TEACHER LEARNING: A CASE STUDY OF TWO TEACHER LEARNING COMMUNITIES IN KWAZULU-NATAL

BONGIWE ZULU

UNIVERSITY OF KWAZULU-NATAL

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Dedication

This thesis is dedicated to the memory of my father, Wilson Mduduzeni Nxele, my mother Tholiwe MaNcanana Nxele, my mother-in-law Nomakhosi Vistel Zulu and my late brothers, Sthembiso and Sabelo Nxele.

ACKNOWLEDGEMENTS

DECLARATION

I, Free-Queen Bongiwe Zulu declare that:

1. The research reported in this thesis, except where otherwise indicated, is my original research.

2. This thesis has not been submitted for any degree or examination at any other university.

3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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Student Name: Bongiwe Zulu   Signature:

Supervisor: Prof Carol Bertram   Signature:

Co – Supervisor: Dr TG Mukeredzi   Signature:

LIST OF ACRONYMS

CCK	Common Content Knowledge
BCM	Business Commerce Management
CAPS	Curriculum And Assessment Policy Statement
CASS	Continuous Assessment
CES	Chief Education Specialist
CHAT	Cultural-Historical Activity Theory
CK	Content Knowledge
CPD	Continuous Professional Development
CT	Commerce Teachers
CV	Curriculum Vitae
DBE	Department of Basic Education
DCES	Deputy Chief Education Specialist
DHET	Department Of Higher Education And Training
DTDC	District Teacher Development Centre
EMS	Economic And Management Sciences
FET	Further Education And Training
GET	General Education And Training
HCK	Horizon Content Knowledge
HOD	Head of Department
INSET	In-Service Education And Training
IQMS	Integrated Quality Management
ISPTED	Integrated Strategic Planning Framework For Teacher Education And Development
KCC	Knowledge of Content and Curriculum
KCT	Knowledge Of Content And Teaching
MIP	Matric Intervention Programme
NCEE	National Council Of Economic Education
NCS	National Curriculum Statement
NGO	Non-Governmental Organization
NICPD	National Institute For Curriculum And Professional Development
NSC	National Senior Certificate
NWP	National Writing Project
OBE	Outcome Based Education
OLCs	On-Line Learning Communities
PCK	Pedagogical Content Knowledge
PLCs	Professionals Learning Communities
POA	Programme Of Assessment
PORTER	Power Of Buyers, Power of The Suppliers Competition, Substitute and Rivalry
SACE	South African Council of Teachers
SCK	Specialized Content Knowledge
SES	Subject Education Specialist
SMT	School Management Team
TLCs	Teacher Learning Communities
UK	United Kingdom
UKZN	University of KwaZulu-Natal
UNESCO	United Nations Educational Scientific and Cultural Organization
USA	United States of America

ABSTRACT

Teacher learning in teacher learning communities (TLCs) has now become a professional development model of the 21th century in the South African context. It is plausible that South African education reformers through the Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) also consider teacher learning communities for the professional development of teachers at a local level (Department of Basic Education and Department of Higher Education and Training, 2011). The DBE and the DHET (2011) emphasise that teachers are professionals; hence they call them professional learning communities (PLCs) although they are also TLCs. The ISPFTED focuses on the PLCs that are within the school context. However, not enough is known about TLCs that are outside of the school in the South African context, and this study investigates two such TLCs.

This study explores how learning occurs, what type of knowledge is learnt and the nature of collaborative relationships in two teacher learning communities: the Commerce Teachers' Association and a mathematics group of teachers from one district in KwaZulu-Natal. The Mathematics Group is a Department of Basic Education (DBE) cluster for Mathematics high school teachers. The Commerce Teachers' Association is an association of Commerce teachers, which both the DBE and the DHET (2011) regard as one of the key role players in the establishment and function of a PLC.

The study uses the Cultural Historical Activity Theory (CHAT) to understand how learning occurs in the two teacher learning communities. However, CHAT in this study, does not have the language to describe the kind of teacher knowledge that is learnt in both the Commerce Teachers' Association and the Mathematics Group. Hence, two models (Grossman, 1991; Ball, Thames & Phelps, 2008; Hurrell, 2013) of teacher knowledge domains complemented CHAT to conceptualise the kinds of teacher knowledge learnt in both the Commerce Teachers' Association and the Mathematics Group.

Methodologically, this study used a qualitative approach but benefitted from the versatility of the case study design by collecting both qualitative and quantitative data. Multiple forms of evidence were collected through interviews, observations, surveys and document analysis. CHAT and teacher knowledge domains were used to create analytical frameworks.

The findings of the study reveal that neither the Commerce Teachers' Association nor the Mathematics Group reflected the formation of an ideal TLC or what the DBE and the DHET (2011) envisaged as a professional learning community (PLC). The findings reveal that most Commerce teachers learnt by internalisation of the knowledge from the external facilitators (DBE subject advisors from other districts, grade 12 final examination moderators and examiners) who were then expected to externalise their new knowledge in the classroom situation. This learning took place in once-off workshops held in the central venues. The findings showed that in the Commerce Teachers' Association subject matter knowledge, pedagogical content knowledge (PCK), general pedagogical knowledge, curriculum knowledge and contextual knowledge were learnt with particular emphasis on curriculum knowledge and general pedagogical knowledge. The learning by the teachers in the Commerce Teachers' Association was directed towards meeting the DBE demand to improve grade 12 learners' performance in the final examination. Although the survey findings suggest that Commerce teachers collaborated during the workshops and outside of the workshops, the findings from observation did not show that teachers were collaborating during the workshops.

On the other hand, the 14 teachers from the Mathematics Group attended several workshops that took place in the circuit and out of the circuit. These workshops were separately organised by the Mathematics subject advisor and a non-governmental organisation (NGO). Observations of two NGO Mathematics and one DBE moderation workshops revealed that the Mathematics teachers acquired different types of Mathematics knowledge and skills, both as individuals and collectively. The findings revealed that common content knowledge, specialised content knowledge, knowledge of content/student/teaching and knowledge of content and curriculum horizon were learnt. However, not all of these knowledge domains were learnt in the DBE moderation workshop, as it focussed on the content and curriculum horizon. The NGO facilitator, who is an experienced teacher in Mathematics, focussed on the specialised content knowledge for teaching grade 10, 11 and 12 learners. The findings suggest that the teachers in the Mathematics Group collaborated during the workshops and outside of the workshops.

On the whole, the Mathematics Group seems to reflect the characteristics of a TLC while the Commerce Teachers' Association does not. This study implies that in the South African context, existing clusters and groups can operate as teacher learning communities but much depends on external factors such as the leadership, time, resources and size; and also the

autonomous decision-making of what should be learnt, and how it should be learnt. Therefore, the DBE, NGOs, and teachers should work harmoniously so that existing clusters and groups, including informal groups initiated by teachers themselves, operate as teacher learning communities, in order to achieve meaningful teaching and learning.

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CHAPTER ONE: OVERVIEW OF THE RESEARCH

1.1 Introduction

South African continuous professional development (CPD) models have begun to shift away from the traditional approaches that are now seen as "fragmented and offering short courses or workshops that do not put emphasise on content knowledge" (Taylor, 2002, p. 5) and towards collaborative learning in communities. This is evident from the empirical studies and the expanding literature on how teachers learn in a community of practice, particularly in teacher learning communities (TLCs), sometimes called professional learning communities (PLCs) (Jita & Mokhele, 2014; Brodie & Borko, 2016). The Department of Basic Education (DBE) and the Department of Higher Education and Training (DHET) have also noted that professional learning communities are important in promoting teacher development. Hence, the DBE and DHET (2011) have made provision for the establishment of PLCs in the Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED). There are a growing number of South African studies (Brodie & Borko, 2016; Cereseto, 2015) about how teachers learn in learning communities, and this study aims to add to this knowledge base as it explores teacher learning in teacher learning communities in KwaZulu-Natal.

This chapter presents the overview of this study which explores teacher learning in two teacher learning communities. The first section presents my personal context and motivation of the study. The second part discusses the background of the Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) policy in South Africa because one of the reasons for undertaking this research study emanated from this policy. The third section presents the rationale of the study which is followed by the purpose of the study. The chapter ends with the preview of the chapters in this thesis.

1.2. My personal context and motivation of the study

I was motivated to further explore the teacher learning phenomenon after my Masters study: "Teacher learning in the context of educational reforms: A study of Economics teachers" (Zulu, 2010). This study was framed by cognitive and social learning theories. In relation to

the theoretical frames, the study findings revealed that situated and social contexts in South Africa do not provide a sufficient explanation for how teacher learning takes place. These theories assume a context where productive learning is supported. The findings from the six teachers that I interviewed in that study revealed that there are learning communities that are not school-based in the Zethembe District (pseudonym). The findings also suggested that there was learning that was taking place. I then became eager to understand how teacher learning communities were formed, how teachers learn in these communities, and the nature of collaborative relationships in these learning communities. For the current study it took me two years to find the appropriate theoretical framework. I needed a framework that could be used in different contexts and could integrate social and cognitivist perspectives. I am an Economics teacher but I felt that my questions could not be fully addressed if I focused on Economics teachers only. I was also cluster coordinator of Economics teachers. I may be biased so I therefore decided to investigate the Commerce Teachers' Association and a group of Mathematics teachers in one cluster in the district, which I have called the Mathematics Group in order to compare the findings.

Furthermore, the ISPFTED captured my interest. This DBE and DHET (2011) policy is about the establishment of professional learning communities to strengthen teacher professional development. However, "establishing the PLCs does not occur spontaneously or quickly" (Morrissey, 2000, p. 4). There are knowledge gaps concerning how teacher learning communities are formed, the kinds of learning that happen in these teacher learning communities and how teacher learning takes place. The ISPFTED focuses on PLCs that are within the school context. South African researchers on PLCs, such as Cereseto (2015), have also alluded to the fact that there is still a need for researching PLCs outside of schools. My study therefore looks at TLCs outside the school context.

1.3. Background to the study

The Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) policy is the South African policy which was launched in 2011 by the Minister of Basic Education, Mrs A. Motshekga, together with the Minister of Higher Education and Training, Dr B. Nzimande. The ISPFTED is intended to improve the quality of teacher education and development in order to improve the quality of teachers and teaching within a 15- year timeframe. The DBE and the DHET (2011) hope to achieve this outcome through

outputs and activities grouped in terms of the agency that has prime responsibility for ensuring their achievement:

A. Output and activities to be led by the Department of Basic Education

B. Output and activities to be led by the Provincial Departments of Education.

C. Output and activities to be led by the Department of Higher Education and Training (DBE & DHET, 2011, p. 4).

From these three groups of output and activities, the establishment of PLCs to strengthen teacher professionalism falls under the second one, B: Output and activities led by the Provincial Education Departments (PEDs). According to the DBE and the DHET (2011), the issue of enhancing professional development at the local (or provincial) level was raised, because teachers experience significant difficulties in accessing and receiving support, resources and continuing professional development opportunities close to where they live and work. This is especially true for the large majority of teachers who work in rural areas and whose difficulty is even more pronounced. Hence the DBE and the DHET (2011) envisage that support and resources for teachers, and access to professional development opportunities, will be enhanced at a local level by the establishment of PLCs in schools.

In the South African policy context, "PLCs are communities that provide the setting and necessary support for groups of classroom teachers, school managers and subject advisors to participate collectively in determining their own developmental trajectories, and to set up activities that will drive their development" (DBE & DHET, 2011, p. 14). This definition of PLCs seems to imply that PLCs are within the school. Servage contends that a: "Professional learning community (PLC) is normally associated with a certain set of behaviours, dispositions and learning priorities manifesting in collaborative professional development" (Servage, 2009, p.151). In this light, this study focuses on two teachers' groups which are called teacher learning communities (TLCs). In this study, "TLCs embody characteristics closely associated with sustained improvement in school teaching and learning" (Hargreaves, Berry, Lai, Leung, Scott & Stobart 2012, p. 12). While the DBE and DHET use the term PLCs in this study I use the term TLC because the learning communities may not reflect all the characteristics of a PLC. The research was conducted a year after the introduction of the ISPFTED in South Africa.

According to the DBE and DHET (2011), the key role players in the establishment and the functioning of the PLCs are the Provincial Education Departments, districts, teacher organisations, subject-based professional teacher associations, and the teachers themselves. The role of the DBE, from local up to national level, is to support the work of the PLCs by developing activities and materials that can help stimulate their work. The other key role players are school management teams and the South African Council of Educators (SACE). What follows now is a discussion of the functions of the key role players in the establishment and functioning of PLCs. These functions are adapted from "Professional Learning Communities: A guideline for South African schools" (DBE, 2015, pp. 12-15).

The role of teachers is to:

- ❖ Be motivated to actively engage in PLCs as a way to strengthen teacher professionalism and improve learning outcomes.
- ❖ Be open to contribute as well as learn.
- ❖ Regard actively participating in PLCs as an integral part of teaching practice.
- ❖ Take up leadership roles in PLCs, such as facilitation, setting the agenda and defining the outcomes.

The role of the School Management Team (SMT) is to:

- ❖ Motivate teachers to engage in PLCs and to create the conditions wherein PLCs can thrive. However, it is not the role of the principal to chair every meeting.
- ❖ Guide the process to establish PLCs in school, including expected outcomes and output and identifying people willing to take up leadership roles.
- ❖ Support PLCs by resource allocation, logistics and timetabling.

The role of the Districts is to:

- ❖ Support PLCs with resources and expertise on facilitation skills, video analysis, development of teaching resources, and the use of ICT etc.
- ❖ Highlight issues for discussion at provincial and national level.
- ❖ Function as a hub for exchanging PLCs practices within the district.
- ❖ Create opportunities for follow up via PLCS in other professional development activities such as workshops.
- ❖ Provide annual progress reports of implementation of PLCs to the provincial level District Teacher Development Centre.

- ❖ Develop synergies between PLCs and district subject committees.

The role of Provinces is to:

- ❖ Provide enabling environment for PLCs to be successful.
- ❖ Provide external input to PLCs through subject advisors or trained mentor teachers,
- ❖ Provide support to PLCs through development of expertise in the use of the evidence-based assessment.
- ❖ Monitor implementation of PLCs in the provinces, recording inputs from the districts.
- ❖ Develop synergies between PLCs and provincial and district subjects committees.
- ❖ Function as a hub for exchanging PLCs practices within the province.
- ❖ Inform the national level on matters pertaining to the implementation of PLCs.
- ❖ Provide annual progress reports of the implementation of PLCs to the national level.

The role of national level is to:

- ❖ Ensure a common vision for PLCs and their implementation and to ensure that each province works towards the same objectives.
- ❖ Invite the expert contributors to discussions on an ad-hoc basis in order to keep informed about local and international good practices on PLCs.
- ❖ Assist with the development of meaningful activities to stimulate the development of the learning communities.
- ❖ Provide teachers with resources that help them to integrate their own professional knowledge with the latest research-based knowledge about content and practice.

The role of Teacher Unions includes:

- ❖ Promoting teacher professionalism through advocating, supporting and encouraging teachers to participate actively and meaningfully in PLCs and address their development needs.

The role of South African Council of Educators (SACE)

In SACE there is teacher- initiated (Type 1 and 2) Professional Development activity within the SACE CPTD system. Type 1 Professional Development activities include mentoring and coaching less experienced teachers, reading educational materials for teaching and learning, and initiating or leading school projects. Type 2 Professional Development activities include

discussing educational topics with colleagues and taking part in interventions such as responding to schools' projects.

- ❖ In compliance with SACE CPTD systems, teachers must attend at least eight relevant educational meetings/ or breakfast sessions per annum in order to claim 10 Professional Development points for the year, including discussing educational topics with colleagues. Teachers need to report on PLC meetings and how they contributed to professional development in their Professional Development Portfolio.

The role of Subject-Based Teacher Organisations is to:

- ❖ Bring expertise and collaborate with other partners to develop diagnostic self-assessment tools that will help to identify areas of improvement for individual teachers. The areas of improvement can then be worked on within the PLCs.
- ❖ Develop, select and share materials and resources that can be used in PLCs.
- ❖ Develop an on-line clearinghouse where resources developed in PLCs can be shared.
- ❖ Develop an on-line forum that can be used to facilitate follow –up discussion within PLCs and to create links between PLCs.

The role of Higher Education Institutions includes to:

- ❖ Strengthen the knowledge base of teacher professional development and PLCs and to disseminate results widely in order to benefit the education system.
- ❖ Integrate PLCs in their offer of professional development. Training materials could include materials for use in PLCs, follow-up programmes.
- ❖ Instil recognition for the need of continuous professional development in their pre-service teacher training programmes.
- ❖ Encourage students to engage with activities (such as reflection, peer observation, action research) which are central to PLCs.
- ❖ Build awareness, insight and skills on the support of PLCs for school leaders in their in-service programme.
- ❖ Encourage students of pre-service and in-service programmes that school leaders form their own PLCs.

The roles of these key role players in PLCs seem to suggest that learning activities that take place in PLCs as envisaged by the DBE and DHET (2011) go hand in hand with accountability. For example, the stakeholders such as principals and teachers should account

for what was learnt to SACE. Furthermore, the ISPFTED does not stipulate how the subjects groups that are led by the school-based subject specialists differ from the school-based PLCs. While the ISPFTED focuses on the PLCs that are within the school, this study investigates TLCs that are outside of the school context.

1.4. Rationale for the study

The broad issue that has led to this research study is the official recognition of teacher learning in learning communities. According to the DHET and the DBE (2011), these teacher learning communities are called professional learning communities (PLCs). These two departments claim that the PLC is one of the professional development models used in the South African context. In the ISPFTED, the DBE and the DHET (2011) make a commitment of support for teachers and access to professional development opportunities that will be enhanced at the local level.

The ISPFTED is aligned with the international literature (Bolam, McMahon & Stoll 2005; William, 2007) on teacher learning communities (TLCs). According to Bolam et al. (2005), the aim of the TLC is to provide support for, and to engage the environment in, continuous learning and development of teachers and schools. These authors further claim that learning in TLCs enables better learning and achievement of learners. In general, the international studies on TLCs emphasize that TLCs that are formed within the school context are powerful to help teachers improve their teaching practices. For example, Schnellert, Butler and Higginson, (2004) focused on a study of six teachers who worked with university researchers, which was undertaken in one of the Canadian schools. The findings of this study noted that the collaboration of the six teachers enabled them to use learning tools designed to develop and measure the progress in literacy skills among students. In other words, the six teachers were able to meet part of the Canadian policy target called Learning Through Reading.

In addition, there is some evidence of studies that are carried out not only on TLCs within the school, but on those that are outside of the school context. International studies by Priestley, Miller, Barret and Wallace (2011) and Butler, Schnellert and MacNeil (2015) have focused on TLCs that are outside of the school. These two international studies report that teachers engaged in TLC activities among other things as a way of talking, sharing ideas and thinking about their own professional development in relation to the education policy (strategies for

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formative assessment initiatives). This situation is similar to the South African ISPFTED policy context of the TLC, where the DBE and the DHET (2011) state that TLC activities should include having discussions on educational topics with colleagues and taking part in interventions set up as a response to Annual National Assessment results.

Generally, both international and South African studies, as shown above, seem to focus on TLCs that are within the school context. There is still a need to understand how learning occurs, the kind of knowledge learnt and the nature of collaborative relationships in the TLCs that are outside of the school context. Hence, this study is important because it contributes to the knowledge about the TLCs that are outside the school context.

The South African studies on TLCs (Brodie & Borko 2016; Maistry 2005; Graven 2005) seem to rely on Wenger's (1998) theory on communities of practice which has some short-comings when used. One of the shortcomings is that it does not accommodate the presence of an expert facilitator in the community (these shortcomings are shown in chapter two). Furthermore, there has been a call from Brodie and Borko (2016) for a strong theoretical perspective that should include each of the three concepts in the term: "professional learning community". In relation to the above gap and call, this study uses cultural- historical activity theory (CHAT) and teacher knowledge conceptual frameworks as lenses through which learning in TLC can be understood. The three concepts of a professional learning community seem to be illuminated within the seven elements of CHAT. In South Africa, there are studies that have used CHAT as a theoretical framework. Mukeredzi (2009) used CHAT to understand unqualified teachers' professional learning in rural schools and Van Der Riets (2008) in Mukeredzi (2009, employed it to understand HIV/AIDS Interventions. This study draws on CHAT to understand teacher learning in two TLCs.

1.5. The purpose of the study

This research study explores teacher learning in teacher learning communities (TLCs). There are teacher learning communities that are formed within the school context and there are those TLCs that are outside of the school context. The South African literature on TLCs shows that there is a growing body of research on professional development models for teachers that support the concept of learning communities as a new paradigm of professional teacher learning, both within and outside of the school context. In Brodie and Borko (2016) a different group of South African researchers have studied PLCs that are within the school context. These researchers claim that "PLCs attempt to make a difference in an over-

changing or and never changing or whether changing they hold promise for long term, sustainable system wide teacher and learner development" (Brodie & Borko, 2016, p.7).

The current study focuses on two groups of teachers teaching at the FET Band, grades 10–12, in KwaZulu-Natal. One is a group of Mathematics teachers, and the other is a group of Commerce teachers. The study investigates how teachers learn and the kinds of teacher knowledge that is learnt in these learning communities. In the study I aim to contribute to the knowledge about teacher learning in TLCs in the South African context, specifically in the rural context. The research questions I am interested in are:

1. How were these two selected teacher learning communities formed?

2. How does teacher learning happen in these two selected teacher learning communities?

3. What kind of teacher knowledge is learnt in these teacher learning communities?

4. What is the nature of the collaborative relationships in the teacher learning communities?

1.6. Preview of Chapters

Chapter Two starts with an explanation of the concepts of professional development and teacher learning and shows the differences between these concepts. An explanation of the characteristics of the PLCs according to the ISPFTED and the literature, further elaborates and explores South African and international perspectives, particularly of empirical studies of teacher learning communities (TLCs) or professional learning communities (PLCs). The conclusion of the chapter discusses the implications of the literature review in terms of TLCs/ PLCs in South African context.

Chapter Three discusses the theoretical and conceptual frameworks which inform the study. The chapter starts with a detailed explanation of CHAT and how it is used in the study. The chapter also highlights the limitations of CHAT regarding issues of teacher knowledge, which were addressed by using Grossman's (1991) and Ball, Thames and Phelps' (2008) domains of teacher knowledge.

Chapter Four provides an extensive discussion of the methodology of this research with a focus on research approach, research design, data collection techniques, sampling, ethical issues, trustworthiness of the study and analytical tools. The last section of chapter four discusses the limitations of the research.

Chapter Five discusses the history and formation of the Commerce Teachers' Association. This chapter uses CHAT to conceptualize the election meeting for an executive committee. The chapter concludes with the implications of the Commerce Teachers' Association history and formation in terms of the formation of a teacher learning community.

Chapter Six uses CHAT and Grossman's (1991) knowledge domains to establish how teacher learning happens, the type of knowledge learnt and the nature of the collaborative relationship in the Commerce Teachers' Association.

Chapter Seven presents the findings on the history and formation of the Mathematics Group. The chapter ends with the implications of the Mathematics Group's history and formation in terms of the formation of a teacher learning community.

Chapter Eight uses CHAT to establish how teacher learning happens, as well as Ball, Thames & Phelps' (2008) and Hurrell's (2013) supporting questions, to analyse the type of knowledge learnt. Chapter eight also discusses the nature of collaborative relationships in the Mathematics Group.

Finally, Chapter Nine brings together the findings of this research according to the four research questions of the study. This is done by comparing the findings of each case in relation to the characteristics of PLCs. The chapter ends by showing the implications of the study and highlights aspects of future research in teacher learning communities.

1.7. Conclusion

This chapter has presented the overview of this study. The next chapter is a review of the literature.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

Chapter one, the overview of this research, has reviewed some of literature in order to show the gaps in the research that need to be addressed concerning teacher learning in teacher learning communities (TLCs). This chapter reviews the international and South African literature in more depth. Increasingly, research (Priestly, Miller, Barret, & Wallace, 2011; Schnellert, Butler, & Haigginson, 2008) in professional development raises a concern about traditional training models that offer training that is too short, and provide insufficient classroom support structures. The traditional models such as training and cascading models seem to be popular ones that are used in South Africa to prepare teachers for implementation of curriculum reform. The training model is universally recognisable and has been the dominant one for continuous professional development for teachers. According to Guskey (2000) in the training, model teacher professional development is generally delivered to teachers by an expert with the agenda determined by the deliverer. Kennedy (2005) maintains that this model of CPD supports a skill-based technocratic view of teaching whereby CPD provides teachers with the opportunity to update their skills in order to demonstrate their competence.

Another traditional model is the cascading model which Kennedy (2005) describes it as the model that involves individual teacher attending training events and then cascades or disseminates the information to colleagues. The cascading model is popular for reaching many participants in a short time and it transmits the knowledge or information from the top to the lower stratified groups of teachers. This consequently entails training-the-trainer to ensure that the message flows down from experts and specialists eventually to the teacher (Ono & Ferreira, 2010, p. 61). Currently the DBE is using this model for the matric intervention programme (MIP) whereby the subject cluster leaders are trained and then they train other teachers. In the South African context these models seem to be dominant, as they are also used to introduce teachers to the new curriculum reforms such as National Curriculum Statement (NCS), Revised National Curriculum statement (RNCS) and Curriculum and Assessment Policy Statement (CAPS).

