards lesson study activities?
7. How can you overcome the attitudes teachers have towards lesson study activity?
8. What materials do teachers need for them to practice lesson study?
9. Who has been providing materials you have mentioned in question 7?
10. What are the factors that support teachers' ability to participate in lesson study activities?
11. What are the factors that sustain lesson study in teaching mathematics?
12. What are the benefits of implementing lesson study in teaching mathematics to the teachers?
13. What are the benefits of practicing lesson study to the learners?
14. What are the benefits of practicing lesson study to the ministry of education?
15. Do you think it's a good idea to continue conducting lesson study in schools? Give reasons for your answer.
16. What are the challenges of conducting lesson study in teaching mathematics?
17. Do you complete a lesson study cycle? If your answer is no give a reasons and if the answer is yes, explain the cycle
18. What has made lesson studies not to be practiced in some schools?

Thank you for your responses, time and your willingness to participate in this study.

APPENDIX 7

Unfilled Lesson observation Guide

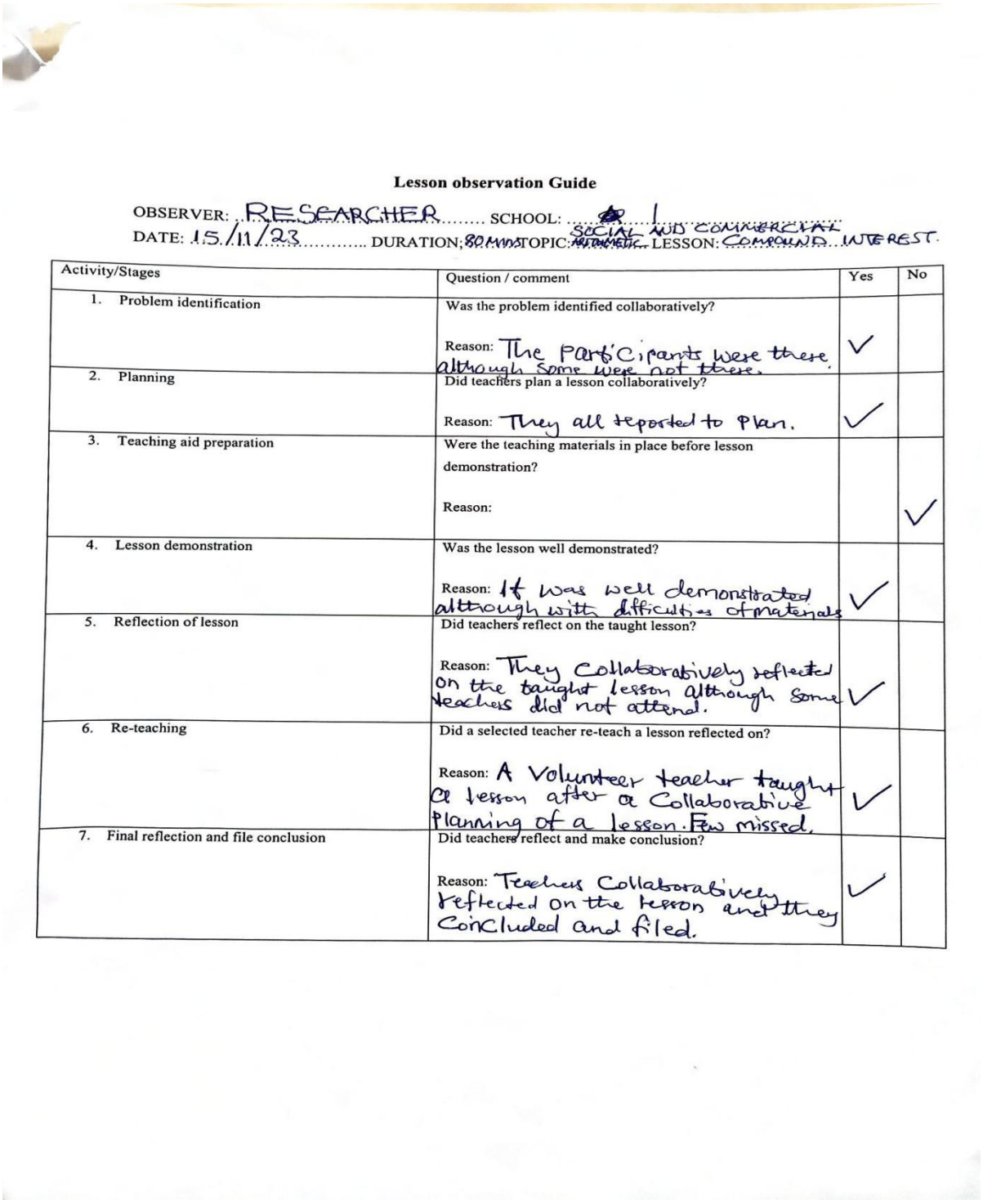
OBSERVER: …… SCHOOL: …….