The traditional models have many strengths; one of them is that the knowledge that is presented to teachers is often beyond their existing experience and it can be presented in

convenient ways (Hoban, 2002). However, the traditional professional development models are criticised for being brief, fragmented, incoherent encounters that are decontextualized and isolated from real classroom situations (Kennedy, 2005; Bantwini, 2009; Cochran- Smith & Lytle, 1999; Servage, 2009; Kriek & Grayson, 2009; Graven, 2002; Armour & Mokopoula 2012; Jita & Mokhele, 2012; Hargreaves, Berry, Lai, Leung, Scott & Stobart, 2013). Some of these authors critique the traditional training models and then suggest that teacher learning communities can mutually enhance each other's and their pupils' learning, thus building capacity for sustainable improvement (Hargreaves, Berry, Lai, Leung, Scott & Stobart, 2013). Hence this study seeks to understand how teacher learning happens in two teacher learning communities. The following are the research questions:

1. How were the two selected teacher learning communities formed?

2. How does teacher learning happen in the two selected teacher learning communities?

3. What kind of teacher knowledge is learnt in these teacher learning communities?

4. What is the nature of the collaborative relationship in teacher learning communities?

This literature review has four sections. The first section attempts to explain the concept professional development, because teacher learning communities are one of the professional development models. Secondly, it explains the meaning of teacher learning and the different ways in which teacher learning may happen. The third section describes teacher learning communities (TLCs) as one approach to teacher learning, international and South African perspectives of TLCs. The fourth section discusses implications of the literature to this research study.

2.2. Professional Development

Professional development in general refers to the development of a person in his or her professional role. Day (1999) defines professional development as the means by which teachers and other members of the teaching profession improve and broaden their knowledge and skills to develop the personal qualities required in their professional lives. In agreement with Day (1999), other researchers (Darling- Hammond, 1994; Keiny, 1994) also define professional development as a process of enhancing teachers' professional status by expanding the knowledge base upon which the profession draws and increasing teachers' epistemological awareness. Sometimes professional development is called Continuing

Professional Development (CPD) or In-Service Education and Training (INSET). In an international literature review of teacher professional development by UNESCO International Institute for Education Planning (2003), the concept professional development is perceived as being more than career development. It includes both formal experiences (such as workshops and professional meetings, mentoring) and informal experiences (such as reading professional publications, watching television documentaries related to an academic discipline etc.).

In the South African context, CPD refers to a process whereby teachers continuously improve their skills, knowledge and attitude while employed (Hendricks & Bosschoff, 2009, p. 477). The DBE workshops may have developed teachers skills and knowledge, but they do not appear to have been successful in increasing the learners' achievement. For example, the Department of Basic Education has run a number of workshops which focus on how to teach the curriculum, which started out as Curriculum 2005 in 1997, shifted to the National Curriculum Statements in 2002 and currently is in its third iteration, known as the Curriculum and Assessment Policy Statements (Bertram, 2011, p. 19), but learner achievement has not improved significantly.

To give a more descriptive interpretation of professional development, the term is defined as "the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purpose of teaching; and by which they acquire and develop critically the knowledge and skills for planning and practice with children, young people and colleagues through each phase of their teaching lives" (Ifanti & Fotopoulopou, 2011, p. 41). Guskey (2000) defined professional development as the process and activities designed to enhance the professional knowledge, skills and attitudes of educators so that they might in turn improve the learning of students (Guskey, 2000, p.16). He further perceives professional development as having three characteristics:

➤ Professional development is an intentional process. This means that professional development is a deliberate process, guided by a clear vision of purpose and planned goals. When goals and purpose are clear it is easier to determine the kind of information that needs to be gathered to verify whether or not those goals were met.

➤ Professional development is an on-going process. In this characteristic of professional development, Guskey (2000) highlights that every subject area and academic discipline is expanding, and in order to keep abreast of the new knowledge and

understanding, educators at all levels must be continuous learners throughout the entire span of their professional careers.

➢ Professional development is a systemic process. It is important to be clear about the organisational support of professional development. Regarding this characteristic, Guskey (2000) comments on co-operative learning strategies that happen when a group of educators takes part in a professional development. He further clarifies that through co-operative learning participants gain a thorough understanding of co-operative learning, organize a variety of classroom activities based on co-operative learning principles, and practice various implementation strategies (Guskey, 2000, p.21).

Guskey's (2000) definition and characteristics of professional development appear to be in line with Hoban (2002) who says teaching is conceived as a labour that is mastered. This suggests that teacher learning only involves attending formal workshops to gain additional knowledge and skills to increase mastery. While teacher learning can happen through formal professional activities, it can also happen through informal activities. Avalos (2010) reviews publications on teacher professional development in order to show the shift from traditional (such as training models characterised by a once-off workshop) to modern teacher professional models; for example teacher learning communities. She defines professional development in relation to learning, by saying that "professional development is about learning, learning how to learn, and transforming knowledge into practice for the benefit of the students' growth" (Avalos, 2010, p. 1). In this definition professional development is defined in relation to learning and knowledge.

Interestingly, some researchers (Darling-Hammond & Richardson, 2009; Lovett & Cameron, 2011) maintain that the definition of the term "professional development" is incomplete. Hence they call for a definition of professional development that relates to three areas: content, context, and design. However, these authors do not give an actual definition of professional development. Instead, they relate the three areas to teacher learning. Darling-Hammond and Richardson (2009) argue that the content of teachers' professional learning should be centred on student learning and involve active teaching, assessment, observation and reflection. They further explain that if professional development is designed in a way that makes learning active and sustained, there is greater chance of teachers' engagement. Furthermore Darling-Hammond and Richardson (2009) maintain that peer observation of practice, shared analysis of students' work and data, and engagement in study groups all have

particular value in satisfying the learning needs of teachers. In summary, these three areas (content, context and design) imply that professional development should always be understood in relation to teacher learning that takes place in multiple contexts. Borko (2004) concurs by saying that in order to understand teacher learning we must study it within multiple contexts, taking into account both the individual teacher-learners and the social systems in which they are participants.

The next section presents an analysis of the concept of teacher learning and the ways in which teacher learning happen.

2.3. Teacher learning

Teacher learning is a complex phenomenon which can be understood from different perspectives. The complexity perspective assumes that "there are various dynamics at work in social behaviour and these interact and combine in different ways such that even the simplest decisions can have multiple pathways" (Opfer & Pedder, 2011, p. 378). In the context of this research on teacher learning in teacher learning communities, complexity of teacher learning is signified by the interaction of the different elements of an activity system. However, this study is not framed by the complexity theory, but rather the complexity ideology is integrated within cultural- historical activity theory (CHAT).

Teacher learning activities may be formal or informal, planned or incidental, and voluntary or compulsory (Fraser, Kennedy Reid & McKinney 2007). These authors then state that teachers' professional learning can be defined as the process that results in specific changes to professional knowledge, skills, attitudes, beliefs or action of teachers. "The most precise thing that researchers can say about teacher learning is that teachers learn in a range of different ways" (Bertram, 2011, p. 12). Teacher professional development and professional learning are not the same but they are closely intertwined, "for without professional development it is unlikely to have any impact, this means that any well-constructed professional development should be designed to promote learning" (Timperley, Wilson, Barrar & Fung, 2007, p. 3). However, it is possible for teachers to participate in formal professional development activities but not learn, and conversely, teachers may learn from informal activities. In relation to the school context, the literature views professional development as being an "integration of teacher learning with school improvement because learning is linked to what teachers do in the classroom, and teachers' learning is collaborative

and thereby allows them to effect changes beyond the individual classroom" (Lovett & Cameron, 2011, p. 90).

One group of researchers define teacher learning in relation to both cognitive theories and socio-cultural perspectives of learning (Kelly, 2006; Browns, Collins & Daguid 1989). These are the theories that are used to explain how teacher learning takes place. According to Kelly (2006), the cognitive perspective advocates that individuals acquire skills and knowledge which reside entirely in the individual's mind. According to this theory, for teachers to become experts they need to learn the defined body of knowledge which constitutes professional expertise, and then apply this in their practices. Similarly, Gillian, Lewis, Wils and Mutch (1996) who look at teachers as adult learners, define teacher learning as a process of gaining knowledge and understanding of a concept or topic. Their definition seems to be in line with the cognitive approach. The cognitive literature (Kwakman, 2003; Lieberman & Mace, 2008; Henze, van Driel & Verloop, 2009) identifies different strategies of teacher learning such as learning by reading and learning by thinking. Essentially, the key point is that teachers may learn from either formal or informal activities or both individually and collaboratively. However, the cognitive perspective focuses strongly on individual learning.

Reading seems to be the most popular example of individual learning. According to the international literature on professional development by UNESCO (2005), learning by reading includes informal experiences such as reading professional publications, reading books, watching television documentaries related to one's subject and browsing information from the internet. Kwakman (2003) states that the main aim of reading is keeping up to date with new insights and developments influencing the professional field such as new subject matter, new teaching methods, teaching manuals, new pedagogical approaches and societal developments which have an impact on education and teaching in general.

Some evidence of the success of teachers learning individually is shown by Lieberman and Mace (2008). In their study, they found websites of teaching practice to be extremely helpful to teachers. Furthermore, the findings of a study of experienced science teachers' learning in the Netherlands context highlight that teachers learn individually. These science teachers learn by reading study books and newspapers while preparing for the lesson. In this study, these teachers developed their competences in new teaching methods by experimenting individually and practising in the classroom (Henze, Verloop & van Driel, 2009, p. 189). This individual aspect of learning is not well documented for South African teachers.

Teachers also learn by thinking, which is firstly a cognitive and individual activity, although can have benefits for the group. According to Henze et al. (2009), learning by thinking requires teachers to take time to reflect and think about school matters. In this instance, a teacher is not just a teacher but a reflective practitioner. Reflection is viewed as the cornerstone of professional development as it is a prerequisite to recognizing and changing routine behaviour (Kwakman, 2003, p. 153). He maintains that unlearning routines is the first step in changing practices and thus improving the quality of teaching and education. He further stresses that the object of reflection is to address teachers' own way of teaching and the act of reflection is also connected to the availability of feedback that may spring from different sources within the work environment (Kwakman, 2003, p. 153). Teachers reflect in different ways. They can reflect by writing in journals, telling their stories, and writing their autobiographies. Nieto (2003) believes that teaching is an encounter with self. Hence, teachers need to put their experiences and associated feelings into words, that is, by telling or writing their autobiographies. This act of reflection is the way in which emotional knowledge is learnt. Nieto (2003) further states that teachers' stories can be a source of inspiration and strength for other teachers.

These two teacher learning strategies, learning by reading and learning by thinking seem to be in line with a cognitive perspective which posits that "knowing is treated as the manipulation of symbols inside the mind of the individual, and learning as the acquisition of knowledge and skills thought to be useful in a wide variety of setting" (Borko, 2000, p. 4). The understanding according to the cognitive perspective is that learning acquired in one setting will be easily be transferred to another setting. This statement is further supported in Cobb and Bowers (1999) who relate learning and knowledge. They state that a central organizing metaphor is that knowledge is an entity that is acquired in one setting and conveyed to other tasks.

In contrast to cognitive views, the literature (Kelly, 2006; Lave & Wenger, 1991; Long, 2007; Putman & Borko, 2000; Elster; 2010) argues that teacher learning is not only about acquiring fact-based knowledge, but that teachers have to learn new concepts of content and pedagogy and have to take on new roles. The socio-cultural perspective of learning is clearly articulated in situated and social learning theories (Lave & Wenger, 1991, Kelly, 2006; Long, 2007; Putman & Borko, 2000; Elster, 2010). From a socio-cultural perspective, learning is understood as a collaborative practice. The social learning theories posit that the socio-cultural perspective of learning is based on the following assumptions.

- Expert teachers have an active and productive relationship with their knowledge- in-practice and knowledge-of- practice (Kelly, 2006). On the one hand Kelly (2006) explains that knowledge- in-practice cannot be easily articulated, hence he calls it tacit knowledge and it is rooted in professional activity. On the other hand he writes of knowledge-of- practice as practical knowledge. Cochran-Smith and Lytle (1999) use these two terms differently from Kelly (2006). Their concept of knowledge-in-practice "assumes that teachers learn when they have opportunities to probe knowledge embedded in the work of the expert teacher and/ or deepen their knowledge and expertise as makers of wise judgements of rich interactions in the classroom" (Cochran-Smith &Lytle 1999, p. 250). Secondly, the knowledge-of-practice concept of teacher learning "assumes that knowledge making is understood as a pedagogical act that is constructed in the context of use intimately connected to the knower and to immediate situations" (Cochran-Smith & Lytle, 1999, p. 273).

- The process of knowing-in-practice "does not reside within individuals; rather it is distributed across teachers, students and both conceptual artefacts and theories, and physical artefacts such as books and computers" (Kelly, 2006, p. 507).

- Teacher learning is the movement of teachers from peripheral (novice) to full (expert) participation in the specific working practices and their associated ways of knowing and thinking which define particular school circumstances (Wenger, 1998).

- Teacher identities are significant, and revealed in the stance teachers adopt in their working lives (Wenger, 1991). Teacher identities refer to the ways in which teachers see themselves in response to the action of others towards them. Wenger (1991) suggests that construction of identity takes place through participation in situations.

- The socio-cultural approach is comprised of four areas that are seen as the central components of social learning theory namely: teacher knowledge, teacher knowing, teaching practices and teacher identity (Kelly, 2006, p. 507).

The above assumptions imply that when teachers are in their classroom they draw from their practical knowledge and tacit knowledge. However, the tacit knowledge is abstract, so one may not easily account for how teachers use it.

A situative view assumes that knowing and learning is situated in a physical and social context (Brown, Collins & Duguid, 1989; Greeno, Collins & Resnick, 1996). From a situative perspective teacher learning is defined "as a process of increasing participation in the practice

of teaching and through this process, it is a process of becoming knowledgeable in and about teaching" (Borko, 2000, p. 4). Learning is assumed to be situated in the physical context where it is used (Brown, Collins & Daguid, 1989; Greeno, Collins & Resnick 1996; Borko, 2000). According to Borko (2000), teacher learning occurs in many different aspects of practice, including their classrooms, their school communities, and professional development courses or workshops. From a situative perspective, teacher learning is defined as a process of increasing participation in the practice of teaching and through this process, becoming knowledgeable in and about teaching (Borko, 2000, p. 4).

The situative view of cognition is similar to the socio- cultural approach in that they both consider knowledge making a pedagogical act that is constructed in the context of use connected to the knower and through relevant and immediate situations, such as the classroom situation. Learning by doing is in line with the situative perspective that learning is regarded as an "integral part of generative social practices in the lived-in world" (Lave & Wenger, 1991, p. 31). Teacher learning in the workplace takes place as a result of teachers' participation in everyday activities in the working context (Darling-Hammond, 1998; Mclaugh, 1997; Putnam & Borko, 2000; Henze, Verlooop & van Driel, 2009). Lieberman and Mace (2008) concur with Kwakman (2003) that teacher learning takes place through experience and practice. Kwakman (2003) contends that by doing and experimenting, teachers not only gain new experiences but new ideas as well in that they put more effort into improving their own professional practices within the classroom. Pedagogical knowledge is therefore acquired in this way. Jarvis (1987), in Kwakman (2003), seems to agree that 'doing' (Kwakman, 2003, p.153) in itself may be linked to learning, as doing addresses routine behaviour. Kwakman (2003) suggests that experimenting, as an intentional effort of teachers to try something new within the classroom, is most appropriate to teacher learning.

Furthermore, the research review on teacher learning shows that the socio-cultural approach focuses strongly on the context of learning. This is evident when Darling-Hammond (2009) states that professional development is more effective when the school- based approach is used, as it is not in isolation because it provides hand-on learning. Day and Gu (2007), however, remind us that schools can provide favourable and unfavourable learning environments which may enhance or diminish teachers' sense of space and energy to learn. It seems as if Day and Gu (2007) concur with Resonoltz's (1989) findings in Adey (2004), who links the school environment variables with a model of effective professional development.

Adey (2004) claims that teachers typically say they never stop learning in enriched schools, while teachers say that it takes two or three years to learn to teach in impoverished schools. He clarifies that when learning in enriched schools, teachers see professional development as continuous and often self-driven by experimentation and reflection, as well as from conferences, while in impoverished schools, professional development is seen as finite, to learn a particular skill or technique, and is perceived as provided by outsiders (Adey, Hewitt & Landau, 2004, p.171). Furthermore, Day and Gu (2007), in their study on variations in the conditions for teachers' professional learning, find that professional learning activities in relation to classroom knowledge have a positive impact on teachers' morale and are significant to teacher confidence in the classroom. However, Borko (2000) argues that the school learning environment typically does not emphasise sharing of learning and cognitive performance, it focuses on individual competence.

This section has provided an explanation of teacher learning through the lenses of cognitive and social learning theories. These theories on teacher learning explain teacher learning in different ways. In this study, I argue that a definition of the concept of teacher learning should integrate both cognitive and social learning perspectives. Hence this study uses cultural- historical activity theory because this theoretical framework integrates both cognitive and social perspectives. I have also presented the ways in which teacher learning happens. In the context of this research the complexity of teacher learning is assumed to be occurring within systems of an activity in teacher learning communities.

In the section that follows, I analyse the literature on teacher learning communities.

2.3. Teacher learning communities

The literature on teacher learning shows that the working context is seen as being broader than classroom and schools, as it includes various communities such as cross-school professional groups of people (Henze & van Driel, 2009, p. 189). Teacher networks have gained popularity in countries such as the United States of America (USA) and the United Kingdom (UK). However, the international literature does not have a universal definition of a TLC. The definition of the term teacher learning community depends on the context in which it is formed, within the school or out of the school. For example, in one school setting, Chow (2015) defines a teacher learning community as a place where teachers are engaged as active learners in matters of special importance to them and where everyone is encouraging everyone's learning. Teacher learning communities "embody the concept of teacher learning

in a setting in which teachers come together over time for the purpose of reconsidering their existing beliefs and practice, gaining new professional knowledge and skills and reconstructing reform agendas that enhance student learning and professional practice" (Chow, 2015, p. 288). Many international studies on TLCs stress that teachers are professionals; hence they call them professional learning communities (PLCs). The meaning of the phrase "professional learning community" as used in the international studies is explained in the meaning of teacher learning community.

The literature (Hargreaves, Berry, Lai, Leung, Scott & Stobart, 2012; William, 2007) shows that the concept teacher learning communities (TLCs) is distinct from professional learning communities (PLCs). PLCs focus specifically on practice rather than teaching and learning, while TLCs "embody characteristics closely associated with sustained improvement in school teaching and learning" (Hargreaves et al., 2012, p. 12). William (2007) contends that TLCs are only those groups of teachers who learn and attempt to make changes in their classroom practice. According to William (2007), TLCs do not include administrators and other professionals, although these people can provide TLCs with support and advocacy of the group. Pirtle and Tobia (2014) also argue that the term PLCs has become overused and the meaning is often lost. They say that PLC is the name given to teachers' collaborative professional learning. Only when teachers reflect on their instructional practice, consider the effect that instruction has on students, and implement insights gained from the meeting or workshop to improve their teaching performance, can such collaboration be called a PLC (Pirtle & Tobia, 2014, p.1). From the views of these two authors, one may conclude that reflection is an important aspect of the PLC.

In TLCs, teachers are regarded as communities of learners. The concept of *communities of learners* stems from theories of situated learning and community of practice which describes the collaboration of teachers with each other and with researchers (Lave & Wenger 1991; Lieberman & Muller, 2008). According to Lieberman and Muller (2008), a community of practice is about much more than what works in terms of shared experiences. In relation to shared experiences, they argue that learning is not about what happens in people's heads, it is about what happens in their relationship and conversation with others who are engaged in common work. This strategy of learning is also known as collaborative learning (Kwakman, 2003, p.153). According to Kwakman (2003), collaboration is very important to professional development as it not only provides necessary support for learning but also provides teachers with feedback and brings about new ideas and challenges. Hargreaves (1994) argues that the

content of collegial interaction is the most important in considering the contribution of collaboration to teachers' professional development. However, collaboration may take different forms that do not automatically lead to learning (Kwakman, 2003, p .153). Furthermore, in a research review on teacher learning, Darling-Hammond (2009) highlights that collaborative and collegial learning environments help to develop communities of practice to promote change.

With regard to the term professional learning communities, Long (2012) notes that the term *professional* acknowledges teachers as professionals. Stoll and Louis (2007) define this term by relating it to a community's work. They state that the word *professional* suggests that the community's work is underpinned "by a specialized and technical knowledge base, a service ethic orienting members to meet client needs, strong collective identity through professional commitment and professional autonomy through collegial control over practice and professional standards" (Stoll & Louis, 2007, p.2).

The word *learning* is between the professional / teacher and the community. According to Stoll and Louis (2007) learning appears between the professional and the community because it connotes a shift away from a focus on process, and towards the objective of improvement. *Learning* in the context of professional community, involves working together towards a common understanding of concepts and practices (Stoll & Louis, 2007, p. 3). *Learning* is further defined by Long (2012) as gaining professional knowledge and expertise through shared process and experience. The terms professional and learning lead us to another phrase: *professional learning*. According to Long (2012), the concept of professional learning promotes an educational view that learning for teachers is continuous, dynamic and ever-changing. Other researchers (Doecke, Parr & North, 2008, cited in Long, 2012) contend that professional learning is concerned with pedagogy, where teachers' choices about content and strategies impact directly on the quality of learning of the students. *Professional learning* therefore focuses on teachers as facilitators or controllers of their own learning that can be made possible through networks or groups of teachers who explore common issues of pedagogy established within school contexts (Long, 2012, p. 148).

The term *community* in general, means a group with similar interest or origin living together. The concept *community* of learners (in this study, teachers are learners) stems from situated learning which describes collaboration of teachers with one another (Lave & Wenger, 1991;

Elster, 2010). In this study, the community is a group of teachers who share the same set of concerns, problems and interest in a particular topic (Long, 2012). Chow's (2015) study on teacher learning community in a Chinese context uses Senge's (1990) work on learning organisations. Chow understands the concept "learning community" as people in a learning organization who expand their capacity to create the results they desire through exploring collective aspirations (Chow, 2015, p. 288). Senge (1990) describes five learning disciplines that are requisites to building a learning organisation: personal mastery, mental models, team building, building shared vision and systems thinking. Long (2012) defines professional learning communities as the personal and collaborative development of teacher professional knowledge, and expertise gained through shared process and experiences pursued over sustained period of time. These two authors concur with each other in defining professional learning communities. The goals of professional learning communities are to improve learning and teaching skills, to share responsibility for professional growth and development of colleagues and to partake in professionally guided discourse about one's teaching and learning (Elster, 2010, p. 218).

2.3.1. Characteristics of PLCs

The literature on PLCs identifies several characteristics of PLCs and these characteristics are also applicable to the TLCs. For the purpose of this literature review I am use the terms TLCs and PLCs according to authors' usage of them.

The literature identifies seven characteristics, namely: shared values and vision, collective responsibility, reflective professional inquiry, collaboration, regularity, promotion of group and individual learning, and distributed leadership (Stoll, Bolam, Wallace & Thomas, 2006). Some of these characteristics have been alluded to by the definitions in the above section. These characteristics are applicable for TLCs both within and outside of the school.

2.3.1.1. Shared values and vision

According to Thomas (2006), TLCs have a shared vision and sense of purpose which is centrally important in the TLCs. In the South African context, policy states that a shared vision and clear focus on ensuring learning for pupils, constitutes highly quality teaching and learning (DBE and DHET, 2011, p. 14). In other words, members of a TLC take ownership of the values. A shared value base provides a framework for "shared collective, ethical decision making" (Stoll et al., 2006, p. 226).

2. 3.1.2. Collective responsibility

Collective responsibility in a TLC suggests that members of the TLC come together to build a collective understanding of how all their learners learn, and to improve it (DBE & DHET 2011, p. 14). The international literature also states that members of a TLC consistently take collective responsibility for student learning (Stoll et al., 2006). A study on TLCs suggests that collective responsibility helps to sustain commitment, to put peer pressure and accountability on those members who do not do their fair share, and to ease isolation (William, 2007, Stoll et al., 2006). The literature (Cochran-Smith & Lytle, 1999; Servage, 2009) on teacher learning communities states that "communities or teacher networks provide the social and intellectual context in which teachers at all points along the professional life span can take critical perspectives on their own assumptions as well as theory and research of others and jointly construct local knowledge" (Cochran-Smith & Lytle, 1999, p. 283). Agreeing with Cochran-Smith and Lytle (1999), Servage (2009) states that teacher learning communities are the sites of learning that provide some professional autonomy when the learning content is pre-determined. The question is: Who determines the content that should be learnt in teacher learning communities? Cochran-Smith and Lytle (1999) further highlight that when a group of teachers and others come together to learn, there are issues related to negotiating agenda, sharing power and decision making, representing the work of the group, and dealing with the inevitable tensions of individuals and collective purpose and view point.

2. 3.1. 3. Reflective professional inquiry

Reflective professional inquiry in the context of TLCs refers to what Stoll et al. (2006) call reflective dialogue, which includes serious conversation about serious education issues or problems involving the application of new knowledge in a sustained manner. The literature states that conversations include frequent examining of teacher practice and joint planning for curriculum development. Furthermore, during the interaction, the "tacit knowledge is then converted into shared knowledge" (Stoll et al., 2006, p. 226).

2. 3. 1. 4. Collaboration

One body of research documents collaboration as an important characteristic of a TLC. According to Stoll et al. (2006, p. 227), collaboration involves teachers in developmental activities with consequences for several people going beyond superficial exchange of help, support, or assistance. Hermansen and Nerland (2014) highlight that the ways in which new

pedagogical ideas are operationalized depend on how teachers negotiate and invest meaning into what is being introduced, and existing practices. The DBE (2015) in the South African PLCs Guide for Schools states that effective PLCs encourage opening up one's classrooms through peer learning, team teaching, observations and mentoring. Hargreaves et al. (2013) maintains that observing peers teaching is a core TLC practice because it supports the de-privatisation of practice, fosters accountability among participants and focuses directly on classroom teaching and learning.

The success of collaboration in TLCs depends on its nature. Hargreaves (1994) identifies two types of collaboration, namely collaborative cultures and contrived collegiality (Hargreaves, 1994). The following Table 1 shows Hargreaves' (1994, p. 192-199) explanation of the nature of collaborative cultures and contrived collegiality.

Collaborative cultures	Contrived collegiality
Spontaneous. Collaborative cultures emerge from the teachers themselves as a social group. They may be administratively supported and facilitated by helpful scheduling arrangements by educational leaders. Collaborative working relationship evolves from and is sustained through teaching community.	*Administratively regulated.* Contrived collegiality does not evolve spontaneously from initiative of teachers, but is an administrative imposition that requires teachers to meet and work together.
Voluntary. Collaboration arises not from administrative constraint or compulsion but from the perceived value among teachers that derives from experience, inclination or non-coercive persuasion that working together is both enjoyable.	*Compulsory.* Contrived collegiality makes working together a matter of compulsion as in mandatory peer coaching, team teaching and collaborative planning arrangements. Teachers are forced in one way or other to attend the collaborative meetings.
Development-oriented. In collaborative cultures, teachers work together primarily to develop initiatives of their own or to work on externally supported or mandated initiatives to which they themselves have a commitment. In collaborative cultures, teachers most often establish the tasks and purposes for working together, rather than meet to implement the purpose of others. When they have to respond to external mandates, they do so selectively, drawing on their professional confidence and discretionary judgement as a community.	*Implementation- oriented.* Under the condition of contrived collegiality, teachers are required or persuaded to work together to implement the mandates of others. Such mandates may take the form of the national curriculum, accelerated learning programmes or co-operative learning strategies.
Pervasive across time and space. In collaborative cultures teachers schedule activity that can be administratively fixed as taking place at a designated time in a designated place. Their meetings and planning sessions may form part of collaborative cultures but they do not dominate the arrangements for working together.	*Fixed in time and space.* Contrived collegiality takes place at particular places at particular times. This is part of its administrative regulation.
Predictable. Contrived collegiality is designed to have relatively high predictability in its outcomes. However, this cannot be guaranteed.	*Unpredictable.* Because, in collaborative cultures, teachers have discretion and control over what will be developed, the outcomes of collaboration are often uncertain and not easily predicted.

Table 1: Differences between collaborative cultures and contrived collegiality (adapted from Hargreaves 1994, p. 192-199)

The collaborative cultural perspective involves collaboration that emerges from teachers themselves. Collaborative cultures involve evolutionary relationships characterised by openness, trust and support among the participating teachers (Hargreaves, 1994; Jita &

Mokhele, 2012). The contrived collegiality is characterised by administrative regulation of the teacher collaborations, where district officials of education departments provide instructions and set agendas and goals of such collaboration (Jita & Mokhele 2012). Collaborative cultures seem to be an important ingredient of effective TLCS. This is evident from several international studies which examine collaborative activities. For example, Chow's (2015) study findings reveal that difficulties associated with development of TLCs arose mainly from the lack of culture of collaboration.

Some researchers such as Servage (2009) and Jita and Mokhele (2012) use the term contrived collegiality to refer to micro-political perspectives, and collaborative culture referring to cultural perspectives. Jita and Mokhele (2012), in the study on institutionalising teachers' clusters in the South African context, use Hargreaves (1994) for developing analytic work on micro-political and cultural perspectives for understanding human relationships. In line with Hargreaves (1994), Servage (2009) states that the micro-political perspective is in favour of contrived collegiality. The micro-political perspective posits that the ideology regulates professional behaviour from within by shaping how teachers construct their professional identities. The learning activity in the micro-political perspectives tends to be managerial driven so teacher learning community may have limited activities that best lend themselves to standardisation such as assessment, reporting practices, interventions protocols and pedagogical best practices (Servage, 2009).

2. 3. 1. 5. Regularity

This characteristic talks about regularity of the meetings or workshops for the TLCs. The members of TLCs meet regularly. The meetings can be formal and informal. The research study conducted by William (2007) on changing classroom practices suggests that members use their established goals; they meet regularly to engage in discussion about tasks and topics in order to effect changes in teaching and learning. The international research studies show that technology can be used instead of physical meetings of TLCs. TLCs have expanded into the digital realm, and have become on-line learning communities (OLCs) (Calhoun & Green, 2015, p. 56). According to Calhoun and Green (2015) the online teacher learning communities use voice over the internet protocol technologies, such as Skype and Google Hangout, for visual exchanges of information. Conversation is also conducted through text. This regularity of meetings of TLC members is another aspect that differentiates the TLC as a

model of professional development from the traditional CPD models which normally have once off sessions with teachers.

2. 3. 1. 6. Leadership

Leadership support and opportunities for distributed leadership are additional characteristics of TLCs. Distributed leadership means that leadership is distributed amongst the members of the TLCs. Priestley, Miller, Barrett and Wallace (2011) highlight the importance of teachers' political participation in the decision making process. In relation to decision-making, the literature states that the organisation of TLCs can allow greater or lesser participant choice and decision- making power. Table 2 shows three examples of different landscapes of subject leadership in teacher learning communities

Congenial leadership	Shared leadership	Paternalistic leadership
An accommodating imperative	A learning imperative	A managerial imperative
Concern for people and relationships	Concern for growth and empowerment	Concern for control and accountability
Bereft of leadership	Open boundaries for leadership	Closed boundaries for leadership
Private and individual knowledge	Distributed and hierarchical knowledge	Centralized and hierarchical knowledge
Haphazard and ineffectual	Transformational	Transactional
Evasive in Exercising power	Exercising power with and through	Exercising power over

Table 2: Landscape of Leadership in TLCs (Adapted from Chow, 2015)

The TLCs outside of the school context have facilitators who are described as servant leaders who highlight the value of members' contributions, and guide teachers into a state of interdependency and reciprocity (Calhoun & Green, 2015, p. 60). According to literature the TLCs have a "facilitator, but not a guru" (William, 2007, p. 40). William (2007) then elaborates that a facilitator in a TLC is someone who needs to be in charge to make sure that the meetings happen, that there is a room available, that the refreshments are provided, that the agenda is followed and so on. However, it is important not to set the expert person as an expert whose job is to tell the rest of the group what to do (William, 2007, p. 40). Hence distributed leadership is suggested to be a "powerful lever" (Priestley et al., 2011, p.269) in developing innovation in TLCs when leaders assume collegial figures rather than authoritarian leaders. The literature suggests that in order to enable the TLCs to grow into collaborative learning and knowledge sharing communities, there should be adequate infrastructure for team learning opportunities. These are possibilities for members to play

new roles, for example in curriculum leadership, and in creating and sharing stories of individual and community success (Darling-Hammond, 1998, Stoll et al., 2006, Hargreaves et al., 2013 and Chow, 2015).

2. 3 .1. 7. Group as well as individual learning is promoted

This characteristic of TLCs seems to integrate both individual and collective learning. Stoll et al. (2006) explain this characteristic in relation to the TLC that is within the school. "All teachers in a TLC are learners with their colleagues, and collective learning is evident through collective knowledge creation whereby the school community interacts, engages in serious dialogue and deliberates about information and data, interpreting it communally and distributing it among them" (Stoll et al., 2006, p. 227). Teachers learn in interaction with students, colleagues and external experts. Henze et al. (2009) also state that when teachers learn in interaction, they engage in different learning activities such as communicating with students in class, sharing new ideas and materials. According to these authors, learning in interaction also involves teachers' joint work as subject committees in preparing lessons, co-teaching and writing teaching methods. However, the literature on teacher learning communities and social learning theories seems to focus on collective learning as if it is only group learning that occurs in TLCs. Individual learning is promoted when teachers interact with the resources such as books. In relation to group and collaborative learning, Ciampa and Gallagher (2015) argue that TLCs support collaborative learning performance in individual knowledge development and also in group knowledge sharing (p. 885).

This section has explored the definition of the concept of teacher learning communities and the characteristics of a PLC/ TLC. The following section discusses TLCs in relation to the empirical studies undertaken on TLCs internationally.

2.3.2. International perspectives of teacher learning communities

The empirical studies on teacher learning give a great deal of evidence that supports the idea that teachers learn best when they are members of learning communities (Jonassen, 1995; Knight, 2002; Mclaughin & Talbert, 2006; Servage, 2008; Lieberman & Mace, 2010; Elster, 2010; Mackey & Evans, 2011; Shannon,2011). These learning communities are both within the school context and outside the school context.

There is evidence from the literature (Hermansen & Nerland 2014; Hargreaves, Berry, Lai, Leung, Scott & Stobart, 2013; Lieberman & Mace 2010) that teacher learning communities

are formed as per education policies of a country. This is evident from the research undertaken in tandem with a development project initiated by a Scottish Education Authority, The Highland Council. In Scotland an Associated Schools Group (ASG) is a subject specific teacher network. These were established in 2006 to 2007 on the basis of the Scottish Government Framework for learning teaching. The ASG brought "together secondary school teachers in English, Mathematics, Modern Foreign Languages, Science and Social subjects and each group was coordinated by a subject leader. The groups adhered to some characteristics of TLCs such as collaborative practices which were then taken back to teachers' classroom and wider school community" (Priestly et al., 2011 , p. 275). The findings of this study suggest that the model enjoyed a degree of success in inculcating changes. However, it emerged that more needs to be done to address systemic issues, such as the pervasive influence of a narrow attainment agenda shaping classroom practices (Priestly et al., 2011, p. 265). Furthermore, the findings also suggest that where strong leadership was less evident, the teachers reported that it was the source of frustration for participating teachers and was the reason for disengagement of some teachers from the groups. This situation suggests that leadership in TLCs is an important aspect; it can promote engagement or disengagement of TLCs' members. Leadership in this study is highlighted because leadership plays an important role in the formation and the functioning of the TLC.

Many international research studies on teacher learning give a great deal of evidence that teachers learn when they are members of learning communities. For example, McLaughlin and Talbert (2006) studied school-based learning communities for more than 15 years. The findings of their study show that school-based communities are uniquely situated between macro or system level directives and the resources and micro realities of teachers' classrooms (Lieberman & Mace, 2008). In their letter which was addressed to the president of United States, Lieberman and Mace (2008) analysed two different situations that prevail in two schools, namely Brandeis and Mills (Lieberman & Mace, 2008). In the first school Brandeis, teaching strategies were individualized, dependent on teachers' choices. In contrast with this, Mills' teaching strategies were collectivized, interdisciplinary and project based. In this comparison, Lieberman and Mace (2008) find that teachers of Mills school learnt better than teachers of Brandeis school. This is in line with PLC findings of the study which was conducted by Henze et al. (2009) in Netherlands, which suggests that teachers who learnt collaboratively kept engaged in specific professional learning activities for longer periods and

felt more often confident at a start of the innovation compared to those teachers who learnt mainly individually (Henze, Verloop & van Driel, 2009, p.196).

There is also evidence from international literature on teacher learning that describes learning in professional learning communities that are outside the school context. Lieberman and Mace (2010), in their evaluative literature based on teacher learning in the 21st century, wrote about the National Writing Project (NWP). The NWP has existed for more than 30 years in more than 200 sites in United States of America. From these 200 sites, Lieberman and Wood (2000) studied two sites of NWP, one urban and one rural. The study found that "the practices that occurred during the summer institute, helped teachers see that working together was a powerful way to learn about their own and other practices because during the institute, teachers learned to share their best strategies, learn from others, become writers themselves and be open to learning as a lifelong process" (Lieberman & Mace, 2010, p.78).

In some countries, such as Canada, United States of America and New Zealand, online professional learning communities are assuming an increasing role in teacher professional development. This increasing role of online of professional learning is evident in Mackey and Evans (2011), who explore networks of practice for professional learning in New Zealand. The online professional learning communities "employ communication technologies to foster collaborative process, interaction and social construction of knowledge" (Markey and Evans, 2011. p. 2). Another study on online professional learning communities, found that communication via computer platforms enabled the mutual sharing of information among the teachers, as well as the planning and documenting of tasks and teaching units (Elster, 2010).

International studies (McLaughlin & Talbert, 2006; Butler, Schenellert & Kimberly, 2015; Halbert & Kaser, 2012) on TLCs seem to put more emphasis on TLCs that are within the school context. In these school-based TLCs the teachers learn different types of knowledge through collaboration with each other. For example, the findings of the study on TLCs undertaken in East Melbourne, report that teachers identify student needs, pose questions, develop criteria for monitoring progress, and they also draw resources to enhance their own learning and embed new powerful ideas in practice (Halbert & Kaser, 2012). In other TLCs in the international context, teachers engage in TLCs in order to learn to implement mandated agendas of the education administrators. Butler et al. (2015) put it in this way; teachers' engagement in TLCs is a valuable means of fostering educational changes. This came from their study in a school district in Western Canada. The education leaders were seeking to

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advance adolescent literacy in subject- area classrooms. Some of the findings of this study showed that 28 of 40 participants reported that they learn: "how to better ground practice in theory, principles, knowledge or values" (Butler, Schenellert & Kimberly, 2015, p.15). Interestingly, the findings of this study also report that:

> The vast majority of teachers seemed comfortable with their
> positions as agents within the district-level initiative, they were
> taking actions, on their own and together, to have impact in their
> schools, and perceived themselves as capable of achieving valued
> goals for students' and colleagues' development (Butler,
> Schenellert & Kimberly, 2015, pp.15- 16).

The above quote seems to suggest that teachers are agents of change within a TLC that is initiated by the education authorities. In most cases the TLCs are seen to be successful when they are initiated by teachers themselves.

The next section discusses the South African context of teacher learning communities.

2. 3. 3. South African perspectives of teacher learning in teacher learning communities

This section draws from the local studies on teacher learning communities and South Africa Education policies. In South Africa, there is evidence that teacher learning communities are flourishing in some schools. Teacher learning in TLCs as a model of CPD seems to have gained momentum in the last 15 years. For example, Graven's (2002) study of the community of Mathematics, investigated teacher learning in relation to preparation for curriculum change and Maistry's (2008) study focused on Economic and Management Sciences (EMS) teachers. These two studies were initiated by the researchers, and used Wenger's (1998) model as a theoretical framework to understand how learning happens in a community of practice. The findings have highlighted the potential that teacher learning communities have for teacher development. For example, in the study of Economic and Management Science (EMS) teachers, "Teachers were able to describe the new EMS curriculum in more practical ways and could articulate benefits they had identified" (Maistry, 2008.p.137). This evidence from EMS teachers tells us that these teachers learnt curriculum knowledge and content knowledge in a socially situated way. These two studies focused on primary school teachers. There is

also a recently published book, edited by Brodie and Borko (2016) which brings together a range of recent South African studies on professional learning communities. Many of these PLCs include university academics and NGOs as well as teachers.

In South African policy documents, teacher learning communities are also referred to as clusters or teacher networks, which are generally initiated by the DBE for the purpose of supporting and monitoring policy reform. The literature on teacher clusters in the South African context reports that clustering started as early as the 1980s and early 1990s among non-governmental organisations (NGOs), teacher organisations and subject associations (Jita & Ndlalane, 2009, p. 58). After 1994, teachers' clusters were formed in various subjects. The clusters are led by the subject advisors and cluster coordinators. The clusters seem to be considered as a reform unit for facilitating the moderation of continuous assessment. There have been studies on clusters that were conducted in Mpumalanga province (Jita & Ndlalane, 2009; Jita & Mokhele, 2012; De Clercq & Phiri, 2013; Jita & Mokhele, 2014). One of these studies suggests that in the Mpumalanga province there are clusters that are not only used for CASS moderation only but they are also used for school-based, in-service education. This was evident from the findings of a study on cluster approach to professional development, which reports that teachers in their clusters (Mathematics and Natural Science) were able to collaborate and share their experiences (Jita & Mokhele, 2014, p.12). A key question is to what extent clusters in fact display the characteristics of PLCs and thus can be said to actually be operating as PLCs.

Furthermore, the South African study on teachers' experiences of the grade ten Economics curriculum, undertaken by Mtshali (2009), also gives evidence that some South African teachers are members of clusters that seem to operate like TLCs. Mtshali (2009) states that Economics clusters were established in terms of the DBE (2001) with an aim of monitoring continuous assessment of grade 12. The findings of this study reveal that Economics clusters offer teachers a platform to share common problems and experiences by way of discussing and arranging team teaching. Drawing from the experiences of the participants in the study, Mtshali (2009) made several recommendations. One of his recommendations is that the Department of Education, in consultation with organisations who have an interest in Commerce education, should consider establishing a teachers' association that administers the teaching of Economics in various regions, such as the National Council on Economic Education (NCEE) in the United States of America.

There is increasing attention paid to teacher learning communities as a major lever for improving teachers' work (DBE & DHET, 2011). Servage (2009) notes that PLCs as a model of continuous professional development (CPD) have emerged within the public policy contexts that are shaping educators' experience with public education in some very deliberate ways. This is evident from the South African context of PLCs. In South Africa, using PLCs as a model of CPD stems from the Integrated Strategic Planning Framework for Teacher Education and Development (DBE & DHET, 2011). PLCs are communities that provide the setting and necessary support for groups of classroom teachers, school managers, and subject advisors, to participate collectively in determining their own developmental trajectories, and set up activities that will drive their development (DBE and DHET 2011, p.14). The ISPFTED states that the National Institute for Curriculum and Professional Development (NICPD) will support the work of the PLC by developing activities and material that can help to sustain their work, and the District Teacher Development Centre (DTDC) will serve as the central meeting venue for the PLCs as they will be adequately resourced to support PLC activities (DBE & DHET, 2011, p.14).While these international studies suggest that PLCs should be initiated by teachers, the ISPFTED policy seems to suggest that the PLCs in South Africa are initiated by the Department of Basic Education (DBE) and the Department of Higher Education and Training (DHET). This is evident from the recent DBE document entitled 'Professional Learning Communities: A guideline for South African schools' (DBE, 2015) which provides the guidelines to set up, maintain and ensure PLCs work effectively. As mentioned earlier in Chapter One, the DBE (2015) identifies nine role players of the PLCs

According to the DBE and DHET (2011) the role of teachers in the PLCs is also linked to Integrated Quality Management Systems (IQMS). IQMS evaluate an educator's performance, identify specific needs for support and development, and provide support for continued growth, to promote accountability and to monitor an institution's overall effectiveness (Mestry, Hendricks & Bisschoff, 2009, p. 479). The PLCs are linked to IQMS, in that the IQMS will help teachers identify their professional development needs and then engage in PLCs to address these needs.

2.4. The implications of the literature review to this study

The literature has shown that teacher learning can take place in different places which include teachers' classrooms, their communities within and outside of the school, and professional development workshops. Teachers can learn both formally and informally. The literature has

also shown that teacher learning takes place both individually and socially. In this study, teacher learning communities are generally defined as groups of teachers who take initiative for their own learning. For the purpose of this study, I use the concept TLC because the focus of the study is on two groups of teachers, Mathematics Group and a Commerce Teachers' Association. In this study, teacher learning is assumed to be both individual and social, and teacher knowledge is one of the four central components of social learning (Kelly, 2006). The literature of teacher knowledge is reviewed in Chapter Three.

The literature shows that in South Africa there is now an increase in the studies that explore how teacher learning happens. There is a book recently published by Brodie and Borko (2016) on the studies of PLCs in the South African context. The two studies on teacher learning communities, Graven's (2002) and Maistry's (2005), made a remarkable contribution to understanding teacher learning communities through Wenger's (1998) model. These studies on teacher learning in TLCs come from the urban and developed (well resourced) context which raises a concern about the relevance for developing a context where poor teacher content knowledge is a key concern. The studies on TLCs in the South African context suggest that Wenger's (1998) framework is not adequate for understanding how learning occurs in TLCs because it does not consider the presence of the expert in the TLCs.

One of the characteristics of TLCs states that group as well as individual learning is promoted. This characteristic suggests that there is a need for a theoretical framework that could integrate both cognitive and social perspectives. The cultural-historical activity theory (CHAT) discussed in Chapter three conceptualizes learning from both cognitive and social perspectives and is therefore used in this study. Lastly, the DBE and the DHET (2011) advocate the formation of PLCs. Their policy (ISPFTED) seems to be salient for teacher learning communities that are outside of the schools. There is also a need for understanding the nature of collaborative relationships in teachers' groups.

2.5. Conclusion

This section has discussed teacher learning communities (TLCs) from both international and South African perspectives. The next section discusses the theoretical and conceptual frameworks of this study.

CHAPTER THREE: THEORETICAL AND CONCEPTUAL FRAMEWORKS

3.1. Introduction

This study explores teacher learning in two teacher learning communities in the Zethembe (pseudonym) District in KwaZulu-Natal. In this study, one group is a group of Mathematics teachers from one circuit and the other group is the Commerce Teachers' Association, comprised of Commerce teachers from the four circuits in the same District. These two groups were identified as teacher learning communities in Zethembe District.   The study intends to achieve four objectives:

1. To establish how the teacher learning communities were formed.
2. To ascertain how teacher learning takes place in these TLCs.
3. To identify the kind of teacher knowledge that is learnt/ gained by those in these TLCs.
4. To investigate the nature of the collaborative relationship in these TLCs

 These objectives are in line with the four research questions of the study:

1. How were the two selected teacher learning communities formed?
2. How does teacher learning happen in these selected teacher learning communities?
3. What kind of teacher knowledge is learnt in these teacher learning communities?

4. What is the nature of the collaborative relationships in these teacher learning communities?

To achieve the above-mentioned objectives, suitable theoretical lenses were essential to inform empirical data analysis and the study as a whole. This chapter therefore discusses the theoretical and conceptual frameworks which frame the study. This study uses Cultural-Historical Activity Theory (CHAT). In this study, CHAT is the main theory, complemented by a conceptual framework of teacher knowledge, as a conceptual framework. This chapter has two sections. The first section of this chapter gives a detailed discussion of CHAT. This is followed by a detailed explanation of kinds of teacher knowledge as defined by different scholars such as Shulman, 1987, Grossman 1990, Adler, 2002, Ball, Thames and Phelps, 2008.

CHAT is the most suitable frame for this study because it embraces two different types of theories, the cognitivism theory and the socio-cultural theory of learning. The first one, the cognitivism perspective, advocates that individuals acquire skills, knowledge and understanding in one setting which resides in individuals' minds. The teachers are these individuals and are then expected to transfer their knowledge to their classrooms. The transfer of knowledge and skills is central to cognitivists. In relation to teacher learning, a phenomenon under this study, Kelly (2006, p. 503) argues that cognitivism suggests that for teachers to become experts they need to learn the defined body of knowledge which constitutes professional expertise, and apply this in their practice. This approach seems to focus on individual learning. The second one, the socio-cultural perspective of learning is clearly articulated in situated and social learning theories (Lave & Wenger, 1991, Kelly, 2006, Long, 2007, Putman & Borko 2000 and Elster 2010). From a socio-cultural perspective learning is understood as collaborative practice. Learning is assumed to be situated in physical and social contexts where it is used (Brown, Collins & Daguid, 1989, Greeno, Collins & Resnick, 1996). For the purpose of this study these two theories (cognitivism and socio-cultural theory) seem to be very vague because they do not give a clear picture of how participation happens. In this study, I needed a framework that could consolidate these two approaches into one because I believe teacher learning is best understood using both a cognitive and a socio-cultural perspective. Hence CHAT was a suitable theoretical lens for this study.

Both these theories, and CHAT itself, are grounded on Vygotsky's (1978) constructivism theory. Vygotsky, the founding father of social constructivism, "believed in social interaction which he viewed as an integral part of learning" (Powell, 2006, p. 243). CHAT is a socio-cultural meta-theory which incorporates expansive learning and transformative agency. It elaborates, through its activity system model, the actions and processes that take place in each of these two teacher learning communities. The next section discusses cultural-historical activity theory (CHAT).

3.2. The Cultural-Historical Activity Theory

Cultural-historical activity theory was founded on the ideas of Vygotsky (1978). Vygotsky died when his theoretical ideas were still in flux and when no finished coherent systems of ideas were yet in sight (Ellis, Edward & Smongorinsky, 2010). Several international

researchers (Leont'ev 1978; Engeström 1987; Hedegaard, Chaiklin & Jansen 2002; Portes 2011; Moll, 2014) have elaborated on Vygotsky's theoretical ideas. The focus of Vygotsky's approach to learning was on a cultural-historical approach. Wertsch (2010) synthesized Vygotsky's cultural approach into several themes:

Firstly, higher mental processes, such as problem solving and voluntary attention, have a social origin. Secondly, human thinking must be understood developmentally and historically at both individual and cultural levels of analysis. Thirdly, mediational means of various kinds are crucial in human social and psychology (Wertsch, 2010, p.231).

Moll (2014) elaborated by adding a fourth theme that active subjects create themselves through their social actions. These four themes summarise Vygotsky' psychology about how each individual learns. According to Ellis, Edward and Smongorinsky (2010) a cultural-historical approach has an interest in the relationship between human consciousness and practical activity, implying that what happens conceptually is not isolated from practical collective activity. Ellis et al. (2010) further contend that Vygotsky emphasizes cultural-history by stating that one's activity is produced by historical remains or development of their culture.

In line with the above-mentioned researchers, Portes (2011) also states that the cultural-historical perspective is a tool which can be used to understand cases of acquiring new problem solving skills, new effective cognitive perspectives and actions. Portes (2011) further states that cultural-historical theory is a special tool with which to understand the development of human consciousness. He further states that: "CHAT reflects the interaction of subjective and objective conditions related to individual adjustment and mediation in a reciprocal sense" (Portes, 2011, p.116). Vygotsky's cultural-historical approach therefore posits that the world in which we live is humanized, full of material and symbolic objects such as signs and knowledge systems that are culturally constructed, historical in origin and social in content (Moll, 2014, p. 30).

Vygotsky's approach is concerned with interactions with other human beings especially where social groups incorporate a person into their cultural practice (Moll, 2013, p. 31). For example, Davydov (1993) explains that Vygotsky focused on joint work, mediated by artefacts, norms and modes of acting. Engeström and Miettinen (1999) also highlight that

Vygotsky was interested in consciousness which is generally regarded as collective rather than individual. This consciousness does not exist situated in a person's head, but it is in the interaction between individuals and their culture, through mediation (Engeström & Miettinen, 1999).