DATE: …….. DURATION; ……TOPIC: ……. LESSON: …….

Activity/Stages	Question / comment	Yes	No
1. Problem identification	Was the problem identified collaboratively? Reason:		
2. Planning	Did teachers plan a lesson collaboratively? Reason:		
3. Teaching aid preparation	Were the teaching materials in place before lesson demonstration? Reason:		
4. Lesson demonstration	Was the lesson well demonstrated? Reason:		
5. Reflection of lesson	Did teachers reflect on the taught lesson? Reason:		
6. Re-teaching	Did a selected teacher re-teach a lesson reflected on? Reason:		
7. Final reflection and file conclusion	Did teachers reflect and make conclusion? Reason:		

APPENDIX 8

Filled Lesson observation Guide for school 1



Lesson observation Guide

OBSERVER: RESEARCHER ..... SCHOOL: ★ 1

DATE: 15/11/23 ..... DURATION: 80 MINS TOPIC: ~~ARITHMETIC~~ SOCIAL AND COMMERCIAL LESSON: COMPOUND INTEREST.

Activity/Stages	Question / comment	Yes	No
1. Problem identification	Was the problem identified collaboratively? Reason: The participants were these although some were not these.	✓	
2. Planning	Did teachers plan a lesson collaboratively? Reason: They all reported to plan.	✓	
3. Teaching aid preparation	Were the teaching materials in place before lesson demonstration? Reason:		✓
4. Lesson demonstration	Was the lesson well demonstrated? Reason: It was well demonstrated although with difficulties of materials	✓	
5. Reflection of lesson	Did teachers reflect on the taught lesson? Reason: They Collaboratively reflected on the taught lesson although some teachers did not attend.	✓	
6. Re-teaching	Did a selected teacher re-teach a lesson reflected on? Reason: A Volunteer teacher taught a lesson after a Collaborative planning of a lesson. Few missed.	✓	
7. Final reflection and file conclusion	Did teachers reflect and make conclusion? Reason: Teachers Collaboratively reflected on the lesson and they concluded and filed.	✓	

APPENDIX 9

Filled Lesson observation Guide for school 2

Lesson observation Guide

OBSERVER: RESEARCHER SCHOOL: 2

DATE: 2/10/23 DURATION: 80MINS TOPIC: MENSURATION LESSON: TOTAL SURFACE AREA

Activity/Stages	Question / comment	Yes	No
1. Problem identification	Was the problem identified collaboratively? Reason: The problem was identified Collaboratively although in some.	✓	
2. Planning	Did teachers plan a lesson collaboratively? Reason: The teacher planned a lesson	✓	
3. Teaching aid preparation	Were the teaching materials in place before lesson demonstration? Reason: No teaching materials were present but lecture method.		✓
4. Lesson demonstration	Was the lesson well demonstrated? Reason: The lesson was well demonstrated although one was absent.	✓	
5. Reflection of lesson	Did teachers reflect on the taught lesson?		

APPENDIX 10

Proposed Research Budget

SN	Description	Quantity	Unit Price	Total in Kwacha
1	Transport to the selected Schools of Lusaka District			1200
2	Meals	8	30	240
3	Printing of Proposal	4 copies	91.5	366
4	Binding of Proposal	4 Copies	15	60
5	Printing of final Dissertation	4 Copies	100	400
6	Binding of final Dissertation	4 Copies	50	200
7	Hard drive	1	300	300
8	Miscellaneous	.....	.....	1000
			TOTAL	**K3,3766=00**

APPENDIX 11

COLLABORATIVE LESSON PLAN A

TEACHER: A
SUBJECT: MATHEMATICS
TOPIC: MENSURATION

DATE: 2nd October, 2023
DURATION: 80 MINUTES
CLASS: 8A

SUBTOPIC: TOTAL SURFACE AREA

NO. OF BOYS: 30
GIRLS: 40

REFERENCES: longman mathematics book 8 and other sources
TEACHING LEARNING /AIDS: learners book, chalk board and chart
RATIONALE: This lesson is on area of a cylinder. Teacher exposition, demonstration and question and answer. This lesson will develop learners' knowledge about finding the total surface area of a cylinder and triangular prism. The skill of Calculation of surface area and volume of a cylinder and triangular .The value of Accuracy in calculations involving surface area and volume.
LEARNING OUTCOMES: P.S.B.A.T:

- **Find the total surface area of cylinder and triangular prism.**

PREREQUISITE KNOWLEDGE: Learners have ideas about the topic being taught.