Vygotsky's theory further posits that all human activities are mediated by culturally created signs, tools, social interactions, and higher mental functions. These tools are both material and psychological (Moll, 2014). Nunez (2009) points out that in Vygotsky's perspective of the word "activity" does not only refer to the practical immediate actions of human beings such as reading or problem solving but also refers to a hierarchical structure made up of operations that combine into actions which in turn make up a whole system. According to Ellis, Edward and Smongorinsky (2010) Vygotsky's notion of activity refers to mediated action, meaning that activities are mediated by society, tools, practices and understandings salient in culture. In other words, through interaction and engagement in activity, with mediation by signs and tool, an individual's internal mental state is transformed.

Waite (2006) and Karpov (2013) elaborate on Vygotsky's internalization and externalization of the activities by explaining that there is internal and external activity. Internal activity refers to internal thought processes and the workshops in the context of this study are an example of an external activity. Mukeredzi (2009) quoting Waite (2006) noted that internal activity and external activity cannot be understood as separate entities because they mutually penetrate, control and affect each other. The inner mental activity arises from external activity so internalisation occurs as a result of external activity. Externalisation changes an internal activity into an external activity. In other words, internalization can only manifest itself in external practical actions performed by individuals. For instance, in the context of this study, subsequent to internalization (learning) externalization may manifest when teachers are able to perform assigned tasks based on that learning.

There has been further evolvement in the focus of Vygotsky's ideas on the internal and external activity. According to Engeström (1987), activity stimulates consciousness, it is collective though it may be carried out individually, and it has historical dimensions. It is also a social construction, which is socially mediated by the socially constructed psychological and material tools. The focus in this study is on how people learn through collective engagement in a particular activity. An activity in this case is therefore not an individual endeavour, but a socially mediated process. Teachers in the activity system jointly learn and

the learning is oriented towards a goal (in this case learning Economics or Mathematics) which will then bring about adjustment to their prior knowledge (attaining an outcome). According to Engeström (1987), CHAT has evolved through three generations as explained below by different authors.

3.2.1. First Generation Activity Theory

This generation of activity theory is the work of Vygotsky which is based: "on the relationship between mind, activity and mediation means, in human development, and the notion that an individual's interaction with the object in the world as mediated by artefacts, signs, symbols and practical tools" (Hardman, 2008, p. 68). The focus of this generation is the individual. Baquedano-Lopez, Figueroa & Hernandez (2011) also elaborated by stating that this generation is based on integrating cultural artefacts into learning through the concept of mediation. Mediation is an important concept of CHAT which refers to the development or change of behaviour through the use of artefacts or tools (Engeström 1987, cited by Ahmed, 2014, p. 4). This generation has three elements as shown by the triangle (Figure 1).

Mediating artefacts

Subject   Object
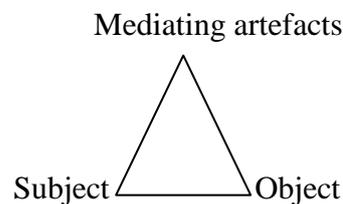
Figure 1 Vygotsky's model of mediated activity

Figure 1 is a graphical representation of Vygotsky's activity system. In this activity system Vygotsky hypothesised that artefacts mediate all actions (Feldman & Weiss, 2010, p. 35). It is based on the assumption that tools (artefacts) mediate between the subject and the object in the activity system. These tools include material and psychological tools. In this generation, mediation of an activity occurs between the subject and the object of action where the subject is typically an individual human being (Beatty & Feldman, 2012, p. 285). In relation to the study this could relate to the use of Mathematical shapes by an individual teacher to understand particular Geometry theorems.

Engeström (1987) argues that the first generation has limitations in that the first generation activity model does not expound the social and collaborative nature of an activity and also does not elaborate on the actions. The major critique of Vygotsky's first generation in relation to this study is actually that it offers units of analysis as the object-oriented action mediated by cultural tools and signs. Thus, his conception is underpinned by collective social activity (cultural tools and signs). However, the role assumed by other human beings and social relations in this triangular model of activity is blurred. For example, if I were to use the first generation activity theory in this study it would mean that I only use three elements; subject (individual Mathematics or Commerce teacher), object (learning of Mathematics or learning of Economics) and mediating artifacts (knowledge and language) which would not help me to understand the social and collaborative learning through engagement in activity. Leont'ev (1978) developed the second generation of activity theory to address these shortcomings. Since the first generation of activity theory can only be used to understand an individual activity, it not useful for this study which tries to understand the collective learning of teachers in the two TLCs.

3.2.2. Second Generation Activity Theory

The second generation shifted from the notion of individual learning to collective learning and began to incorporate the idea of internal contradiction as central for change (Baquedano et al., 2011). These researchers realized that in this generation there was still not much attention paid to cultural diversity. Leont'ev (1978) added features to separate individual action and collective activity, coming up with activity, action and operation to achieve the object. Hardman (2008) explains this extension of Vygotsky's theory in this manner: "Activity is driven by an object oriented motive, which is social, actions are conscious and are directed at goals and the final, lowest level of the model, automatic operations are called into play by tools and conditions of actions being carried out" (Hardman, 2008, p. 70). Hardman implies that the second generation additional features were intended to show that there is a difference between the individual's behaviour and the collective activity.

Object ——— Activity

Goal ——— Action

Condition ——— Operation
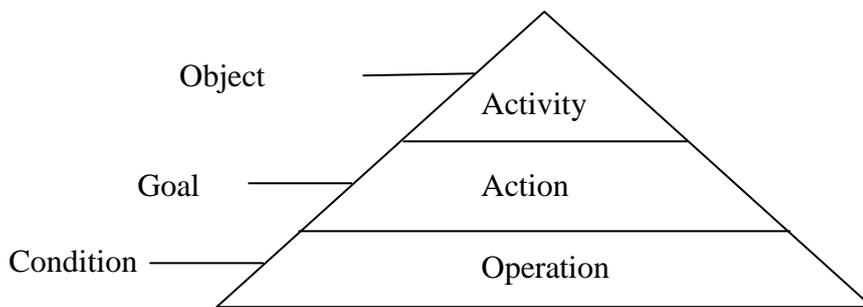
Figure 2 Second Generation Activity Theory (adapted from Hardman, 2008)

Figure 2 shows the hierarchical relationship between different structural levels and their object, goals and conditions. Timmis (2014, p. 11) explains the three levels of activity:

- Activity level: In this level, activities are differentiated from each other according to the motive.
- Action level: At this level, individual actions are distinguished from each other according to their specific and conscious goals.
- Operations level: Operations are actions that have become routine, habitual or unconscious, differentiated from each other according to the conditions under which they operate.

Ahmed (2014) maintains that many humans make sense of an activity only when seen in the context of collective activity wherein different people take different roles according to a division of labour, mediated by rules. Beatty and Feldman (2012) concluded that activity is therefore realized as individual and co-operative actions, chains and networks of actions that are interrelated by the same overall object and the motive to be achieved. In the context of this study, action is what the learning of Mathematics and Commerce teachers do, and operations refer to how things are done. For the purpose of this study the second generation of activity theory also has limitations. This generation of activity theory is criticized for its inability to understand dialogue, multiple perspectives, and networkings of individual activity systems (Wertsch 1991; Engeström 2001; Beatty & Feldman 2012). Engeström (2001) realised that the second generation does not situate human functioning in the activity and so he elaborated on this theory in the third generation.

3.2.3. Third Generation of Activity Theory

Like Leont'ev (1978) Engeström expanded the activity theory from the second generation to the third, and other authors have recently started working on the fourth generation. Ever since Vygotsky's foundational work, the cultural-historical approach was very much a discourse of vertical development toward 'higher psychological functions'. Cole (1988) (see also Griffin & Cole, 1984) was one of the first researchers to clearly point out the deep-seated insensitivity of the second generation activity theory toward cultural diversity. When activity theory went international, questions of diversity and dialogue between different traditions or perspectives became increasingly serious challenges. It is these challenges that the third generation of activity theory was intended to deal with.

Engeström (2001) incorporated a shared meaning of activity, then added rules, community and division of labour and called all this elements of an activity system all inclusive of their cultures and histories. The third generation thus encompasses the concept of boundary-crossing, (illustrated in Fig 3 below) which gauges the nature of a process by how multiple agencies or activity systems work together, sharing and supporting the other and forming new meanings through interaction and negotiation (Engeström 2005; 2007). The concept of boundary-crossing emerged out of Engeström's work on the care of children with long term illnesses – where their care was managed by the children's hospitals and primary care health center services. So the system here crossed its boundaries to tap into knowledge of other activity systems - working with other activity systems.
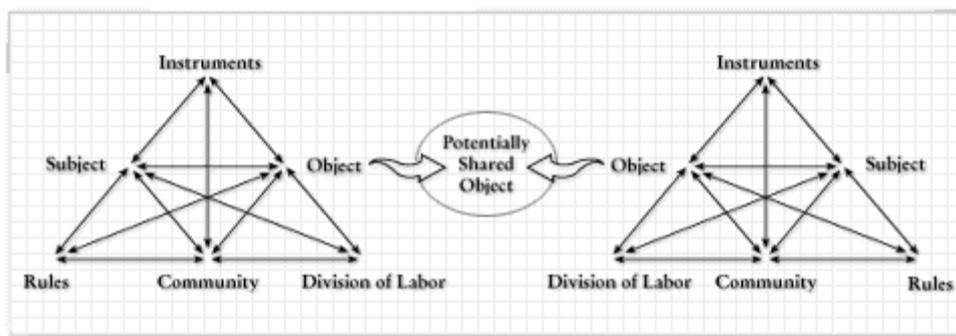
Figure 3: Two interacting activity systems in the third generation of activity theory **Engeström** 2001).

Engeström's 'third generation' of CHAT aimed to capture 'conceptual tools to understand dialogue, multiple perspectives and networks of interacting activity systems' (Engeström, 2001, p. 135). In this model the focus is placed on the 'boundary' between two activity systems and their inherent cultures, and on the potential of the 'boundary crossing space' as a site for learning (Engeström, 2001, p. 136). Thus the interplay between the elements of an

activity system or between different activity systems (boundary-crossing) can provide opportunities for new learning, and for change. Engeström indicates that the constant change and movement within activity systems and the inherent contradictions act as a vehicle to bring about 'expansive learning' (Engeström, 1999).

Expansive learning is the type of learning that is initiated when some individuals involved in a collective activity take the action of transforming an activity system through reconceptualization of the object and the motive of activity enhancing a radically wider horizon of possibilities than the previous mode of activity (Engeström, 2003, p. 31). Thus, this is the capacity of participants in an activity to interpret and expand the definition of the object of activity and respond to it in increasingly enriched ways. Also, this may be evident in teachers' dispositions to recognise and engage with distributed expertise in their work places. Expansive learning thus involves the creation of new knowledge and new practices for a newly emerging activity: that is, learning embedded in and constitutive of qualitative transformation of the entire activity system (Engeström 1995; 2001). Such a transformation may be triggered by the introduction of a new technology or new curriculum. This type of learning may be distinct from that which takes place when existing knowledge and skills embedded in an established activity are gradually acquired and internalised, as in the TLCs, or when existing knowledge is positioned in new activity settings. Expansive learning cycle is represented in Figure 4 below.

Figure 4: Expansive Learning Cycle: Alain Senteni (2006)

(Need) analysis of the current situation (steps 1, 2)

- questioning their present activity by jointly analyzing problematic situations in it;
- analyzing the systemic and historical causes of the problems identified;
- revealing and modelling inner contradictions of the systemic structure of the activity causing the problems

Transforming the model (steps 3, 4)

- representing the systemic structure of the activity in order to find a new form for the activity that would resolve in an expansive way the inner incompatibilities between its components;
- finding a new interpretation of the purpose of the activity (object) and a new logic of organizing it,
- creating a new activity model

Implementing the new model of activity (step 5)

- concretizing and testing the new model (e.g. what changes do we try next month ? putting first steps into practice, pushing the next steps)

- begining to transform the practice by designing and implementing new tools and solutions.

Reflecting on the new practice, consolidating it, spreading it (steps 6, 7)

- teaching others what we have learned
- codifying the new rules etc.

Closely related to expansive learning is the concept of transformative agency. Transformative agency refers to collective actions that expand and bring about new possibilities for activity. (Engeström, Sannino & Virkkunen, 2014). Transformative agency is thus both the ability of the working group to share the common object and the group's capacity to transform it. The efforts of the group working together were to break away from current forms of activity and envision new forms of activity—as the object of design efforts. In other words participants transform their understanding of the problematic situation into an abstract model of the activity system, ascend it as the central contradiction (may break it up into small parts or into metaphors to make it more understandable) and construct the whole model of the renewed activity (this is better understood from Vygotsky's stages of concept formation through group step-by-step process)

In this study, CHAT is very useful to understand who was doing what in each workshop of the Commerce Teachers' Association and the Mathematics Group. Pioneers of CHAT (Vygotsky, 1978; Leont'ev, 1978; Engeström, 1987; Ellis, Edwards & Smagorinsky, 2010) argue that this theory provides intellectual resources to develop a coherent view of how teachers at different stages in the professional life-course conceptualize their praxis. This study draws on the third generation of activity theory. The third generation addresses the issue of cultural diversity, which acknowledges conflict arising in interaction between multiple systems with different histories and cultures, as essential in teacher development and learning (Engeström, 2005, 2007). Engeström (1987, 2001) theorized the second and the third generations by offering the following expanded activity model. (Figure 5 on the following page shows the elements of the third generation activity system)
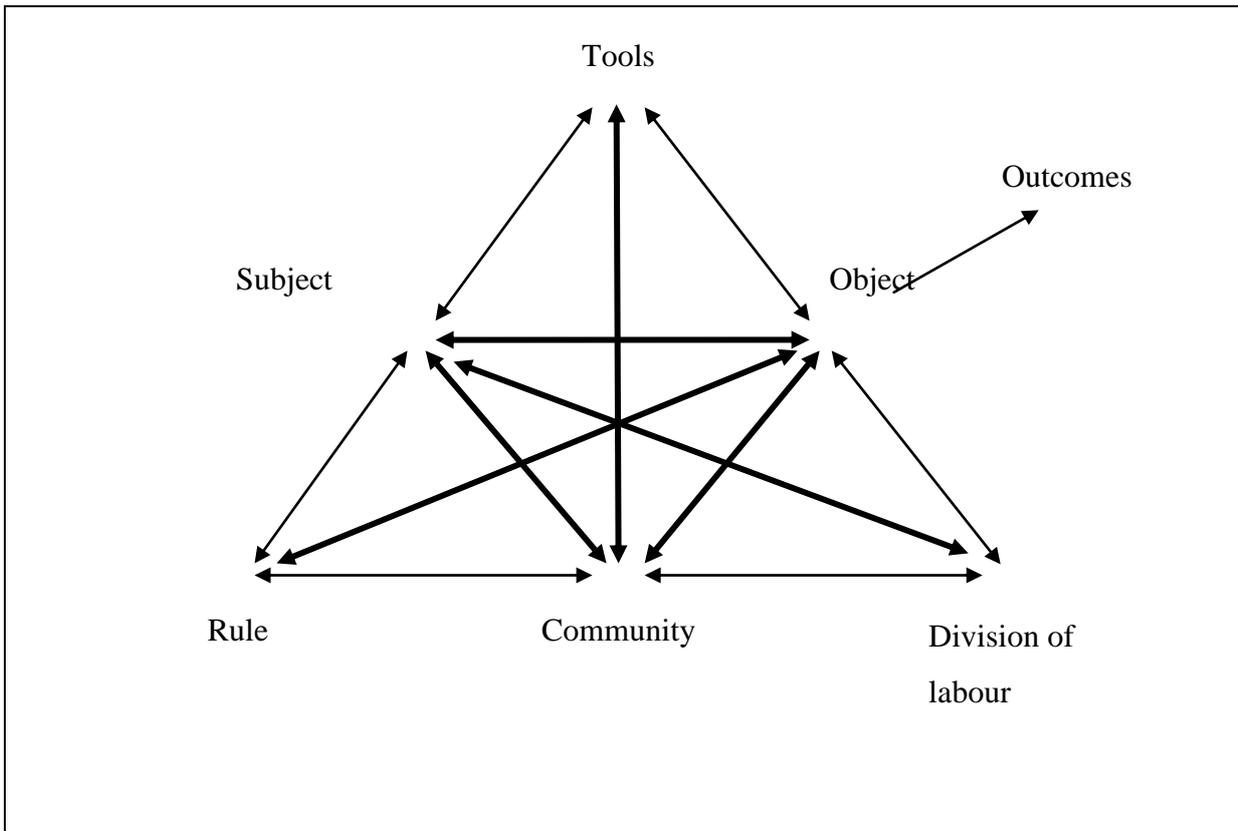
Figure 5: Third generations of activity theory models (adapted from Engeström, 2001)

The above Figure 5 is an activity system CHAT model. The triangle shows that all the nodes of an activity system interact for successful enactment of the object by the subject to produce the outcome; this interaction of nodes is shown by the bolded lines.   Inside the triangle there are bolded lines. The lines represent the interconnectedness of the elements. Contradictions will be represented by broken lines in later sections

I now explain each element of Engeström's (1987) activity system before I relate these elements to my study. The correlation of these seven elements of the activity system to my study is shown in section 3.4, where I explain the usefulness of CHAT. I have drawn from several authors to elaborate on Engeström's (1987, 2001) explanation of the seven elements of the activity system.

Subject: The subject of the activity is the individual or group whose viewpoint is adopted (Engeström 2001, Murphy and Rodriguez-Manzanares 2008; and Beatty and Feldman 2012). In other words, the subject of the activity is the person or subgroup whose action we seek to

understand. For example, in this study I seek to understand how Commerce teachers and Mathematics teachers learn.

Object: In Engeström's model the object of activity refers to the raw material or the place where the activity is situated. The object of the activity: "is modelled and transformed in the form of result" (Abboud-Blanchard & Cazes, 2012, p. 142). Nunez (2009) also elaborates by saying that human activity is object-oriented, implying that human activity is not random but aimed at the achievement of an objective. The object of the activity is what motivates the actions of the subjects. Beatty and Feldman (2012) elaborate by saying that the object is a raw material or a problem space, at which the activity is directed. In this study teacher learning is the object of the activity (within the workshop).

Tools: The tools or mediation means are the instruments to mediate or enable the achievement of the object. CHAT proposes that physical and psychological meditational tools are used to build cultures (Ellis, Edward & Smagorinsky, 2010). CHAT posits that socio-cultural practices involve mental and material tools and artefacts or a form of mediation constructed and used purposefully by subjects in order to meet objectives in a manner that can lead to individual or social development of enduring capacity (Cole, 1996). Language used during interaction is an important tool because it has a double function. According to Moll (2014) language serves as a means of communication that enables teachers to socially coordinate actions with others through meaning making. It also enables the internalisation of communication and it mediates intellectual activity through the discourse of inner speech (Moll, 2013, p. 33). The tools are used by the subjects to work on the object with the support of the community to produce the outcome.

Community: According to Engeström (2001), the community consists of the participants engaged in collective action with the subjects, along with the other individuals or groups. In this study, the community is composed of individuals who share the object with the subject. For instance the Department of Basic Education (DBE) (as community) and the Commerce teachers (subjects) are both interested in good learner achievement. In CHAT the term community is not only used to refer all the people that are involved in the activity system but other people who share the same object with the subject. They may not attend every session of the activity systems but as long as they have some interest in what goes on, they are part of the community. For example, book publishers did not attend all the workshops of the

Commerce Teachers' Association but they still remain part of the community of the Commerce Teachers' Association.

However, in other studies, community as an element of an activity has been used differently. This was evident from the following study: Structuring an activity theory based framework for evaluating a science extended curriculum programme (Kizito, 2015), a study that was conducted in a South African context. This study uses CHAT as a lens but community as an element of CHAT seem to be used to refer to the environment in which the activity is carried out (Kizito, 2015, p. 223). In other words, there is evidence that suggests that community means an environment in which the activity is carried out. In this study, I argue that community should be seen as one of the elements of an activity system, and it should not be understood as community as defined in the communities of practice theory. However, the word communities, when used in the title of this study (Teacher learning in two teacher learning communities) is understood in relation the communities of practice context.

Division of labour: This involves the division of tasks and roles vertically and horizontally among the members of the community and the division of power and status (Murphy & Rodriguez-Manzanares, 2008 p. 443). In Engeström's (1987) model, the division of labour is about how members share the work in the activity system. Division of labour also includes division of power and status in the activity system. Division of roles and power can be both horizontal and vertical. For example, the role assumed by Mathematics teachers during the content workshop when they act at the same level with facilitator, suggests horizontal power or horizontal division of labour. An example of vertical power is shown by the role of the Economics subject advisor in the Commerce Teachers' Association when she assumed the role of the chairperson to direct the workshop proceedings during the revision workshop.

Rules: "Rules are both implicit and explicit, including regulations, norms, conventions, policies, social relations, modes of behaviour and other beliefs that shape the behaviour of the community members" (Beatty & Feldman, 2012, p. 285). Rules govern the entire operations of the activity system. In this study, the DBE, as the wider community, created rules that informed the subjects about the object, which was the learning of Economics (i.e. the focus of activity); the desired outcome (which was improved teaching); the subject's position in the community; as well as the way in which these all act on the object and interact among each other, as community. The rules also include the rules of TLCs.

Outcome: Some scholars, such as Feldman and Weiss (2010), do not include the outcome as a part of their activity system model. In fact, in most of the cases the CHAT scholars use only the above six elements. There is however, a group of CHAT scholars (Engeström, 1987; Saka, Southerland & Brooks, 2009; Lee 2011; Roth & Lee, 2007) who have included the outcome as the seventh element of an activity system model. In CHAT, achievement of the outcome is an ideal situation which occurs when the human elements (subject and community) and the non-human elements (object, tools, rules, division of labour) of the activity system act according to expectation. The actions towards the object lead to the outcome.

 This third generation of CHAT, according to Engeström (2001, p.135), is also based on the following five principles.

- The unit of analysis in activity theory is the activity system (Engeström, 2001). In other words in this study each workshop or meeting represents a unit of analysis, thus an activity system.
- Multi-voicedness refers to multiple perspectives, interests and traditions, due to the collective nature of an activity which can be a source of contradictions/disagreements and ultimately transformation in the system. This is because members of an activity system "carry their own diverse histories" and the system itself "carries multiple layers and strands of history engraved in its artefacts, rules, and conventions" (Engeström, 2001, p.135)).   With the multi-voicedness principle, Engeström (2001) focussed on the way in which multiple perspectives engage in an activity system. Hence, he described multi-voicedness as a collaborative and dialogical process in which different perspectives meet, collide and emerge (Feldman & Weiss, 2010).
- The principle of historicity argues that the history of activity system helps understand problems as well as the potentials of activities because parts of previous phases of activities stay often embedded in them as they develop (Engeström, 2001). It seems as if this principle highlights another important issue in CHAT that activities have their own history as they and their elements are under continuous, uneven change and development (Abboud-Blanchard & Cazes, 2012).
- The fourth principle argues that the power of the activity model also rests in the concept of contradictions. He states that contradictions arise when ways of thinking and doing come into conflict within each of elements, between elements or among

activity systems, resulting in tensions within the system. This principle is explained in detail in the 3.2.4.

- The principle of expansive learning comes from expansive theory. According to Engeström (2001), expansive learning refers to the possibility of extensive learning and transformation in the activity system through re-conceptualization of the object and the motive of activity and embracing a radically wider horizon of possibilities than in the previous mode of the activity. Contradictions may lead to expansive learning and transformation. However, as explained earlier, some contradictions may not lead to any learning as these will simply be divergent views.

3.2.4. The principle of contradictions in CHAT

This study focusses on how teacher learning happens in two teacher learning communities. It is therefore important to elaborate on the principle of contradiction because contradictions are often at the centre of learning and development as they can enable learning to progress, depending on "whether or not they are acknowledged and resolved" (Murphy & Rodriguez-Manzanares, 2008, p. 445). Contradictions occur as a result of conflict within each of the elements, between the elements, or among the activity systems resulting in tensions within the system. Engeström (2001) divided these contradictions into four categories: primary contradictions manifest themselves within each constituent component of the CHAT triangle, secondary contradictions arise between elements of one activity system, tertiary contradictions arise between the object or motive of an activity system and the object or motive of a culturally more advanced form of activity, and the quaternary contradictions arise between a central activity and neighbouring activities.

Contradictions may be visible or invisible. The visible or obvious are those contradictions that are openly discussed by those experiencing them. Invisible or unspoken/ unstated contradictions are taken for granted; members of a group may not even recognise them (Murphy & Rodriguez-Manzanares, 2008 p. 446). According to these two researchers, invisible contradictions include cultural assumptions about how things are done and how relationships are managed. In relation to invisible contradictions, Tylor (2014) argues that it is not all the time that contradictions can lead to change or development because contradictions may be ignored. Ignoring contradictions may have a negative effect on the activity system. Learning occurs through developing abilities to solve or come up with

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innovative ways of addressing those contradictions. By addressing contradictions, expansive learning is possible as participants think through and come up with solutions. Further, when Mathematics or Economics teachers as practitioners engage in debate, discussion and reflection on contradictions, learning beyond what was initially possible in the activity system may occur.

This section has presented the historical development of CHAT from the first generation to the third generation. "CHAT is an evolving tradition, rather than a settled theory, as different generations attest; as such, it is open to adaptation and development" (Timmis, 2014, p. 14). This quote suggests that researchers still continue to develop CHAT. The ideas on the fourth generation are still in flux. The next section presents application of CHAT to this study of teacher learning in teacher learning communities.

3.3. Usefulness of CHAT in this study of teacher learning in two teacher learning communities

There is evidence that Vygotsky's ideas have been articulated in the South African context by different researchers (such as Kizito, 2015, Hardman 2005, 2008, Mukeredzi, 2009). For example, Hardman (2005) has used CHAT in the designing and planning of various courses in Mathematics. Hardman (2008) has also used CHAT in the study of teacher/ student interaction in classroom. It has also been used to understand professional development experiences of professionally unqualified teachers in rural secondary schools (Mukeredzi, 2009).

CHAT is described as: "a psychological and multi-disciplinary theory with a naturalistic emphasis that offers a framework for describing activity and provides a set of perspectives on practice that interlink individual and social levels" (Nunez, 2009, p. 53). Duran (2011) argues that there is no singular interpretation of CHAT but the basic tenets of the theory as adopted by contemporary theorists frame the human action in terms of learning and acquisition of adaptive socio-cultural practices. Vygotsky postulated that the mind is socially constructed (Hardman, 2008).

The relevance of CHAT in this study starts with Vygotsky's swing of ideas from a biologically based understanding of human behaviour to the socio-cultural explanation of

activity. Vygotsky considered learning as a shared collective process in a responsive social context (Gindis, 1999). However, the first generation was not suitable for my study except for certain aspects such as the cultural-historical approach. The cultural-historical approach tries to understand the influence of social practices on human development (Hedegaard, Chaiklin, & Jansen, 2002). In line with the above-mentioned theorists, social practice is also defined as a structured human tradition for interaction around specific tasks and goals. This study on teacher learning in two teacher learning communities recognises that learning in TLCs is a social activity. Therefore, Vygotsky's idea foregrounds the communicative aspect of teacher learning in which knowledge is collectively constructed and shared. Hence this study of teacher learning in teacher learning communities assumes that knowledge is constructed during the communicative interaction amongst teachers in their teacher learning communities.

CHAT focuses on "how people learn through collective engagement in a particular activity, meaning that "what happens conceptually is not isolated from practical collective activity" (Mukeredzi 2009, p. 72, drawing on Worthen and Berry 2004). Furthermore, Saka, Southerland and Brooks (2009) elaborate by saying that participation in external activity causes individuals to shape the external activity in which they engage. In relation to this study, learning was also understood; "through the process of internalisation and externalisation in response to contradiction as well as appropriation of available cultural resources in order to design a novel form of practice" (Saka, Southerland & Brooks 2009, p. 100). For instance, in the context of this study, subsequent to internalisation (learning) externalisation may be manifest when teachers are able to perform assigned tasks based on that learning. However, this does not necessarily mean that learning and mastery can take place without contradictions. As indicated in the CHAT principles, contradictions arise when the multi-voicedness in the activity come into conflict within each of the elements, between the elements or among the activity systems. Identifying contradictions in this study was important because contradiction may be a source of change and development in activity system.

CHAT posits that learning and activity cannot be separated (Wearn, Rees, Bradley & Vnuk, 2008). This statement is further supported by Lagrange 2012 in her evaluative study of the contribution of activity theory. She contends that knowledge is a product of human activity deeply rooted in society. Since learning is assumed to be socially constructed, CHAT will provide the researcher with an opportunity to better understand how learning occurs.

According to Gindis (1999) learning is a complex, subjective process which is configured as a moment of personality development throughout human life. Echoing the third generation of CHAT, he states that it is also a complex social process that integrates the quality of many different agencies. In relation to this study different agencies can be the members of the community in the activity system.

The main strength of CHAT in this study is that it was used as both a theoretical and methodological frame to understand how teacher learning happens in two identified teacher learning communities. I looked at what was happening in the workshops of the Commerce Teachers' Association and in the Mathematics Group in Zethembe District. From a CHAT perspective, workshops represent the activity systems of the Commerce Teachers' Association and the Mathematics Group. In this study, as each workshop was viewed as an activity system, the CHAT model was used to show the relationship between all human and non-human elements of the workshops. Figure 6 provides an example of a CHAT model of the Commerce Teachers' Association and the Mathematics Group.

Tools & signs (knowledge, experience, language)

Outcomes:
revision skills/
master Maths

Subject: Commerce
and Mathematics
teachers

Object: commerce
teachers learn
revise/learning and
teaching of Mathematics

Rules: DoE
policies,
CAPS,
Commerce
constitution

Community, DBE
officials, teacher
unions, book
publishers, NGOs
Facilitators

Division of labour:
the roles and tasks
of teachers as
subjects and
community

Figure 6: Activity System of Commerce Teachers 'Association and Mathematics Group

Subject: Commerce teachers who are teaching Accounting, Business Studies and Economics in Zethembe District. In the Mathematics Group the subject is the group of Mathematics teachers from one circuit in the Zethembe District.

Object: In the Commerce Teachers' Association learning to revise with Grade 12 learners in order to improve learners' performance in Grade 12 final examinations while in the Mathematics Group it is learning and teaching of Mathematics.

Rules: Department of Basic Education rules and regulations, South African Council of Educators (SACE) rules, policies and policy guidelines such as CAPS, Commerce Teachers' Association Constitution rules, and Non- Governmental Organisations' rules for the Mathematics teachers.

Community: The Commerce and Mathematics subject advisors, Chief Education Specialist, Deputy Chief Education Specialist, teacher unions, book publishers, some local businesses who offer donations to Commerce Teachers' Association, Non-Governmental Organisations (NGOs) that sponsor the Mathematics Group and those NGO facilitators.

Division of labour: The roles and tasks of teachers as subjects and as community.

Tools: The tangible and non-tangible and resources used as mediating artefacts during the workshops.

Outcome (or ideal expected result): improvement in Commerce teaching /revising with learners and improvement of learning and teaching of Mathematics.

The study used CHAT elements and principles to give the picture of what was happening in the activities of the Commerce Teachers' Association and the Mathematics Group in the Zethembe District. CHAT was also used as a methodological lens at the data collection stage and for data analysis. In addition, I used a CHAT dialectical analysis. A dialectical analysis examines how different elements or aspects of the activity system are related appositionally, pulling in different directions (Timmis, 2014, p.23). CHAT is useful in this study because it offers a tool to understand learning that takes place in a setting where people are working together on a shared task or object to be examined. However, CHAT has some limitations in this study which are presented in the next section.

3.4. Limitations of CHAT

Some researchers (Daniels, 2004, 2006, Timmis 2014) have critiqued the third generation of CHAT, upon which this study is framed. These two scholars feel that: "there is an over emphasis on tool-mediated production of the object, and neglect of communication and sign-based mediation" (Timmis, 2014, p.14, Daniels 2004, p.187). Daniels (2006) argues that it is difficult to use CHAT to analyse educational settings. Daniels (2006) suggests that for understanding how meaning making contributes to activity, "a CHAT analytical framework should incorporate discourse analysis based on a conceptual understanding of discourse that is commensurate with the CHAT core idea of activity as socially and historical constructed" (Daniel, 2006, pp. 55-56). However, this study was not aiming at generating discourse analysis but rather at using CHAT elements to understand teacher learning in the Commerce

Teachers' Association and Mathematics Group. However, the CHAT analytical framework is further complemented by teacher knowledge conceptual framework.

In this study, CHAT had some limitations. The framework did not facilitate looking 'inside' the activity to see exactly the kinds of knowledge teachers learnt within the collective engagements. Furthermore, the model does not allow for clear differentiation between types of activities. For instance, any activity could be placed within the model without being in some differentiated. During the data collection phase I was compelled to use the concept of an activity according to participants' point of view, 'activity' was used to refer to whatever they were doing, such as in one case, drawing graphs. CHAT therefore provides a generic lens to facilitate analysing any activity, but because it can be applied to any activity, this does not allow for detailed differentiation between the different kinds of activity where teacher learning has occurred. In line with Daniel's (2006) suggestion that incorporating CHAT with a conceptual understanding is necessary because of its unresolved agendas, I complemented CHAT by a teacher knowledge conceptual framework which is discussed in the next section.

3.5. Teacher knowledge

In terms of knowledge, the CHAT framework of this study posits that there is a relationship between knowledge as a possession of individuals and knowledge as a possession of individual knowers (Engeström, 1987). This section discusses the teacher knowledge concepts that are used to describe the kind of teacher knowledge that is learnt in Commerce Teachers' Association and the Mathematics Group. The broad intention of teacher learning is to acquire or extend knowledge, skills and attitudes towards teaching, thus it is important to describe what kind of knowledge was acquired in these groups.

Different authors define teacher knowledge in different ways. There are those authors who define teacher knowledge according to types of teacher knowledge. For example, Shulman (1987) an American scholar who has spent 30 years or more researching teachers' professional knowledge and reasoning, suggests that there are seven categories of teacher knowledge: knowledge of content, knowledge of pedagogy, knowledge of curriculum, knowledge of learners and learning, knowledge of context, pedagogical content knowledge and knowledge of educational aims. Grossman and Richert (1988) define teacher knowledge in relation to subjects taught, that it is a body of general pedagogical principles, skills, and knowledge of the subject matter taught.

Tamir (1991) elaborates by highlighting the distinction between practical personal knowledge and professional knowledge. According to Tamir (1991), practical personal knowledge is used to capture the idea of experience as the main aspect that makes us regard teachers as knowledgeable and therefore knowing persons. Professional knowledge is defined: "as the body of knowledge and a skill which is needed in order to function successfully in a particular profession" (Tamir, 1991, p. 263). In this case the profession is teaching. Professional teacher knowledge can also be understood from two perspectives, "propositionally and procedurally" (Knight, 2002). According to Knight (2002), propositional knowledge is about meaning making which includes propositional facts, and abstract knowledge of ideas and principles. Procedural knowledge is "know how" knowledge, such as the knowledge of how to teach Mathematics, or how to manage a class of children, or how to design an appropriate test.

Several researchers have different views about the types of teacher knowledge (Shulman, 1986, 1987; Grossman, 1990; Clandinin, 1994; Adler, 2002; Nieto, 2003; Hashweh, 2005; Knight, 2000; Zembylas, 2007; Gurrahy, Cothrina & Kulina, 2005; Maistry, 1998; Hill, Schilling & Ball, 2004; Ball, Thames & Phelps, 2008). There is a great deal of literature on teacher knowledge showing that researchers have built their views about teacher knowledge on Shulman's (1986) work. This is evident from several scholars such as Grossman (1990) and Taylor, and also van der Berg and Mabogoane (2013). These scholars have shown the relationship between Shulman's (1986) domains of teacher knowledge with other types of teacher knowledge. For example, Taylor and Taylor (2013) maintain that Shulman's (1987) content knowledge corresponds with what they call disciplinary knowledge.

In this study, I use Grossman's (1990) four domains of teacher knowledge to analyse the kinds of teacher knowledge that teachers may acquire. In this study the focus was on Commerce (Business Studies Economics and Accounting) and Mathematics teachers. However when I began analysing the data, I realised that using Grossman's (1990) domains of teacher knowledge was not sufficient for conceptualising the kinds of Mathematics teacher knowledge that was learnt in Mathematics Group. Figure 7 shows Grossman's (1991) Model of the domains of teacher knowledge.

SUBJECT MATTER KNOWLEDGE				GENERAL PEDAGOGICAL KNOWLEDGE			
Syntactic Structures	Content	Substantive		Learners and Learning	Classroom Management	Curriculum and Instruction	Other

PEDAGOGICAL CONTENT KNOWLEDGE		
Conceptions of Purpose for Teaching Subject Matter		
Knowledge of Students' Understanding	Curricular Knowledge	Knowledge of Instructional Strategies

KNOWLEDGE OF CONTEXT		
Students		
Community	District	School

Figure 7: Model of Domains of Teacher Knowledge (Grossman, 1990)

3.5.1 Subject matter knowledge

Subject matter knowledge is regarded as an important aspect of any professional development programme. Adler (2002) defined subject knowledge as relatively broad and deep knowledge of the subject that teachers are teaching. Adler's (2002) views imply that teachers should have broad knowledge of their subjects (such as Mathematics, Economics Business Studies and Accounting) that they teach in order to be able to answer any questions from different areas of the subject. Furthermore, teachers' knowledge of the subject must be sufficiently

deep and the teachers must be able to relate the subject to the learners' reality as well as to the careers that the learners intend to pursue. According to Shulman (1986), subject matter knowledge refers to the amount and the organisation of knowledge *per se* in the mind of the teacher. He states that "this content knowledge of the teacher must at least be equal to that of his or her colleagues" (Shulman, 1986, p. 9). The research review of teacher learning conducted by Darling-Hammond (2009), stressed the importance of content knowledge from teachers' reports showing that their knowledge and skills and their practice changed when they received professional development that was coherent, focused on content knowledge and involved in active teacher learning.

In South Africa, there is evidence that subject content knowledge is a crucial aspect of any professional development programme (Venkat & Spaull 2014; Pournara, Hodgen & Pillay 2015). These South African studies on teachers' mathematical knowledge establish findings that many teachers in South Africa lack subject content knowledge. Another group of authors state that in initial teacher education there has been too much focus on general teaching methods and too little on the underpinning conceptual knowledge that needs to be taught (Hofmeyr & Hall, 1995; Taylor & Vinjevold, 1999 and Parker & Adler, 2005). As a result, in 2001, the government restructured teacher education; the teacher training colleges were incorporated into Higher Education system. Professor Kader Asmal's (the former Minister of Education) comments on quality give us one of the reasons for the restructuring of teacher education. He says, "Quality and subject content knowledge which was seen in relation to the National Teacher Education Audit highlighted the poor quality of education in the colleges" (Parker & Adler, 2005, p. 69). In relation to the restructuring of teacher education, Parker and Adler (2005) also state that teacher educators are positioned to redefine knowledge and practices for teacher education and to re-insert disciplined and disciplinary inquiry into teacher preparation programmes.

With regard to the subject knowledge that Commerce teachers need to know, Maistry (1998) in a study of Economics teaching in secondary schools, states that the nature of school Economics knowledge is determined by the demands found in Economics courses in Higher Education Institutions and in the workplace. The reason for this link, between school studies and what follows, is to "enable learners to further their studies *inter alia*, education, macro-economics, economic development, international economics, public sector economics, environmental economics, economic history, monetary economics, ecometrics, business cycles and forecasting, journalism, transport economics, economics doctrines and systems

and related social studies" (Department of Education, 2005, p.10). In relation to this broad scope, Commerce teachers were previously expected to use knowledge of their discipline to make choices about what content is appropriate for the learners and how best to pace and organise teaching and learning (Department of Education, 2005). This was in line with OBE. However, in Curriculum and Assessment Policy Statement (CAPS), the current South African curriculum, teachers have no choice about the selection of the content as they have to follow the CAPS document.

In terms of Mathematics content knowledge, Krauss and Blum (2012) contend that the content knowledge for Mathematics is not treated extensively in the literature. Krauss and Blum (2012) argue that Shulman's description of content knowledge does not specify the relationship between subject matter of the school curriculum and a broad basis of university-related knowledge. In relation to subject matter knowledge, Grossman (1990) argues that this includes knowledge of the content of a subject area, as well as knowledge of the substantive and syntactic structures of the discipline. Knowledge of the content refers to major concepts within a field and the relationships among them (Grossman, 1990, p. 6). For example, there are concepts such as wants and needs in Business Studies. In this context, needs are things that you cannot live without, such as shelter. On the other hand, wants (such as a cell phone) are things that you can live without. Grossman (1990) goes on to say that the substantive structures of a discipline refer to the various paradigms within a field that affect both how the field is organized and the questions that guide further inquiry. For example, the field of school Mathematics in South Africa is organized into three sections, algebra, geometry and trigonometry. The syntactic structures of a discipline in the subject matter knowledge; "includes an understanding of the canons of evidence and proof within the discipline, or how claims are evaluated by members of the discipline" (Grossman, 1990, p 6). Grossman (1990) maintains that knowledge of the structure of a discipline is important because without the knowledge structures, teachers may misrepresent both the content and the nature of the discipline.

In relation to Mathematics, several scholars such as Ball, Thames and Phelps (2008) and Ben-Peretz (2011) critique Shulman's (1987) categorization of teacher knowledge, saying that it focused on knowledge structures rather than knowledge construction. These authors argue that different set of concepts are required for the subject matter knowledge in Mathematics. Grossman's (1990) components of subject matter knowledge also seem to be insufficient to conceptualize Mathematics subject matter knowledge because Mathematics

involves numerical constructions rather than logical structures. In elaborating Shulman's (1987) content knowledge, Ball, Thames and Phelps (2008) break down the subject matter knowledge into three categories that describe the different aspects of teacher knowledge that are relevant to Mathematics. These categories are shown in the following Figure 8:
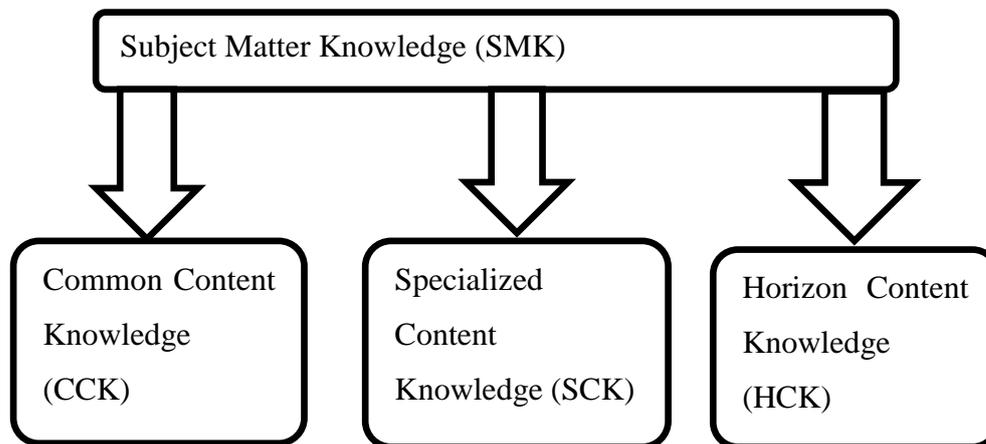
Figure 8: Ball, Thames and Phelps (2008) Components of Subject Matter Knowledge in Mathematics

Common Content Knowledge (CCK). According to Ball et al. (2008), CCK is not specific to teaching but it is a subject-specific knowledge needed to solve mathematics problems. An example of CCK in algebra is $20 \times 10 = 200$. These authors contend that this knowledge is critical for teachers because it is difficult to teach what you do not know yourself.

Specialised Content Knowledge. (SCK) is described as Mathematical knowledge and skills unique to teaching (Ball et al., 2008, p. 400). Ball et al. (2008) contend that teachers need to have a specialized understanding of, for example, how $(x + y)^2$ can be expanded. Furthermore, Ball et al. (2008) also state that SCK enables the teachers to understand learners' strategies and sources of error better. According to Ball et al. (2008), SCK also includes knowledge of representing mathematical procedures and ideas using pictures and manipulatives. The understanding of learners' strategies and error is in line with Grossman and Shulman's notion of pedagogical content knowledge (PCK).

Horizon Content knowledge is described as an awareness of how Mathematics topics are related over the span of Mathematics included in the curriculum (Ball et al., 2008, p.403).

For example, algebra teachers need to understand how exponents relate to polynomials and how to work with rational expressions (Ball et al., 2008, p. 403). Furthermore, the horizon content knowledge includes curriculum knowledge because teachers draw from the curriculum to articulate a familiarity with the structure of the Mathematics curriculum (Hurrell, 2013, p. 58). For example, the syntactic structures of a discipline Grade 10 Mathematics teacher needs the knowledge of the curriculum to know how the Mathematics he or she teaches is related to the grade 11 Mathematics in order to set the foundation for the learners.

3.5.2. General Pedagogical knowledge

It seems as if general pedagogical knowledge has not captured the attention of many researchers because there is little information from the literature (Grossman, 1991; Gurrahy, Cothran & Kulinna, 2005) about it. General pedagogical knowledge "includes a body of general knowledge, beliefs, and skills related to teaching, knowledge and beliefs concerning learning and learners; knowledge of general principles of instruction" (Grossman, 1991, p. 6). This definition of general pedagogical knowledge implies that it is not linked to a particular topic. According to Shulman (1987), this knowledge is about general aspects of teaching such as discipline, care giving and motivation, since it is practically impossible for a teacher to teach in a disrupted classroom situation. Garrahy et al. (2005) give more evidence on the importance of general pedagogic knowledge by exploring teachers' management knowledge. They note that "Regardless of whether one is a novice or veteran teacher, classroom management continues to be a primary concern of educators" (Gurrahy, Cothran and Kulinna, 2005, p. 60). Furthermore, the findings of their study show that learning to manage one's classroom is an on-going developmental process influenced by personal and contextual forces. In the South African context, the Integrated Quality Management Systems (IQMS) as per Resolution number 8 of 1998, Performance Standard number one, requires teachers to show that they are able to create a positive learning environment. They need to cater for the following aspects: learner involvement, diversity and discipline. Hence, they need to acquire general pedagogical knowledge because teachers will not be able to create a conducive atmosphere in their classes if, for instance, they are not able to handle discipline issues.

3.5.3 Pedagogic Content knowledge (PCK)

Shulman (1987) claims that there is a special amalgamation of content knowledge, and pedagogy knowledge that is uniquely the province of teachers and their special forms of professional understanding. He calls this *pedagogical content knowledge (PCK)*. He further states that "pedagogical content knowledge also includes an understanding of what makes the learning of a specific topic easy or difficult; the conceptions and pre-conceptions that students of different ages and backgrounds bring with them to the learning of those tough topics and lessons" (Shulman, 1987, p. 9). Similarly to what Ball et al. (2008) call SCK, Grossman (1991) suggests that "PCK includes knowledge of the most regularly taught topics in one's subject area, the most useful representations of those ideas, and the most powerful analogies, illustration, examples, explanations, and demonstrations, or ways of representing and formulating the subject that make it comprehensive to others" (Grossman, 1991, p. 7).

She further defines PCK more clearly by unpacking it into four central components:

- The first component comprises knowledge and beliefs about the purpose for teaching a subject at different grades. In relation to this study, an example is teachers' knowledge of the purpose of teaching Business Studies from grades ten to twelve.
- The second component of PCK consists of knowledge of students' understanding, conceptions and misconceptions of particular topics in a subject matter. For example, Economics teachers draw from this knowledge to predict learners' thinking about the difference between monopoly and monopolistic competition, or the types of market structures in Economics.
- The third component of PCK includes knowledge of the curriculum materials available for teaching particular subject matter. In Mathematics, curriculum material includes Sketch pad, a software programme used to teach Mathematics.
- The fourth component of PCK includes knowledge of instructional strategies and representations for teaching a particular subject, such as demonstrations, experiments and games.