LESSON INTRODUCTION: Brainstorming questions about the topic being taught will be used to introduce the topic and to revise through the previous lesson

LESSON DEVELOPMENT

CONTENT	TEACHER'S ACTIVITY	PUPIL'S ACTIVITY	METHODS
TOTAL SURFACE AREA OF A CYLINDER EXAMPLE 1 What is the total surface area of a tin with a radius of 6cm and a height of 10cm.(use π=3.14) SOLUTION 1 1. TSA=$2\pi r^2$ +$2\pi r$ x h =2x3.14x6x6 +2x3.14x6x10 =603.18cm^2 EXAMPLE 2 What is the total surface area of a cylinder whose radius is 4cm and a height of 9cm .(use π=3.14)	Teacher to solve example 1on the board Teacher to ask learners to go and solve on the board **EXPECTED ANSWER** **TSA=$2\pi r^2$ +$2\pi r$ x h** **=2x3.14 x4x4 +2x3.14x4x9** **=326.71cm**	Learners to listen attentively and ask question Volunteer learners to go and solve on the board	Teacher exposition/ question and answer Demonstration

EXERCISE 1.What is the total surface area of a cylinder whose radius is 3cm and a height of 5cm .(use π=3.14) 2. What is the total surface area of a tin whose radius is 2cm and a height of 10cm .(use π=3.14)	Teacher to write the exercise on the board	Learners to write the exercise in their exercise books EXPECTED ANSWER Solutions 1.TSA=$2\pi r^2$ +2πr x h =2x3.14x3x3+2x3.14x3x5 =150.72cm2 2. TSA=$2\pi r^2$ +2πr x h =2x3.14x2x2 + 2x3.14x2x10 =25.12 +125.6 =150.72cm2	Writing on the board

CONCLUTION: Teacher to conclude lesson by revising through the lesson with the learners and help the remedial learners

SELF
EVALUATION: ……
……
……

HOME WORK

DATE: 2ND OCTOBER, 2023.

DUE DATE: 6TH OCTOBER, 2023

1. Calculate the total surface area of a cylinder whose height is 12cm and radius 5cm. (Use π=3.14)
2. Calculate the total surface area of a triangular prism whose triangular height is 12cm, base 5cm and the length 10cm. (Use π=3.14)
3. What is the total surface area of a tin with diameter 14mm and height 1mm? (Use π=3.14)

APPENDIX 12

COLLABORATIVE LESSON PLAN B

NAME OF TEACHER: B
SUBJECT: MATHMATICS
TOPIC: SOCIAL COMMERCIAL AND ARITHMETCS
SUBTOPIC: COMPOUND INTEREST

DATE: 15th November, 2023
DURATION: 80 MINUTES
Grade: 8 C
NO. OF BOYS: 45
GIRLS: 20

REFERENCES: long man mathematics pupils book 8 page 50-69 and other sources
TEACHING LEARNING /AIDS: learners book, chalk board and chart
RATIONALE: This lesson is on Compound interest. Teacher Exposition, role play methods will be used. This lesson will develop learners' knowledge's about Calculating compound and simple interest. The skill of Entrepreneurship using simple and compound interest. The value of Appreciation of compound interest, insurance and assurance.
LEARNING OUTCOMES: L.S.B.A.T:

- Calculate compound interest

PREREQUISITE KNOWLEDGE: Learners have ideas about the topic being taught.
LESSON INTRODUCTION: Brainstorming questions about the topic being taught will be used to introduce the topic and to revise through the previous lesson

LESSON DEVELOPMENT

CONTENT	TEACHER'S ACTIVITY	PUPIL'S ACTIVITY	METHODS
SIMPLE INTEREST *Recup* *Simple interest is given by the formula* *SI=PRT ,where P is the principle ,R is rate and T is time* *100* ➢ *The money you pay back or saved as interest you have to add. This total is called the amount and is given by the formula* *Amount =Principle interest* *OR A=P + i* *EXAMPLE 1* *K40000 is borrowed for three years at 10% per annum .Calculate the simple interest owed and the amount to be paid back* *SOLUTION* *SI=PRINCIPLE ×RATE×TIME*	Teacher to explain about simple interest and allows learners to ask questions Teacher to write the example on the board and solve	Learners listens attentively and ask questions Learners to write the examples in their exercise book	Teacher exposition/Question and Answer Role play