However, Shulman's description of PCK has been critiqued by scholars such as Ball, Thames and Phelps (2008). These authors claim that Shulman's (1987) notion of PCK has lacked definition and empirical foundation, which limits its usefulness (Ball et al. 2008, p. 389). Thus, they have built on Shulman's (1987) notion of PCK and suggest three domains for PCK as shown in Figure 9 on the next page:

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┌─────────────────────────────────────────────────────────────┐
│           Pedagogical Content Knowledge (PCK)                │
└─────────────────────────────────────────────────────────────┘
        │                    │                    │
        ▼                    ▼                    ▼
┌──────────────┐    ┌──────────────────┐   ┌──────────────┐
│ Knowledge of │    │ Knowledge of     │   │ Knowledge of │
│ Content and  │    │ Content and      │   │ Content and  │
│ Students(KCS)│    │ Teaching (KCT)   │   │ Curriculum   │
│              │    │                  │   │ (KCC)        │
└──────────────┘    └──────────────────┘   └──────────────┘
```
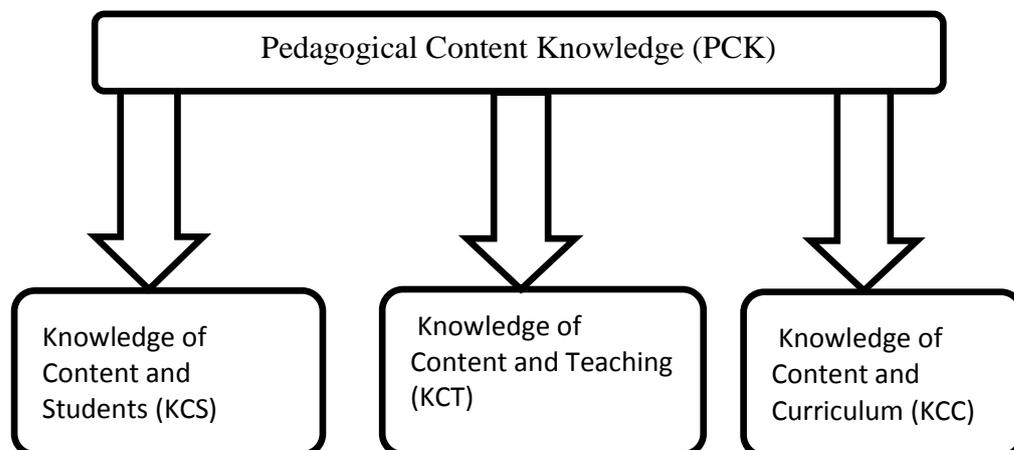
Figure 9: Ball, Thames and Phelps (2008) Components of Pedagogical Content Knowledge (PCK)

Knowledge of content and students (KCS). According to Ball et al. (2008), this is the knowledge that combines knowing about learners and knowing about Mathematics content in order for the teachers to predict learners' thinking. They further explain knowledge of content and students by using an example of exponents. They say that in exponents, a teacher's knowledge of content and of students enables the teacher to expect students to incorrectly think that $(x + y)^2 = x^2 + y^2$ and to anticipate that misconception about the distributive property and exponents. In other words, knowledge of content and of students allows an interaction between specific Mathematical understanding with students and their Mathematical thinking.

Knowledge of content and teaching (KCT): "is the knowledge that allows an interaction between specific Mathematical understanding and an understanding of pedagogical issues that affects student learning" (Ball, Thames and Phelps, 2008, pp. 389-407). In relation to Mathematics, they suggest that knowledge of content and teaching combines knowing about teaching and knowing about Mathematics. This is in line with Shulman's (1987) description of PCK when he says that it is the amalgamation of pedagogical and content knowledge. However, Ball et al. (2008) put it more clearly in a Mathematics context by saying that knowledge of content and teaching is an amalgamation involving a particular Mathematical idea or procedure in addition to familiarity with pedagogical principles for teaching that particular content. On the same point as Grossman's (1991) third component of PCK, which

is instructional strategies and representations, Ball et al. (2008) contend that KCT allows teachers to decide what to do about learners' misconceptions by choosing which examples to start with and which examples to use to take learners deeper into the content.

Knowledge of content and curriculum (KCS)/ (Horizon). Ball et al. (2008) do not give an explicit description of KCS. Similarly to Grossman (1991), they comment that knowledge about content and curriculum means teachers' knowledge of the available materials that they can use to support students' learning. For example, the mathematics teachers drew upon their knowledge of which textbooks are best for teaching geometry and algebra for a certain grade. Krauss and Blum (2012) argue that curriculum is part of the Mathematics content knowledge and they call it advanced background of the subject matter of the Mathematics curriculum.

A curriculum policy is essentially a course of study or plan of what must be taught and learnt. In South Africa there have been many changes in the curriculum, due to the number of implementation challenges such as contextual factors. In 1997 Outcomes-based (OBE) was introduced and was reviewed in 2000, which led to the Revised National Curriculum Statement which later developed into the National Curriculum Statement 2002 (Department of Education, 2006). The National Curriculum Statement was amended and the amendments were effected in January 2012 (Department of Basic Education, 2011). So a single comprehensive Curriculum and Assessment Policy Statement (CAPS) for each subject was developed to replace subject statements, learning programme guidelines and subject assessment guidelines. Therefore, CAPS is the curriculum that South African teachers currently need to know. This study was undertaken during the transitional stage of the curriculum at the Further Education and Training level (Grades 10 to 12). CAPS was introduced in 2012 in Grade 10. During my data collection stage in 2013, CAPS was introduced in Grade 11. So the curriculum knowledge in this study is based on CAPS.

Shulman (1987) claims that teachers need to understand the principles underpinning the curriculum. Brown (2005) highlighted that technological advancements have resulted in technological advancement of the curriculum, which implies that technological tools are needed to support students and teachers to be empowered. This would enable them to fit in to the world of technology. The teacher's knowledge must be shaped to understand the technologically advanced curriculum. This leads us to the importance of Information Communication Technology (ICT). Currently in South Africa, the Department of Basic Education, in partnership with Siyavula-Technology Powered Learning, a technology

company and Vodacom, is introducing technological teaching and learning of Mathematics in certain schools with a strong focus on schools which are in the rural areas.

3.5.4. Contextual knowledge

According to Grossman (1991), teachers must act upon their understanding of the particular context in which they teach in order to adapt to specific school settings and to individual students. She describes context knowledge as comprising the following:

- Knowledge of the district in which teachers work, including opportunities, expectations and constraints posed by the district (Grossman, 1991, p.5). For example in this study, Economics teachers should have knowledge of the district officials, how they work and who holds power for decision making.

- Knowledge of the school setting including the school culture, departmental guidelines and contextual factors at the school level that affect instruction (Grossman, 1991, p. 5). One example of a contextual factor may be lack of learner teacher support material.

- Teachers need to understand students and communities, and the students' backgrounds, families, particular strengths and weaknesses and interests (Grossman, 1991, p. 5). In relation to knowledge about learners Shulman (1987) states that knowledge of learners involves understanding learners' characteristics and cognition as well as knowledge of motivational and developmental aspects of how students learn. For example, in South Africa the curriculum for teacher education includes Educational Psychology which exposes teachers to the cognitive developmental stages of learners according to ages. The inclusion of Educational Psychology in teacher education implies the importance of the knowledge of learners. Sontoro (2007) states that teachers need to know how their students' identities and their own identities are constituted through ethnicity. He maintains that teachers need to understand the nature of students' ethnic identities. They need to understand their cultural practices, values, beliefs and how these issues shape them as learners and members of ethnic communities.

This section has presented both Shulman's and Grossman's understandings of teacher knowledge. Shulman's (1987) categorization of teacher knowledge was critiqued first.

However, the teacher knowledge literature discussed above suggests that from Shulman's (1986) domains of teacher knowledge, subject content knowledge and pedagogical content knowledge have caught the most attention of many scholars such as Ball, Thames and Phelps (2008). Grossman's (1991) four domains of teacher knowledge upon which this section is organised a synthesis of Shulman's (1987) seven domains into four domains. Ben-Peretz (2011) argues that Shulman's (1987) domains of teacher knowledge focus on knowledge structures rather than knowledge construction. Grossman (1991) also seems to focus on knowledge structures. In this study, Grossman's (1991) four domains of teacher knowledge were only useful in describing the types of knowledge that were learnt in the Commerce Teachers' Association.

When it came to investigating Mathematics teacher knowledge, I used a different understanding. Ball, Thames and Phelps (2008) expand and refine subject content knowledge and PCK in order to understand Mathematics teacher knowledge. Interestingly, Shulman's (1987) other domains are combined with subject matter content and PCK, for example knowledge of content and curriculum. While Shulman (1987) describes PCK as an amalgamation of subject matter and pedagogical knowledge, Hill, Ball and Schilling (2008), Ball, Thames and Phelps (2008) and Hurell, (2013) describe PCK as a combination of content knowledge with one or more categories of Shulman's categories. Mathematics teacher knowledge researchers consider mathematical horizon and knowledge of content and curriculum (KCC) as incomplete. They believe these still need revision and refinement because they run across several categories (Hill, Ball & Schilling, 2008; Ball, Thames & Phelps, 2008; Hurell, 2013). This combination of different categories of teacher knowledge supports the literature on teacher knowledge and learning which maintains that different forms of teacher knowledge may not be easily separable (Brodie & Sanni, 2014, p. 190).

Hurrell (2013) contends that Ball et al.'s (2008) domains are domains of professional knowledge. In each of the domains he has formulated some supporting questions which may be used to audit where professional development might be appropriate (Hurrel, 2013, p. 58). In this study I use Grossman's (1990) domains of teacher knowledge (Figure 5) to describe the kinds of knowledge that is learnt in the Commerce Teachers' Association because, the tasks in which Commerce teachers engaged seem to focus more on general issues such as examination structures. On the other hand, for the Mathematics Group I adopted and refined an analytical tool by combining Horizon knowledge and Curriculum knowledge. I excluded PCK because this knowledge is covered by the category Specialised Content Knowledge. The

following Table 3 shows the analytical tool that is used to describe the kinds of teacher knowledge learnt in the Mathematics Group. I developed the analytical tool from Ball, Thames and Phelps' (2008) domains of teacher knowledge and a revision of Hurrell's (2013) supporting questions.

Domain	To what extent does the workshop develop teachers' knowledge to:
Common Content Knowledge (CCK)	Calculate answers correctly. Solve mathematical problems. Use terms and notations correctly
Specialised Content Knowledge (SCK)	Present mathematical ideas. Respond to learners' why questions Find examples/ analogies/ demonstrations/ resources to make a specific mathematical explanation. Recognise what is involved in using a particular representation Appraise and adapt the mathematical content of the textbook. Modify tasks to be either easier or harder. Give or evaluate mathematical explanations. Choose and develop useable definitions. Use mathematical notation and language, and critique its use. Ask productive mathematical questions. Select representations for particular purposes.
Knowledge of Content and Students/ Teaching (KCS/KCT)	Anticipate what learners will find easy or difficult about completing a task. Recognise the misconceptions that learners have and common errors that students make.
Knowledge of Content and Curriculum (Horizon) KCC (H)	Articulate the topics of the curriculum. Understand the purpose of the curriculum. Make connections across the topics in the Mathematics curriculum. Link representation to underlying ideas and to other representations. Articulate how the Mathematics you teach fits into Mathematics which comes later.

Table 3: Ball, Thames & Phelps (2008) domains of teacher knowledge and revised Hurrell's (2013) supporting questions

3.6. Conclusion

This chapter has presented the theoretical and conceptual framework of this study. In line with Timmis (2014), CHAT is an integrated theoretical and methodological framework. This study has used CHAT at different levels namely as a theoretical frame and for data analysis. The study has used CHAT elements and principles to analyse the activities of Commerce Teachers' Association and the Mathematics Group. However, CHAT was not appropriate in

describing the kinds of teacher knowledge that was learnt in Mathematics Group and Commerce Teachers' Association. Hence, the domains of teacher knowledge were used as an additional conceptual framework of this study.

The next chapter discusses the research design and methodology of this study.

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1. Introduction

The previous chapter discussed CHAT and teacher knowledge conceptual framework of this study. This chapter explains the research design and methodology of the study that was used in order to address the following research questions:

1. How were the two selected teacher learning communities formed?
2. How does teacher learning happen in two selected teacher learning communities?
3. What kind of teacher knowledge is learnt in these teacher learning communities?
4. What is the nature of the collaborative relationship in these teacher learning communities?

The chapter starts with my research paradigm where I explained the interpretive paradigm as a way of seeing the world. Then I described the research approach showing how I mixed qualitative and quantitative approaches. The third section discusses the research design of the study. Fourthly, the chapter explains the four methods of data collection. The fifth section discusses how I analysed the qualitative and quantitative data. The sixth section then describes how I ensured the trustworthiness of the study. The seventh section explains the ethical issues. The ninth section finally discusses the limitations of the study and how I addressed them.

4.2. Research paradigm

This study is framed by Cultural-Historical Activity Theory (CHAT) which posit that multiple realities exist and that each reality is an intangible construction rooted in people's experiences in everyday life and how they make sense of them (Elster, 2010; Elis Edward & Smogorinsky 2010). Coherent with CHAT, the study was located in an interpretive paradigm; the central endeavour in the context of this paradigm was to understand the subjective world of human experience (Cohen, Manion & Morrison, 2000, p.51). According to Cohen et al. (2000), researchers working within the interpretive approach believe that it is people who define the meaning of any particular situation. In relation to this study, I described and understood how Commerce and Mathematics teachers learn in their teacher learning communities in the Zethembe District (pseudonym). Regarding the nature of knowledge in the interpretive paradigm, knowledge is socially constructed by those in the research process

and my role as a researcher, as stated by Robinson (2002), was to understand the complex experience from the point of view of the participants and to make sense of the meaning that teachers assign to the phenomenon, and how they interpret the participants' actions. In line with the research literature (Robson, 2002; Creswell, 2007; Cohen, Manion & Morrison, 2007; Bertram & Christiansen, 2014) the interpretive perspective in this study was based on the following assumptions.

Human life can only be understood from within. From the ontological point of view, the interpretivists focus on people's subjective experiences, on how people construct the social world by sharing meanings, and how they interact with or relate to each other (Bertram & Christiansen 2014). In this study the interpretive perspective is used to understand how Commerce (Accounting, Business Studies and Economics) and Mathematics teachers learn in their workshops and outside of the workshops. According to Robson (2002), a social construction of reality implies that there are many ways of seeing the world, perceptions may never stay the same but will change. There is no objective reality that can be known, but there are multiple realities (Robson, 2002). Furthermore, Creswell (2007) also contends that human behaviour is affected by the social world, there are multiple and no single realities of phenomena and those realities can differ across time and place.

Social life is a distinctively human product (Creswell 2007). Within an interpretivist paradigm, I also assumed that reality is not objectively determined but socially constructed. For example, teacher learning, the phenomenon of this study was to understood as socially constructed by Commerce and Mathematics teachers when they are in their workshops or outside of the workshop. This is in line with Robson (2002), who contends that epistemology (nature of knowledge) in the interpretive paradigm is that knowledge is socially constructed by those in the research process. So my duty as a researcher was to understand the complex experience from the point of view of the participants. The interpretive paradigm appears to share the same assumptions with CHAT because the ontology of CHAT is dialectic, meaning that it assumes a biologically, materially, and historically constructed reality that both shapes and is shaped by individual actions (Seaman, 2007, p. 6). Drawing from Creswell (2007), the underlying assumption in this study was that by placing people in their social context, there is a greater opportunity to understand how teacher learning occurs in the Commerce Teachers' Association and in the Mathematics Group.

The human mind is the purposive source of origin of meaning. By exploring the richness, depth and complexity of phenomena I developed an understanding of meanings imparted by Commerce and Mathematics teachers to phenomena and their social context (Creswell, 2007). Creswell further elaborates by saying that the social world does not exist independently of human knowledge. In the context of this study, my knowledge and understanding of the phenomena has an influence in terms of questions asked and in the way I conducted this research.

4.3. Research Approach

In this study, my aim was to understand how teacher learning occurs in the Commerce Teachers' Association and the Mathematics Group. These two groups of teachers were being studied in their own place or in a "natural setting" (Creswell, 2014). Therefore, the study follows a qualitative approach. According to Denzin and Lincoln (2005), qualitative research approach studies things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. In line with Denzin and Lincoln (2005), in this study I was interested in meaning, how people make sense of their lives, what they experience, how they interpret their experience, and how they structure their social world.

The research literature (Creswell, 2007, 2014; Robson 2002) identified five characteristics of a qualitative research approach. The characteristics of a qualitative research approach are explained in relation to the study of teacher learning in teacher learning communities in the table below:

Characteristics	Explanation of qualitative characteristics in relation to the study
Natural setting:	In this instance the qualitative researcher collected data in the field at the site where participants experience the issue. In relation to the study, I collected data through observation; I observed three workshops for Commerce teachers as well as three workshops for Mathematics teachers. Furthermore, I had "face to face interaction" (Creswell, 2007) with teachers during the workshops and during the interview sessions which were held with four participants from each group of teachers.
Researcher as key instrument:	Qualitative researchers collect data themselves through examining documents, observing behaviour, and interviewing participants. They may use a protocol as an instrument for collecting data but the researchers are the ones who actually gather the information (Creswell, 2007, p. 54). In this study I assumed active roles as an interviewer, observer, data transcriber and analyst. However in Commerce workshop, I was viewed as part of the group by the participants because I am an Economics teacher. I had to be vigilant in reducing biasness. I was assisted by peers to videotape the Mathematics workshops. I employed and independent person to transcribe the Mathematics data from the videotape.
Multiple sources of data:	Qualitative researchers typically gather multiple forms of data rather than relying on a single data source. In this case I used multiple methods of data generation techniques. I collected qualitative data by using interviews, observations, document analysis and questionnaires. The questionnaires generated both quantitative and qualitative data.
Participants' meaning:	In the entire qualitative research process, the researcher keeps the focus on understanding the meaning that the participants hold about the issue, not the meaning that the researcher brings to the research from the literature. During the data collection phase I tried not use the concepts that are used in the literature and such as PCK because there is a different understanding of concepts in different context.
Interpretive inquiry:	Qualitative research is a form of inquiry in which researchers make an interpretation of what they see, hear, and understand (Robson 2002). The researchers, interpretations cannot be separated from their own background, history, context and prior understanding (Creswell, 2014). I reviewed all the data and made sense of them according to Cultural-Historical-Activity Theory (CHAT), and the teacher knowledge conceptual framework and themes that cut across all the data.

Table 4: Characteristics of qualitative research (adapted from Creswell, 2007, 2014; Robson, 2002)

These characteristics (in Table 4) of a qualitative research are all applicable to this research study. Although I used the survey questionnaires to generate qualitative and quantitative data, I argued that the study remained firmly in the qualitative approach because the survey questionnaires were not undertaken in order to prove the findings of the qualitative data (Bickman & Rog, 2009; Tashakkori & Teddlie, 2010; Creswell, 2014). The survey questionnaires were used to collect qualitative and quantitative data from a broader sample of participants to help describe the broader picture of the kind of knowledge that was learnt and nature of collaborative relationship.

The next section discusses the research design of the study.

4.4. Research Design

The study employed the case study as a research design which used a range of data generation tools and collected mostly qualitative data and some quantitative data was generated by the survey. A case study is defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used" (Yin 2009, p.259). For the purpose of this study the case study was used to gain insight into what happens in teacher learning communities. As stated by Rule and John (2011), the case study approach allows the researcher to choose one or a few cases and studies them in depth. In this study, I am studying two cases: the Commerce Teachers' Association and the Mathematics Group in Zethembe District. The case study was used to explore a general issue within a limited and focused setting (Rule & John, 2011). In this study, teacher learning in teacher learning communities was the general issue that is investigated in two focused settings.

The strength of using the case study research design was to generate theoretical insight, either in the form of grounded theory that rises from the case study, or by using an existing theoretical perspective. In line with Rule and John (2011), in this study the case study illuminates broader theoretical and contextual points. This study was not intended to generate grounded theory but it used the Cultural-Historical Activity Theory and the teacher knowledge conceptual framework to develop a rich and thick description of how teacher learning (which is the phenomenon) happens in the Commerce Teachers' Association and the Mathematics Group. This study was a multiple case study because it has two cases.

Multiple cases provide a large amount of information in detail about the research topic (Yin, 2009; Rule & John, 2011). Multiple cases also allow comparison across the cases. In this study the findings for each case were compared, in order to get different pictures about the phenomenon (which is teacher learning) in each context. The comparison of findings is presented in Chapter 9 of this thesis.

However, the case study design had some limitations to the study. Yin (2009) suggests that when the researcher uses multiple cases, she might be tempted to look for similarities and disregard the differences. In this study the findings from each case were compared according to the research questions. This study generated large quantities of data that took time to analyse. The CHAT and teacher knowledge analytical tools were instrumental in handling the quantities of data.

4.4.1. Selection of cases

This study was not aiming to transfer the findings or to generalize to the wider population. The purposive sampling was used because it demands knowledgeable people, those who have in depth knowledge about the particular issues by virtue of their professional role, expertise and experience (Cohen, Manion and Morrison, 2007). Purposive sampling was used to select the cases and the interview participants.

When I started this study I identified three potential cases. These three cases were identified as teacher learning communities in one of the twelve districts (Zethembe District) in KwaZulu-Natal. The first case was IsiZulu Home Language teachers which was a group that has existed for a while. The second case was a group of Commerce teachers known as the Commerce Teachers' Association which was formed by Commerce teachers in Zethembe District. It draws Commerce teachers from schools in four Circuits in the District. The third case was a Mathematics Group or circuit cluster that was formed in accordance with Department of Basic Education orders. The Mathematics Group was supported by Non-Governmental Organisations who came from outside of Zethembe District by providing funding, resources and workshops. However, I ultimately had two cases because there were no workshops for the isiZulu teachers held during the data collection phase. There were activities that were taking place but their focus was on learners, for example Grade 12 learners were grouped together and isiZulu teachers coming from outside of Zethembe District taught them. Figure 10 and Figure 11 for this chapter on the next page is a contextual illustration of two cases.

Zethembe District in KwaZulu-Natal

A
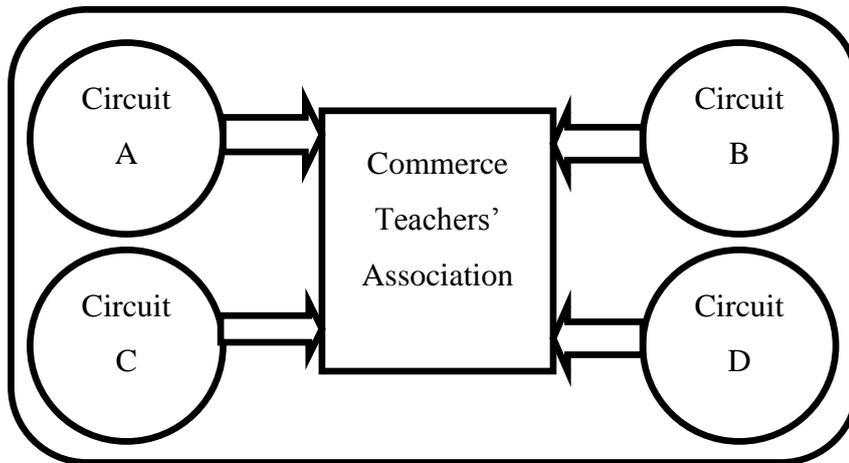
Figure 10: Location of Commerce Teachers' Association

Zethembe District in KwaZulu-Natal

B
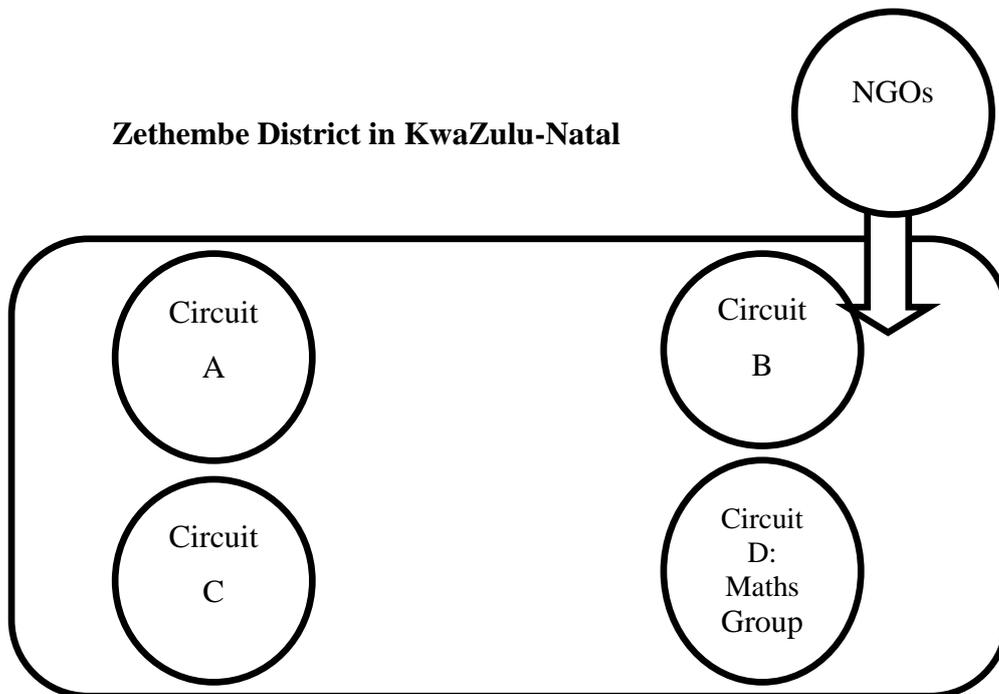
Figure 11: Location of the Mathematics Group

The Mathematics Groups also draws teachers from four circuits, but is assisted by external facilitators from local NGOs.

Purposive sampling was also used to select the interview participants. Purposive sampling suited this study because I needed to interview knowledgeable people, those who have in-

depth knowledge about each of the two communities under study, "by virtue of their professional role, expertise and experience" (Cohen, Manion & Morrison, 2007, p.115). For the Commerce Teachers' Association, the sample consisted of four participants. I gave participants pseudonyms for confidential and protection reasons. The Economics Subject Advisor, Mrs Mathe is an ex- officio member of the Commerce Teachers' Association, Chairperson is Celokuhle, General Secretary was Sebenzile and Sbusisiwe was one of Commerce teachers who was not in the executive committee of Commerce Teachers' Association. Table 5 shows the biographical features of these four interview participants:

Participant	Gender	Age	Subject taught	Teaching Experience	Post Level	No of Years in Commerce Teachers' Association
Mrs Mathe	Female	54	Economics	12 years teaching, 6 years as advisor	Post level 3 Economics Subject Advisor	5 years
Celokuhle	Male	36	Business Studies and Economics	12 years	Post level 2 HOD	5 years
Sebenzile	Female	37	Accounting and Business Studies	15 years	Post level 2 HOD	5 years
Sbusisiwe	Female	30	Business Studies and Economics	9 years	Post level 1 educator	5 years

Table 5: Biographical details of Interview Participants from the Commerce Teachers' Association

The Mathematics Group was a group of Mathematics teachers from one of the four circuits in Zethembe District. The sample consisted of the four participants that were interviewed, Siza, the NGO Mathematics facilitator, Hlengiwe, the cluster coordinator and a lead teacher, Jabulani, a lead teacher and Bongani, a lead teacher. The four participants were given pseudonyms. The following Table 6 shows the biographical details of these four participants:

Participants	Gender	Age	Mathematics Teaching experience	Portfolio in Mathematics Group
Siza	Female	68 years	30 + years teaching Mathematics at school level. 8 years as the Maths Facilitator of NGO workshops	NGO Facilitator
Hlengiwe	Female	35 years	10 years	Coordinator and Maths Lead Teacher
Jabulani	Male	31 years	5 years	Maths Lead Teacher
Bongani	Male	41 years	13 years	Maths Lead Teacher

Table 6: Biographical details of Interview Participants from the Mathematics Group

4.5. Methods of data collection

The study generated data using four different methods: interviews with selected members of the teacher learning communities, observations of meetings and workshops, analysis of pertinent documents, and a survey of all the teachers who are members of the Commerce and maths groups.

4.5.1 Questionnaire

A survey is a method of collecting information by asking a set of pre-formulated questions in a predetermined sequence in a structured questionnaire to a sample of individuals drawn so as to be representative of a defined population (Briggs & Coleman 2007, p. 125). In this study, a survey was used to complement the qualitative data so that I could collect data from a wider range of participants, namely a broader sample of teachers in each of the learning communities. The questionnaires were used to collect both qualitative and quantitative data from teachers in each learning community, in order to find out more about how they learn in the group, what they learn, and about the nature of the collaborative relationships.

Questionnaires are defined as a list of questions which the respondents answer. The questionnaire had closed and open questions. According to Cohen et al. (2007), closed questions prescribe the range of responses from which the respondent may choose, and open questions enable participants to write a free account on their own. The questionnaire that was used in this study had both closed and open questions. According to Bamberger, Rugh and Mabry (2006), closed questions are those questions that can be asked for yes/no answers or

asking the respondent to choose an answer from a multiple-choice menu, while open questions do not present a predefined menu or list of options, but allow freedom to choose how to answer. For example "What was the objective or the purpose of the workshop?" "What did you learn?" (Refer to Appendix C).