100 $S.I=\frac{4000\times10\times3}{100}$ $S.I=K1200$ *There:* *Amount =Principal +interest* *=k400 +k1200* *=k5,200* ***EXAPLE 2*** *Calculate the amount of a three year-loan of k200.00at 5% interest per year.* ***SOLUTION*** $A = P(1 + i)^n$ $=200.00(1 + i)^n$ *=200(1+0.05)3* *=200(1.05)3* *= 200×1.05× 1.05×1.05* *=K231.53* ***EXERCISE*** *A woman deposited K1000 in her account where she earns 10% compound interest per annum for three years.* *a. How much interest did she earn in the first year?* *b. How much does she get at the end of three years?*	Teacher to write the example on the board and ask volunteer learners to go and solve on the board. Teacher consolidates learners responses	volunteer learners to go and solve on the board **EXPECTED ANSWER** $A = P(1 + i)^n$ $=200.00(1 + i)^n$ *=200(1+0.05)3* *=200(1.05)3* *=200×1.05× 1.05× 1.05* *=K231.53* **EXPECTED ANSWERS** a. K100 b. K1331	Role play Teacher exposition

Lesson conclusion: Teacher to conclude lesson by revising through the lesson with leaners to help remedial learners

Learners evaluation: ……
……

Teacher's evaluation:

……...……

APPENDIX 13

SECOND COLLABORATIVE LESSON PLAN B

NAME OF TEACHER: B
SUBJECT: MATHMATICS
TOPIC: SOCIAL COMMERCIAL AND ARITHMETCS
SUBTOPIC: COMPOUND INTEREST

DATE: 17th November, 2023
DURATION: 80 MINUTES
Grade: 8 C
NO. OF BOYS: 45
GIRLS: 20

REFERENCES: long man mathematics pupils book 8 page 50-69 and other sources
TEACHING LEARNING /AIDS: learners book, chalk board and chart
RATIONALE: This lesson is on Compound interest. Teacher Exposition, role play methods will be used. This lesson will develop learners' knowledge's about Calculating compound and simple interest. The skill of Entrepreneurship using simple and compound interest. The value of Appreciation of compound interest, insurance and assurance.
LEARNING OUTCOMES: L.S.B.A.T:

- Calculate Compound interest

PREREQUISITE KNOWLEDGE: Learners have ideas about the topic being taught.
LESSON INTRODUCTION: Brainstorming questions about the topic being taught will be used to introduce the topic and to revise through the previous lesson

LESSON DEVELOPMENT

CONTENT	TEACHER'S ACTIVITY	PUPIL'S ACTIVITY	METHODS
SIMPLE INTEREST *Recup* *Simple interest is given by the formula* $SI=\frac{PRT}{100}$ *,where P is the principle ,R is rate and T is time* ➢ *The money you pay back or saved as interest you have to add. This total is called the amount and is given by the formula* *Amount =Principle interest* *OR A=P + i* *EXAMPLE 1* *K40000 is borrowed for three years at 10% per annum .Calculate the simple interest owed and the amount to be paid back* *SOLUTION* $SI=\frac{PRINCIPLE \times RATE \times TIME}{100}$	Teacher to explain about simple interest and allows learners to ask questions Teacher to write the example on the board and solve	Learners listens attentively and ask questions Learners to write the examples in their exercise book	Teacher exposition/Question and Answer Role play

S.I=4000×10×3 *100* *S.I=K1200* *There:* *Amount =Principal +interest* *=k400 +k1200* *=k5,200* ***EXAPLE 2*** *Calculate the amount of a three year-loan of k200.00 at 5% interest per year.* ***SOLUTION*** ***1st Year*** ***Loan value is 1+(5% /100)*** *=1.05* *= 200.00×1.05* *=k210* *2nd Year* *k210 ×1.05* *=k220.50* *3rd Year* *K220.50 ×1.05* *=k231.53* *Therefore, Loan Value= k231.53* ***EXERCISE*** *A woman deposited K1000 in her account where she earns 10% compound interest per annum for three years.* *c. How much interest did she earn in the first year?* *d. How much does she get at the end of three years?*	Teacher to write the example on the board and ask volunteer learners to go and solve on the board. Teacher consolidates learner's responses	volunteer learners to go and solve on the board *Expected answer k231.53* EXPECTED ANSWERS a. K100 b. K1331	Role play Teacher exposition

Learners evaluation: ……
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Teacher's evaluation: ……
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