The advantages of using the questionnaire in this study were that they can be administered to a large number of people and the information can be easily be captured into the computer programme which counts the responses in each category (Cohen et al., 2007, p. 321). In this study, the computer was used to handle the amount of information that the respondents supplied. The closed questions that were about the nature of collaborative relationships in teacher learning communities were quicker to code and analyse and the open questions provided rich information about the purpose and kind of knowledge that was learnt during the workshops. The advantage of closed questions in this study was that they enabled quick comparisons across the two cases (Commerce Teachers' Association and Mathematics Group).

However, the questionnaires had some limitations. Firstly, the open questions generated a large amount of data which was difficult and time consuming to code. Secondly, the open questions make it difficult to make comparisons between respondents, as there may be little in common to compare (Cohen et al., 2007, p. 331).

4.5.*1.* Questionnaire participants

This study used a survey as a data generation tool in order to get the views of all the members in each teacher learning community. Hence the questionnaires were administered in order to get information from more teachers about the kind of knowledge learnt and the nature of and collaborative relationships during the workshops and outside of the workshops. This section will show the biographical data of the questionnaire respondents. These features of respondents came from the biographic section of the questionnaires.

For the Commerce Teachers' Association, the questionnaire was administered during the election meeting which took place on the 16[th] October, 2014. I targeted two hundred participants but only 58 questionnaires were returned. The respondents comprised of 33 female teachers and 25 male teachers. The following tables give the biographical details of

the respondents according age range, Commerce subject taught, teaching experience, qualifications and duration of membership in the Commerce Teachers' Association.

Age range (years)	Number of participants	Percentage
20–30	17	29.3
31–40	29	50.0
41–50	9	15.5
51 and over	3	5.2
Total	58	100.0

Table 7: The age range of the survey respondents from the Commerce Teachers' Association

Table 7 above, providing the age range of the Commerce participants, shows that 50% of the participants ranged from 31 to 40 years and the lowest percentage (5. 2%) were the participants whose age range was 51 years and over. The rate of questionnaires that were returned was very low which would have threatened the trustworthiness of this study if other research method such as observations and interviews were not used. The next Table 5 arranges the number of participants according to the Commerce subjects taught:

Subject	Number of participants	Percentage
Accounting	18	31.0
Business studies	20	34.5
Economics	19	32.8
None	1	1.7
Total	58	100.0

Table 8: Number of respondents, according to Commerce subjects taught

Table 8 shows that there were more Business Studies teachers, than Accounting or Economics. However, the variation in the number of participants was not big. There were 20 Business Studies teachers, 19 Economics teachers and 18 Accounting teachers. The next Table 9 shows the teaching experience range of the respondents.

Age range (years)	Number of respondents	Percentage
1–5 years	22	37.9
6–10 years	18	31.0
11– 20 years	14	24.1
21– 30 years	2	3.4
31 years and over	2	3.4
Total	58	100

Table 9: Teaching experience range of the respondents

Table 9 above shows that there were few really highly experienced Commerce teachers, only 3.4% of the participants had more than 30 years teaching experience. The greatest proportion (37.9%) was teachers with one to five years teaching experience. The next Table 10 shows the qualifications of the respondents.

Teaching qualifications	Number of respondents	Percentage
Professional Diploma e.g. SSTD	18	31.0
B.A or B.Bcom+PGCE	16	27.6
B.Paed or BEd.	15	25.9
BEd Hons	5	8.6
Other	4	6.9
Total	58	100

Table 10: Qualification of the respondents

Table 10 shows that a third of the participants have a Professional Diploma, 27.6% have a three years degree and PGCE a teaching diploma, 53. 5% have professional degrees for teaching and 6.9% did not have teaching qualification. The next Table 11 shows number of years of the respondents in Commerce Teachers' Association.

Number of years	Number of the respondents	Percentage
Not a member	5	8.6
1 year	14	24.1
2 years	5	8.6
3 years	10	17.2
4 years	17	29.3
5 years	6	10.3
6 years	1	1.7
Total	58	100

Table 11: Number of years in Commerce Teachers' Association

Table 11 above shows that the survey was administered in the sixth year (2014) of the existence of Commerce Teachers Association. Five of the 58 respondents were not members of Commerce Teachers' Association. Therefore 91.4% of the respondents are members of Commerce Teachers' Association.

In the Mathematics Group, the questionnaires were administered in the last moderation meeting held on 22nd of October 2014.The questionnaires were administered by the Mathematics Subject Advisor. There were 40 questionnaires that were issued and 19 participants responded to the questionnaires, which is 50% response rate. These 19 participants comprised of four female and 15 male teachers. The was a high rate of the return of the questionnaires when compared to the number of the Mathematics teachers (14 teachers) that were in the two NGO workshops that were observed and video tapped. The following tables show the biographical details of the respondents from the Mathematics Group.

Age range (years)	Number of participants	Percentage
20–30	4	21.1
31–40	5	26.3
41–50	9	47.4
51 and above	1	5.3
Total	19	100

Table 12: Age range of the respondents

Table 12 above provides the age range of the Mathematics participants, showing that 50% of the participants range from 31 to 40 years and the lowest percentage of 5.2% was the participants whose age range was 51 years and above.

Age range (years)	Number of respondents	Percentage
1–5 years	5	26.3
6–10 years	4	21.1
11–20 years	6	31.6
21–30 years	3	15.8
31 and over	1	5.3
Total	19	100

Table 13: The range teaching experience of the respondents

Table 13 shows that there is a high percentage of teachers whose teaching experience ranges from 11 to 20 years and the lowest percentage (5.3%) was for the teachers whose teaching experience ranges from 31 and plus years. The teachers were also asked about the grade that they teach. There were 13 teachers teaching grade 10, 16 teachers teaching grade 11 and 17 teachers teaching grade 12. These numbers do not total 19 participants because teachers were double or triple counted.

Teaching qualifications	Number of respondents	Percentage
Professional Diploma e.g. SSTD	6	31.6
B.A or BSc/ BComm+PGCE	2	10.5
B.Paed or Bed	5	26.3
BEd Hons	2	10.5
Other	4	21.1
Total	19	100

Table 14: Qualification of the respondents (Mathematics participants)

In terms of qualifications, Table 14 shows that 31.6 % of the 19 participants have professional Diplomas, 10.5 % are teachers with degrees and teaching diplomas, and 36.8 % of teachers have teachers' professional degrees.

The above tables have presented the features of the Commerce and the Mathematics participants. Interestingly, a third of teachers in both Commerce and in Mathematics participants have teaching diplomas. Amongst the Commerce participants, there was a high percentage of teachers whose experience is relatively low, only ranging from one to ten years. Amongst the Mathematics participants, there was a high percentage of teachers whose experience ranges from 21 to 30 years. The next section discusses the methods of data collection.

4.5.2. Interviews

According to Cohen et al. (2007), the research interview is a two – person conversation initiated by the interviewer for the specific purpose of obtaining research relevant information. The purpose for the interviews in this study of teacher learning in teacher learning communities was for Commerce and Mathematics teachers to describe how they learn in their teacher learning communities. Semi-structured interviews were held with eight participants; four participants from the Commerce Teachers' Association and four participants from the Mathematics Group. Refer to Appendix B for the interview schedule. The interviews were held in English. The interviews were conducted after school hours and during holidays. The audio-tape was used to record the proceedings and I also jotted down some notes during the interview. As I was conducting the interviews I was able to clarify

questions for the respondent. I was able to probe in order to find out more information if the respondent had not given sufficient detail. It was easier for a respondent to talk to me than to write down lengthy responses in a questionnaire. In line with Henning, van Ransburg and Smit, (2004) the interview in this study was a good method to use for gaining in- depth data from a small number of people.

The disadvantages of the interviews are that interviewing is not simply a data collection exercise, but also a social interpersonal encounter (Cohen et al., 2007, p. 349). Thus, power relations can influence the interview process. In relation to power, I needed to be aware that my position, as an Economics teacher, could influence the type of information that the respondents volunteered, especially the Commerce teachers. I eliminated biasness by interviewing the Commerce teacher (Sibusisiwe) who was not in the executive committee and not familiar with m.   Furthermore, Cohen et al. (2007) also contend that interviews are expensive in time, they are open to interviewer bias, and they may be inconvenient for respondents. I therefore had to ensure that the interviews were held at a convenient time for the respondents.   Lastly, interviews generate large amounts of data which can be overwhelming for the researcher. In this study, the interview schedule was structured according to my research questions in order to make it easy to handle the large amounts of data.

4.5.3. Observations

Observation is defined as a systemic process of reading behaviour patterns of participants, object and occurrence without necessary questioning or communication (Maree, 2007). Three unstructured observations were held with each teacher learning community. During the observation sessions I was a complete observer, I took field notes and I did not participate in the group. The observations were taped recorded and some were video recorded.

In this study the observations were useful because they enabled me to understand actions, interactions between teachers and facilitators, and amongst teachers themselves during the workshops. The observation was the main data collection technique to address three of the research questions in this study, namely "How does teacher learning occur in the two teacher learning communities?" "What is the kind of knowledge that is learnt in these two teacher learning communities?" "What is the nature of the collaborative relationships in the two

teacher learning communities?" Therefore, through observation, I was able to gain insight and deeper understanding of how teacher learning happens, who is leading the group, what is learnt, learning tasks and the nature of collaborative relationships in the Commerce Teachers' Association and the Mathematics Group.

Observations had limitations to this study. The first limitation was that I was a complete outsider during the Mathematics workshops. In line with research literature (Bickman & Rog, 2009; Bertram & Christiansen, 2011) reporting that human interactions are complex, sometimes it was difficult for me to understand fully the meaning of interactions especially during the Mathematics workshops. I was unable to take detailed notes during the workshop because of my low level of understanding of the specialised Mathematics language. I was assisted by a PhD student who video-taped the Mathematics workshops. During the Economics workshops I was not a complete outsider because I am an Economics teacher which enabled me to understand the human actions taking place during the Economics workshops. However, a limitation in the second situation was that I could have inadvertently included my own judgement. The observations generated large quantities of data. The observation data was analysed through CHAT and teacher knowledge analytical tools.

4.5.4. Document analysis

According to the research literature, documents provide a way of getting a sense of a case, it's different parts, and its history (Rule & John, 2011; Maree 2007). I analysed documents such as annual reports, constitutions, minutes of meetings, agendas, funding documents and documents distributed at the workshops. These documents were used for the purpose of cross-validation of other data collection methods and were used to support or disconfirm them. In terms of the research questions of this study the documents were analysed in order to get more information about the history and formation of each case. The main challenge with document analysis was that it was difficult to access all of them.

This section has presented the data collection methods, while the next section discusses how I analysed the qualitative and quantitative data.

4.6. Data analysis

The raw data from individual interviews and observations was transcribed from audiotape and videotape. The data analysis was conducted both deductively and inductively. According to Bertram and Christiansen (2014) deductive analysis takes place when the researcher starts the process with a set of categories that have already been established by a model or theory and inductive approach enables the data to be analysed using categories that emerge from the data.

Deductively, the analysis was done through both the theoretical and conceptual frameworks. CHAT is a methodological framework which was used to analyse the qualitative data of this study. I used the CHAT model to analyse the three observations for each teacher learning community. Figure 12 below shows the CHAT model.
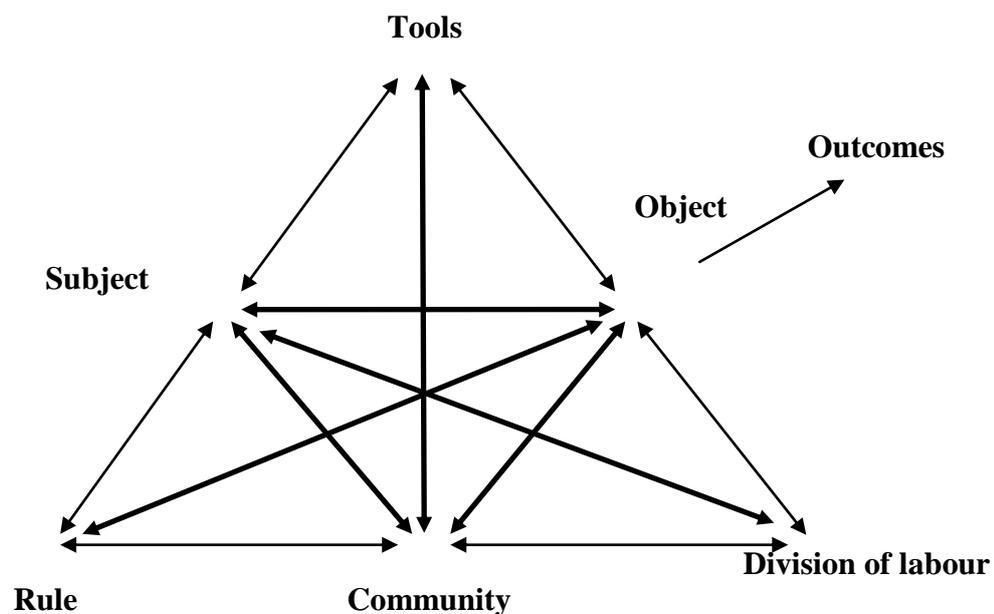
Figure 12: Activity System Model adapted from Engeström (2005)

In order to make sense of the data using the seven elements of CHAT one should have questions in each of these elements. I drew from several researchers such as Engeström (2005), Hardman (2008) and Mukeredzi (2011) to create the CHAT analytical framework (Table 15), which was used to understand how learning occurs in Commerce Teachers' Association and Mathematics Group.

CHAT Elements	Guiding Questions Asked
Subject	Who are the individuals / group whose agency is chosen as a point of view?
Object	What is the purpose of the workshop (activity) for the subjects?
	What is the focus of the workshop?
	What are the teachers working on?
	Why are they working on it?
Division of labour	Who is doing what during the workshop?
	Who determines what is meaningful (pacing and selecting)?
Community	Who are also involved with the teachers (subjects)?
	Who work together with the teachers on the object?
Tools	What are the physical tools that are used during the workshop?
	What are the psychological tools and signs that are used?
Rules	What are the kinds of rules that govern the workshop?
	What are disciplinary rules and what are communicative interaction rules governing the workshop (activity)?
Outcome	What is produced in the workshop?

Table 15: CHAT Analytical framework adapted from Engeström (2005), Hardman (2008) and Mukeredzi (2011)

Each workshop was conceptualised as an activity system comprised of the above mentioned seven elements. These elements are used with CHAT principles: the unity of analysis in activity theory is the activity system, multi-voicedness, the principle of historicity, the principle of contradictions and the principle of expansive learning. All elements and principles are explained in Chapter 3.

In addition to CHAT, teacher knowledge analytical frameworks were used to understand the kind of knowledge that was learnt in Commerce Teachers' Association and Mathematics Group. I decided to use two different teacher knowledge frameworks because of the nature of the subjects that the teachers are teaching. In the Commerce Teachers' Association, most of the data is derived from Business Studies and Economics, which are social sciences. Grossman's (1990) four domains of teacher knowledge were suitable to describe the kind of knowledge that was learnt in the Commerce Teachers' Association. However, these kinds of teacher knowledge were not specific enough to describe the Mathematics subject matter knowledge that was learnt. Hence, I adopted Ball, Thames and Phelps' (2008) and Hurrell's (2013) supporting phrases which are used to analyse the data deductively.

The above Figure 10 and Table 15 serve as analytical frameworks that were used to analyse the data deductively. In addition, an inductive approach was used by identifying key themes that emerged from the qualitative data. The closed-ended responses in the questionnaire were analysed statistically and the open-ended responses were thematically analysed. Lastly, the data was interpreted by integrating both qualitative and quantitative data according to the research questions of this study.

4.7. Ensuring trustworthiness

Within the interpretive study, validation is understood as a judgement of trustworthiness or 'goodness' of a piece of a research (Creswell, 2007, p. 205). The term trustworthiness refers to the way in which the inquirer is able to persuade the audience that the findings in the study are worth paying attention to and that research is of high quality (Creswell, 2003). To strengthen the trustworthiness of this research I used multiple data generation methods. Multiple data generation was very useful for the purpose of verification which was done by comparing observation data with interview, documents and survey data. I adhered to the measures of enhancing trustworthiness of a case study.

According to Bertram and Christiansen (2014), credible research must reflect the participants' reality. To enhance credibility of the data I used the audiotape to record the interviews and observation proceedings. I got assistance from my peers who videotaped the Commerce workshops and the Mathematics workshops. I further verified my understanding of what I had observed during the interview sessions. The data was transcribed from the voice tracer and videotape recorder. The documents and field notes are kept in a ring file for verification. Therefore, these methods of capturing the data have recorded the fullness and essence of the case reality (Rule & John, 2011, p. 107).

Transferability is a concept in qualitative research discourse which is used as an alternative for generalizability of a study (Rule & John, 2011, p. 107). The findings of this study cannot be transferred because the aim of this study was to develop in depth understanding about teacher learning in the Commerce Teachers' Association which was formed by KZN Commerce teachers, and the Mathematics Group which was formed as a Department of Basic Education (DBE) Mathematics cluster with a Non-Governmental Organisation (NGO).

Dependability refers to how I adhered to the case study research requirements. The research methodology literature (Walsham, 2006; Bertram & Christiansen, 2014) states that dependability occurs when the researcher can account for why there may be variations in the study. In this study I used purposive sampling to select three cases. However; I actually finally had two cases because there were no meetings or workshops for the third case.

I strengthened the evidence used in my case study by using different data collection methods (observations, interviews, document analysis, and survey questionnaires). I collected qualitative and quantitative data with survey questionnaires. I used the theoretical and conceptual framework to analyse the data. I used thematic analysis and the quantitative data was analysed and interpreted qualitatively.

According to Rule and John (2011), confirmability is a way of addressing concerns about the researcher's influences and biases in a study. Walsham (2006) notes that "We are biased by our own background, knowledge and prejudices to see things in certain ways and not others" (Walsham, 2006, p. 321). In line with Walsham (2006), I may be biased due to my work as a teacher in the same district under study. I have taught one of the Commerce subjects and I was a cluster coordinator there. This bias was possibly eliminated in that in the Commerce Teachers' Association I also interviewed a post level one teacher who was not on the executive committee of the association. Furthermore, the study did not rely only on the interview and observations data but data was also generated through documents analysis and survey questionnaires which strengthened conformability.

4.8. Ethical issues

This research involves humans, so ethics is important. I adhered to ethical principles in accordance with the standard set by the University of KwaZulu-Natal (UKZN, 2007). The UKZN Ethical Clearance is Appendix A. I requested permission from the Head of Department of Basic Education. (Refer to Appendix E). The permission to observe the workshop meetings and to conduct interviews was obtained from the Head of Department of Basic Education of KwaZulu-Natal Province (Refer to Appendix F). Cohen et al. (2008) states that consent of participants is vital and all the participants must receive a clear explanation of what the researcher expects of them. The participants signed consent forms (Appendix D) and I acknowledged the participants' right to withdraw or terminate

participation. For confidentiality, pseudonyms were used and no information could be linked to the participants.

4.9. Limitations of the research

This research had some limitations. Data collection phase took two years because of contextual challenges. The observation of the workshops presented some challenges because some of them were called within a short period of time. For the Commerce Teachers' Association, I intended to observe three workshops, one in each one of Commerce subjects: Accounting, Business Studies and Economics. The strike action held in September 2013 led to the cancellation of the Accounting workshop. The Business Studies workshop was then called within a short period of time, which meant that I was unable to observe it. I waited for another year. Unfortunately, in 2014 the Commerce Teachers' Association did not have workshops, there was only an election meeting which was held in October. The questionnaire survey was very useful in collecting more data from a range of teachers. The findings of this study cannot be generalised.

There is limited literature on teacher learning in teacher learning communities in the South African context. I realised that concepts (such as teacher learning communities) that are used by academics in Higher Education Institutions are not concepts known to teachers. I had to simplify my topic for the participants, and clearly explain the concepts. Another challenge was the terminology of my theoretical framework, especially the two concepts: activity (workshop) and community. These concepts have different meanings in everyday discourse and in academic discourse. I tried to refrain from using the concept teacher learning community because the layperson's concept of "community" would cause confusion. The term community is used for one of the human elements of the activity system in CHAT.

Finally, a limitation to consider is that I was researching within my own profession and have been a member of the Commerce Teachers' Association, thus there could be an issue of bias or misinterpretation of data during observation. Some of the above-mentioned limitations were beyond my control but they did not compromise the quality of this research because I employed multiple tools of data collection.

4.10 Conclusion

To conclude, this chapter has presented the research design and methodology of the study. I have shown that in this research I believe that reality is socially constructed therefore the

study was an interpretive paradigm. The study uses a qualitative approach using a case study as the research design. The versatility of the case in terms of the data collection methods gave me freedom to answer the research questions by using multiple data generation techniques such as observation, interviews, surveys and documents analysis. The chapter has shown how CHAT and the teacher knowledge analytical frameworks were used to make sense of the data. I have shown how I established the quality and trustworthiness of the study and that I was aware of the issue of biasedness. Hence, I have declared my position in this study and the ethical issues. The last section of this chapter explained the limitations of this study. The next Chapter (Chapter Five) discusses the history and formation of the Commerce Teachers' Association.

CHAPTER FIVE: HISTORY AND FORMATION OF THE COMMERCE TEACHERS' ASSOCIATION

5.1. Introduction

This chapter answers the first research question which is about the formation of the Commerce Teachers' Association. The chapter is framed by the third principle of CHAT which posits that the history of an activity system helps to understand problems and potentials of the activity system because "parts of older phases of activities stay often embedded in them as they develop" (Murphy & Rodriguez-Manzanares, 2008, p. 444). Hence this chapter discusses the history and formation of the Commerce Teachers' Association. The chapter is organised according to the following four themes that emerged from the data: background of the Commerce Teachers' Association; who initiated the formation of the Commerce Teachers' Association; reasons for the formation of the Commerce Teachers' Association; and the formation of leadership and subgroups of the Commerce Teachers' Association. The chapter also presents findings from the election meeting of an executive committee. I concluded the chapter with the implications of the history and formation of the Commerce Teachers' Association.

5.2. Background of Commerce Teachers' Association

The Commerce Teachers' Association is an association of Commerce educators working in one of the 12 districts in KwaZulu-Natal. This district has approximately 87 high schools. The schools are grouped into four circuits. The Commerce Teachers' Association is an association of Commerce teachers in a district as shown in Figure 1. Each school has three or four Commerce teachers. However, there was no evidence that shows that all these teachers are full members of the Commerce Teachers' Association. The following is Figure 11 showing the structure of the district.
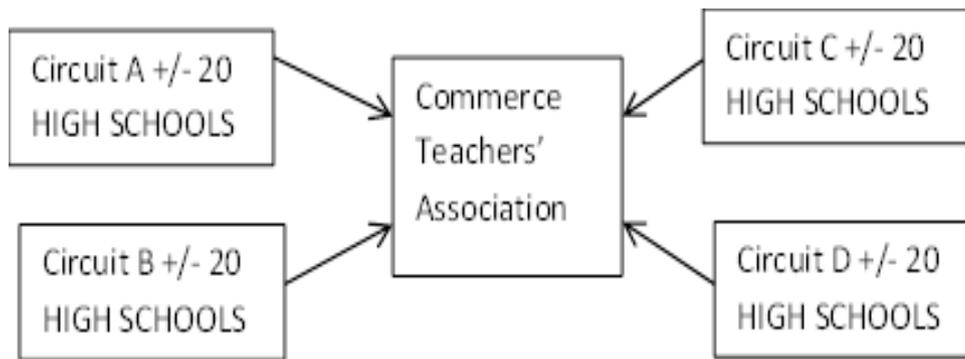
Figure 13: Structure of high schools in Zethembe (pseudonym) District

 In this district, the school commercial subjects are Accounting, Business Studies, Economics and Economics and Management Sciences (EMS). Sometimes Commerce subjects are called Business, Commerce and Management (BCM). The district has four circuits and each circuit has on average 20 high schools. Table 16 shows the number of schools that offer the three Commerce subjects and the total number of teachers for these subjects in the district.

Commerce Subjects	Number of Schools offering the subjects	Number of Teachers
Accounting	75 out of 87	96
Business Studies	85 out of 87	106
Economics	81 out of 87	85
Total	87	287

Table 16: Number of schools and teachers who teach Commerce subjects in a KZN schools' District

Table 16 shows that there are three Commerce subjects offered in the Further Education and Training (FET) phase. In most cases Economics and Management Science, which is a GET Commerce subject, is taught by the same teachers who teach either one or two of the three Commerce subjects. The Commerce Teachers' Association has a different name but for confidentiality I have decided to call this association the Commerce Teachers' Association for the purposes of this research. The Commerce Teachers' Association was launched at a meeting which was held in August 2010. The meeting was attended by Commerce teachers and KwaZulu-Natal (KZN) Department of Basic Education officials.

5.2.1 Who initiated the formation of the Commerce Teachers' Association?

International research reviews suggest that choice, initiation by participants and the relevance to their situations are important ingredients for the effectiveness of Continuing Professional Development (Hargreaves, Berry, Lai, Leung, Scott and Stabar, 2013). For the purpose of this study it was very important to know how the Commerce Teachers' Association was formed in order to understand if its formation was based on collaborative cultures that emerged from teachers themselves as a social group (Hargreaves 1994, Jita and Mokhele 2012). This is one of the characteristics of teacher learning communities.

Participants have different views about who initiated the Commerce Teachers' Association. Celokuhle (pseudonym), the chairperson of the Commerce Teachers' Association reported that this association was formed by Accounting, Business Studies, Economics and EMS teachers after noticing the poor performance in the Matriculation examination of the whole district. He stated that their district was always the last one when it came to the end of the year results. He further stated that he is a member of this teachers' association because he wants to gain more information on the subjects he teaches. He explained that the Commerce Teachers' Association was formed in order to help educators and schools in deep rural areas to receive information that other schools in urban and other provinces are getting. He explains how they started the group:

> We first formed a Committee and from the committee we advertised that we had something like this. We had a big meeting where teachers were invited for the workshop by the subject advisors and then they were informed about this organisation. (Interview with Commerce Teachers' Association's Chairperson, 31/07/2013)

It seems as if both the chairperson and general secretary of the Commerce Teachers' Association agree that the Commerce Teachers' Association was started by Commerce teachers in 2010 within the district because they saw the need for uplifting learner performance in commercial subjects by inviting facilitators from other districts and provinces to provide more information. Sebenzile (pseudonym), the secretary, also stated that their district was always number 11 out of 12 districts in KwaZulu-Natal, so as Commerce teachers they felt that they had to come up with a strategy.

> It was teachers within our district when they saw that there is a need to uplift the performance of our learners in Commercial subjects since our district was always number 11 when compared to other districts so we felt

that there is a need to do something together to assist one another. (Interview, General Secretary, 23/09/2013).

The above quote suggests the formation of Commerce Teachers' Association was in response to the poor performance of learners. In line with CHAT that activity systems are built upon the basis of internal and external contradictions, this suggests that poor performance of learners in grade 12 in the district manifests a contradiction between subjects (Commerce teachers) and the community comprised of learners, parents and Department of Basic Education. From a CHAT perspective, the contradictions subject/community occurred ie Commerce teachers' expectations and the community were the driving force behind the formation of the Commerce Teachers' Association which eventually led to the teachers engaging in learning through the association. Table 17 illustrates how survey participants responded about who organised Commerce Teachers' Association.

The CTA was Organised by:	Department of Basic Education	Commerce Teachers	Commerce Teachers and Department of Basic Education	Did not respond to the question
No of participants	8	12	28	10
Percentage	14%	21%	48%	12%

Table 17: **Respondents' views on who initiated the Commerce Teachers' Association**

While 28 teachers of the 58 teachers said the Commerce Teachers' Association was organised by Commerce teachers and DBE officials, the Economics subject advisor, with Sibusisiwe (pseudonym), a post level one teacher who is a member of the association, and eight teachers from the survey (Table 17) had the same view that it was the subject advisors who initiated the Commerce Teachers' Association. Their view differs from what was stated by the chairperson and the secretary of Commerce Teachers' Association. Sibusisiwe says:

> Mostly it is our subject advisors and we have got Commerce educators, those are the members. The subject advisors invited us to join the group and they made us aware of the Commerce Teachers' Association and invited us to attend a workshop for the Commerce Teachers' Association. I think the subject advisors sat down and discussed about the formation of the group (Interview with Sibusisiwe, 27/08/2013).

Concurring with Sibusisiwe, the Economics subject advisor notes:

> The Commerce Teachers' Association was formed by Business, Commerce and Management (BCM) educators but it was spearheaded by us subject advisors; it is an association for teachers.

The two statements made by Mrs Mathe (pseudonym), Economics subject advisor and the post level one teacher who is not on the executive committee suggest that the Commerce Teachers' Association was initiated by the Commerce subject advisors through the Commerce teachers. From a CHAT perspective, subjects/community contradictions emerged (chairperson and secretary of Commerce Teachers' Association) and (Economics subject advisor) because they have contrasting views about the formation of Commerce Teachers' Association.

The research review (Hargreaves et al., 2013) on teachers' self-directed and continuous learning in a community suggests that effective teacher learning comes with ownership grouping (ownership by all members of a TLC) and control of processes and agenda by the participants. Therefore, understanding who initiated the Commerce Teachers' Association was important because this study focuses on how teachers learn when they are together in a teacher learning community. According to the literature on teaching communities, a teacher learning community is a group of teachers who come together as a team to help one another improve student learning (Owen, 2014, p.58). William (2007) further highlights that the members of teacher learning communities are only those teachers who are attempting to make changes in their own classroom. When a teacher learning community is initiated by teachers themselves, a collegial culture is facilitated which can lead to ownership and participation in continuous professional debates and consequently often professional learning.

5.2.2. The reasons for the formation of Commerce Teachers' Association

Some studies in the South African context show evidence that teacher learning communities that are initiated by teachers themselves aim at supporting teachers in the absence of support from the Department of Education (Jita and Mokhele, 2012). The Constitution of the Commerce Teachers' Association (2009) shows that the Commerce educators who are in a rural district of KwaZulu-Natal were concerned about the low pass rate in Commerce subjects, and the lack of adequate knowledge, methodological and technical skills, motivation in addition to the low morale among Commerce educators. All the four participants who were interviewed highlighted that the Commerce Teachers' Association was formed in order to

improve learner   performance in Accounting, Business Studies and Economics. Mrs Mathe explained the purpose:

> The main idea is to improve results. We network with other subject advisors from other districts who already had this association. BCM teachers formed an association in order to develop educators to become knowledgeable in their subjects, methodologically, technically skilled and highly motivated thereby developing of the professional competences of its members (Interview with Economics subject advisor, 20/07/2014).

From the teachers' and the subject advisor's views about the reasons for the formation of the Commerce Teachers' Association, it appears that poor performance in the National Senior Certificate (NSC) grade 12 results was a major concern in this district. According to the District Analysis report of the 2009 National Senior Certificate Results, the overall pass percentage of grade 12 was 45.13% and the district was placed in position 11 out of 12 districts in the comparative pass rates of 12 districts in KwaZulu-Natal (Department of Basic Education Examination and Assessment Services Reports (2009 – 2013). Drawing on Engeström (2001, p.137) this situation suggests a historically accumulating structural tension within and between activity systems. This structural tension is a contradiction between the subjects (teachers), the object (pass rate) and the community (consisting of learners, Department of Education, parents, and mediational means or curriculum materials). The contradiction of subjects, object, mediational means and community brought teachers and subject advisors to collaboratively engage in different activities to enact the object to produce the outcome which they say is improvement in Grade 12 results.

Another reason for the formation of the Commerce Teachers' Association is highlighted in the circular dated 10[th] October 2014 which was issued at the annual general meeting held on the 16[th] of October 2014 " (Department of Basic Education: Zethembe District). The association was formed due to the need (situational analysis) to develop BCM and EMS educators methodologically and technically" (Deputy Chief Education Specialist). .

SUBJECT	2009	2010	2011	2012	2013
Accounting	62,08	67,76	64,73	71,86	71,75
Business Studies	60,98	74,40	74,97	89,44	84,20
Economics	73,15	81,91	75,44	85	79,00

Table 18: District National Senior Certificate pass rate in three BCM subjects from 2009 to 2013 (extracted from the Department of Basic Education Examination and Assessment Services Reports (2009 – 2013).

Table 18 illustrates the percentage pass of these three BCM subjects in the National Senior Certificate (NSC) from 2009 to 2013 as per Department of Basic Education Examination and Assessment Services Reports (2009 – 2013). The table shows that there was an improvement in NSC Grade 12 results from 2009 – 2012. However, in 2013 the results decreased. The improvement in the NSC results may be due to different strategies that were used in the district, although the Commerce Teachers' Association and the District Officials maintain that the learning taking place in the Commerce Teachers' Association has led to the improvement of the results in the district. For example the Chief Education Specialist commented on the Economics workshop held on 27[th] August 2013:

> The Commerce subjects form the base of the pass percentage of our district. The last three years have shown improvements, the district is on the top 3 of the subjects in KZN, Economics is 85%.The South African policies are mainly covered in Economics and they are very important. Teachers must become change agents (Observation of workshop held on the 27[th] of August 2013).

According to the Chief Education Specialist (community), improvement in Grade 12 Economics results is the outcome that emerged from the subjects (Commerce teachers) enacting the object (economics learning) through mediating artefacts (Revision workshops) enacted by the community (Commerce subject advisors, external facilitators) within their division of labour. In other words, the objective was to get teachers to learn from the workshops and these workshops were mediating means, Economics learning was the object enacted by subjects (Economics teachers).

Nonetheless, improvement in Grade 12 results of the district may also be due to the overall increase in all the Matriculation results over the five years as shown below in the table showing the KwaZulu-Natal provincial pass rate.

Year	2009	2010	2011	2012	2013	2014
Percentage obtained	60,6	67,8	70.2	73,9	78.2	75,8
Percentage changes		+7,2	+2,4	+3,7	+4,3	-2, 4

Table 19: KZN Provincial Pass Rate (From 2014 KZN Analysis of NSC Grade 12 Results)

Table 19 shows that there was an increase in grade 12 results from 2010 to 2013. In 2014 the Grade 12 results dropped, which is also reflected in the result of the Commerce subjects in Table 18. The drop in Grade 12 results suggests contradiction again between subjects (teachers), object, (teaching) outcome (high pass rate) and community (DBE, parents, and learners). While this could suggest that teachers may not have enacted the object teaching effectively, there could be several other reasons that may have affected the outcome involving the entire activity system. Hence, this decrease in Grade 12 results does not necessarily mean that it was due to poor object enactment by subjects in 2014 or to the Commerce Teachers' Association as subjects failing to enact according to the division of labour.

5.2.3. The objectives of the Commerce Teachers' Association

The Commerce Teachers' Association was formed to achieve the following objectives. These objectives are stated in its Constitution, drawn up in May 2009.

The association aims to:

- Deliver to the education system, educators who are knowledgeable, methodologically and technically skilled, and motivated in teaching of Commerce subjects.
- Design and implement programmes that are aimed at equipping Commerce educators with subject content knowledge and methodological skills.
- Design and implement programmes that will facilitate mastery of technical skills, supportive of the teaching activities of educators, such as design and production of overhead transparencies, use of overhead projector, computer literacy, and the use of the computer in teaching, learning, and producing effective teaching material.

The objectives target the content knowledge, general pedagogical knowledge and practical knowledge such as innovations and the use of computer in teaching. Using the CHAT framework, it can be seen that the objectives aim at equipping Commerce teachers as subjects with psychological mediational means. These mediational means are physical (such as hand-outs) and psychological (knowledge imparted by the facilitators from outside the district). In line with CHAT, the objectives for the formation of Commerce Teachers' Association suggest that the epistemic assumptions or beliefs held by the Commerce teachers (the chairperson and the secretary of the Commerce Teachers 'Association) as subjects, and their subject advisors as community, are that Commerce teachers will learn by engaging in workshops to acquire content knowledge and general pedagogical knowledge. Meetings and workshops (in this case the meeting is an activity) are central in this study as they are assumed to have the potential to enable mediation of tasks by the subjects (Commerce teachers). Table 4 below shows the number of executive meetings, annual general meetings and content workshops held during the past four years (2010 to 2014) summarising attendance at meetings and workshops of the Commerce Teachers' Association. In CHAT terminology, these are the activities that educators engaged in.

Year	Subject	Number of Workshops/ Meeting	Focus of the meetings / workshops
2010	Commerce teachers' meeting	1	Launching of Commerce Teachers' Association
2010	Executive meeting	1	Planning for the revision workshop
2010	Executive meeting Accounting Business Studies Economics	1 1 1 1	Planning for revision workshops Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers
2011	Executive meeting Accounting Business Studies Economics	1 1 1	Planning for revision workshops Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers
2012	Executive meeting Accounting Business Studies Economics	1 1 1 1	Planning for revision workshops Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers
2013	Executive meeting Business Studies Economics	1 1 1	Planning for revision workshops Revision workshop for Grade 12 teachers Revision workshop for Grade 12 teachers
2014	Annual General meeting	1	Election of the new executive committee

Table 20: Schedule of meetings of Commerce Teachers' Association

Contrary to the Constitution of Commerce Teachers' Association which stipulates that there should be meetings and workshops once a term, Table 20 shows that the Commerce Teachers' Association executive committee held a meeting once a year and ran only one workshop for each subject. In August 2010, the Commerce Teachers' Association was launched. In the launching meeting, the main object was the election of the executive committee. This was followed by the executive meeting for planning which was then followed by revision workshops for each of the three Commerce subjects held by the external examiners. According to the attendance registers of the workshops, the workshops were called Matric Intervention Programmes (MIP) because the focus of these meetings was on Grade 12 content. The concept MIP is normally used by the Department of Basic Education to refer to DBE's intervention programmes in Grade 12. In 2011 and 2012, there was an executive meeting for planning for content workshops which was followed by the revision workshops. In 2013 there was also one executive meeting for planning for content workshops. Revision workshops were only held for Economics and Business Studies, which took place in August in 2013. There was no Accounting workshop organized by Commerce Teachers' Association for Accounting 2013.

Table 20 (above) is based on survey data shows a summary of attendance at meetings and workshops by each participant. This summary of meetings and workshop attendance excludes the launching meeting held in 2010. In 2014 there were no meetings or content workshops except the annual general meeting which was held in October where the new executive committee was elected. The absence of meetings and workshops for Commerce teachers suggests that the executive committee failed to organise planning meeting and workshops for Commerce teachers as stipulated in the Constitution of Commerce Teachers' Association. The Economics subject advisor who is an ex- officio member of the executive of Commerce Teachers' Association responded to questions about meetings time, frequency of meetings and whether they had met in 2014:

> We are supposed to meet once a term. We have not yet met this year due to programmes and other things. Again most of the executive committee members are members of the school management teams at their schools and another thing is that they do not live in the same area; they do not live in the same proximity of locality. So that is why it is not that easy meeting up (Interview with Economics Subject advisor. 20/7/2014).

From a CHAT perspective, a failure of the executive committee to organize meetings and workshops of Commerce teachers creates contradictions between the several nodes of activity. Celokuhle, the chairperson, was supposed to call an executive meeting to organize workshops. So the chairperson is the source of the contradiction. The contradiction involving the subject (chairperson), the division of labour, and the rules occurred. In other words the subject failed to act within the division of labour and at the same time went against the rules of the association. However, the nature of this contradiction did not lead to any learning.

The Constitution of the association stipulates that the chairperson should ensure that meetings and workshops to enact the object are organized. Lack of meetings and workshops for the Commerce Teachers' Association also lead to the absence of object enactment by subject (which is mostly learning how to revise with learners) in preparation for the exams. Such contradictions impact negatively on the achievement of the outcome. Mrs. Mathe, the Economics subject advisor stated that the district context, in terms of location of schools, also contributed to the shortage of meetings. From a CHAT perspective the location situation of the district suggests "structural contradictions" (Joo, 2014, p. 55) of subjects (Commerce teachers) and district context, because the schools are not in the same proximity of locality. The contradiction here involves subjects (teachers), object (Accounting, Business Studies and Economics learning), and mediating tools (district context). In other words, because schools

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are far apart (district context as mediating tool), subjects cannot enact the object (economics learning) which then impacts on the object and consequently the outcome.

On the whole, Mrs Mathe's statement about frequency of meetings of the executive committee and the schedule of meetings and workshops (Table 5) of Commerce Teachers' Association reveals that meetings and workshops were not held regularly. This situation is in contrast with the literature (Du Four, 2004) on teacher learning which states that in a teacher learning community the group of teachers meets regularly as a team. The focus of these meetings and workshops as shown in Table 20 is Grade 12 revision programmes rather than facilitating mastery of technical skills, teaching and methodological skills as stipulated by the objectives of Commerce Teachers' Association. From a CHAT viewpoint the rules/ the entire activity system occurred contradiction occurred, the rules (in the Constitution) and the entire activity system because there is a divergence of views between the objectives of Commerce Teachers' Association and what was really happening on the ground.

5.2.4. Formation of leadership and Subgroups of the Commerce Teachers' Association

The Commerce Teachers' Association has approximately 287 Commerce teachers as members. Using CHAT terminology, these teachers are the subjects in the activity system. Leadership in the Commerce Teachers' Association is distributed according to portfolios as stated in the Constitution of the association. It has an executive committee comprised of six teachers: chairperson, deputy chairperson, secretary, treasurer, the public relations officer and the project coordinator. Celokuhle, the chairperson, reported that he was chosen democratically by teachers through elections. Similarly, Sebenzile (the secretary) stated that she was also chosen by teachers on the basis of her leadership and management skills. She puts it this way:

> The teachers looked at the expertise in terms of academic and in terms of leadership that was needed, teachers who know how to lead and manage.

The democratic election of the executive committee that took place in 2010 suggests a horizontal division of labour. In addition to these six members mentioned above, the four DBE Commerce subject advisors are ex- officio members. The secretary of the Commerce Teachers 'Association reported that the subject advisors were included in the committee in order to assist in terms of getting subject documents and data. There is a mismatch between

what the secretary stated and what was stated earlier by Sibusiswe, a Business Studies and Economics teacher. Hence contradictions between subjects emerged due to incompatible views. Sibusisiwe stated that the association is led by the Economics subject advisors but the secretary is saying something different, that the association is led by Celokuhle, the chairperson of Commerce Teachers' Association.

The Commerce Teachers' Association is comprised of three groups of teachers namely, Accounting teachers, Business Studies teachers and Economics teachers. In line with CHAT, people can be members of several activity systems. In this study, the meetings of each school subject represent an activity system and some Commerce teachers are members of several activity systems because some of them are teaching more than one of these Commerce subjects. They meet according to the school subjects that they teach. For example, the chairperson teaches Business Studies and Economics, the general secretary teaches Accounting and Business Studies, and the third participant who was interviewed teaches Business Studies and Economics.

 CHAT posits that the activities in which individuals engage take place as a result of collaboration with a particular community of people (Engeström, 2001). In relation to collaboration with a particular community of people there is some evidence that suggests that ex-officio members (the subject advisors) are members of other activity systems within the district and outside the district while at the same time they are members of the community of the Commerce Teachers' Association. The Economics subject advisor stated that the Commerce subject advisors are also members of the Financial Literacy Group responsible for organising the BCM speech contest for learners. Mrs Mathe, Economics subject advisor is also a member of KwaZulu-Natal Provincial Economics Advisory Committee. There are also other members of the community who normally attend the meetings such as the book publishers. However, the object of the book publishers is to sell text books. The book publishers became a part of Commerce Teachers' Association because they were requested to assist. The following extract is taken from the observation notes of the planning meeting to show how the book publishers became involved in Commerce Teachers' Association:

> **Celokuhle:** We must pay the money out of our pocket then we collect. And book publishers will assist as they will get a chance to sell their books.

> **EMS Subject advisor:** We must first check from the catalogue, the books approved for next year (2014) then we ask from those whose books have been approved.

The book publishers supported the Commerce Teachers' Association by providing catering for the meetings. Mrs Mathe, the subject advisor, also highlighted that book publishers played an important role in Commerce Teachers' Association in 2010:

> In 2010 the book publishers assisted Commerce Teacher' Association by organising Examiners of these three subjects to help teachers with examination guidelines.

From a CHAT point of view this suggests that the book publishers were also part of the community. The book publishers, as community, assisted in the enactment of the object (examination guidelines) by organizing Commerce examiners (another part of the community) to facilitate enactment of the object.

This section has presented the historical background around the formation of the Commerce Teachers' Association. The majority of Commerce teachers stated that the Commerce Teachers' Association was organised by Commerce teachers and the DBE. However, it became clear, from the Economics subject advisor, that the Commerce Teachers' Association was initiated by the DBE through Commerce subject advisors. The main reason for the formation of the association was to address the poor performance of learners in Grade 12. This was evident from the chairperson, the secretary and other Commerce teachers that participated in the survey. Furthermore, schedules of meetings (Table 20) which were drawn from meeting and workshop attendance registers suggested that the workshops were held once a year in each of the three Commerce subjects. The focus of the meetings or workshops was revision for the Grade 12 final examination. The following section describes the election meeting.

5.3. Election of the new executive committee

The first principle of CHAT posits that an activity system is taken as a unit of analysis (Engeström, 2001). The activity system is comprised of mediated actions through which actors engage, enact and pursue an object. This section will give a brief overview of the election meeting (activity system) held on the 16[th] October 2014.

5.3.1. A brief description of the election meeting

This was the only meeting of 2014 for the Commerce Teachers' Association which was held on the 16[th] of October 2014. The meeting was attended by about 200 teachers including some school management teams, Commerce teachers from the district, members of the executive committee, the EMS subject advisor, the Economics subject advisor, the Deputy Chief Education Specialist (DCES) and the History subject advisor who was the electoral officer.

The Economics subject advisor was coordinating the programme of the day. The meeting started with a moment of silence as the opening prayer. The Deputy Chief Education Specialist explained the purpose of the day which was the election of the new executive committee. The DCES gave apologies on behalf of the chairperson of the Commerce Teachers' Association who was attending the DoE examination meeting. He then asked to be excused to attend the DoE examination meeting. The Economics subject advisor thanked the outgoing executive committee and the EMS subject advisor gave them a certificate of appreciation and a gift.

The History subject advisor electoral office conducted the election process and was assisted by the outgoing executive committee. He started by reading the election rules from the Constitution of the Commerce Teachers' Association. The teachers were given the nomination forms to nominate where the proposer nominates and asks the nominee to sign. There was no need for a ballot because the nominees were equal to the number of office bearers required in the executive committee. The office bearers are comprised of chairperson, deputy chairperson, secretary, treasurer, project coordinator and spokesperson. The DCES joined the meeting and came with the following circular which was issued to the teachers:

> As Commerce teachers' Association is a non-profit organization, the affiliation fee per school is R200 per year, payable on the day of the elective meeting (16/10/2014).

The former deputy chairperson gave the vote of thanks and presented the electoral officer with a token of appreciation.

I now use the seven elements of CHAT with which to analyse the election meeting as an activity system. Drawing on the first principle of CHAT, the activity system is taken as the unit of analysis, meaning that one must look at all the aspects of the system in order to understand what is happening in the activity system (Feldman and Weiss, 2010, p.38). In this case the activity system is the election meeting as shown in Figure 14 below. The election

meeting was attended by approximately 200 Commerce teachers, and School Management Teams (SMTs), some members of the outgoing executive committee, two Commerce subject advisors and the History subject advisor who was an electoral officer.

Tools: Constitution, nomination forms, ballot papers, programme of the day, circular, knowledge and language, certificates and gifts

Outcomes: New executive committee New

Subject: Commerce teachers and the executive committee

Object: Election of Executive

Rules: Constitution, attendance punctuality

Community: DCES, EMS subject advisor, Economics subject

advisor

Electoral officer

SMTs

Division of labour:

Electoral officer conducted elections, teachers nominated, Economics subject advisor directed and DCES read the circular

Figure 14: Activity System of Commerce Teachers 'Association for Election Meeting

Subjects: According to Engeström (2001), the subject of the activity is the person or the group whose action should be taken into consideration and understood. In the election meeting, as an activity system, I was seeking to understand the actions of about 200 Commerce teachers electing the new executive committee of the Commerce Teachers' Association. Therefore, Commerce teachers were the subjects of the activity system because their viewpoint was adopted.

Object: The object of the activity system was the election of the new executive committee which was enacted by the electoral officer within the division of labour as a community member. The Commerce teachers (subjects) enacted on the object by nominating the candidates. There was no need for a ballot because there was one candidate in each portfolio.

In the CHAT perspective the nomination undertaken by subjects (Commerce teachers) suggests multi-voicedness which means different points of view were considered. Multi-voicedness was affected when the Commerce teachers, as subjects, nominated people who should serve on the executive committee of the Commerce Teachers' Association.

Tools or Mediating Artefacts: The material mediating artefacts consisted of nomination forms, the Constitution of Commerce Teachers' Association and the DCES circular. The psychological mediating artefacts were language as a means of communication and the electoral officer's knowledge and experience. The certificates and gifts that were given to the outgoing executive committee were also part of the material mediating artefacts. These artefacts mediated in the sense that they enabled the election process. The forms were necessary for nominating the candidates. The Deputy Chief Education Specialist distributed and read the circular (mediating artefacts) which was explaining how the Commerce Teachers' Association was formed highlighting that the Commerce Teachers' Association is a non-governmental organisation which is funded by educators. The last paragraph of the circular says: "This affiliation fee replaces a R50 membership fee which was paid by each member of Commerce Teachers' Association." (Circular). This circular that came with the DCES seems to suggest a vertical division of labour by the DoE official because it is not clear how he came up with the R200 subscription fee per school. The circular appeared as an instruction from the DoE official because there was no evidence of any executive meeting that discussed the R200 subscription fees. The certificates of appreciation that were signed by the district director were also mediating tools; they were given to the outgoing executive committee as a token of appreciation for serving on the executive committee.

Rules: The election process was shaped by section 10.1and 10.2 of the constitution which stipulates the procedures of election. The Constitution of the Commerce Teachers' Association was issued to all the teachers.

Division of labour: According to Feldman and Weiss (2010) division of labour refers to both the horizontal division of tasks between members of the activity system and the vertical division of power and status. The programme was directed by Mrs Mathe, the Economics subject advisor, and while she may have been acting according to her duties as the Department of Education official, within the activity system, she was also acting within the horizontal division of labour as a member of the community. Working according to the vertical division of labour occurred when the Commerce teachers and school management

teams were using democratic rights to nominate five members of the executive committee. The absence of the chairperson from the meeting created subject (Celokuhle), the division of labour, the community and rules contradiction. In other words, a contradiction arose because the chairperson did not enact his division of labour as chairperson, and this was not according to the expectations of the community. The chairperson of Commerce Teachers' Association was not at the meeting, hence did not act according to the expected role, thus overlooking the rules.

Community: The participants who had "a stake in the object of the activity system" (Feldman and Weiss, 2010, p. 37) was comprised of the following:

- The Deputy Chief Education Specialist (DCES), who explained the purpose of the day as electing the new executive committee. At the end of the meeting the DCES read the circular.
- Mrs Mathe was coordinating the programme of the day.
- The EMS subject advisor who presented the outgoing executive committee members with certificates of appreciation and gifts.
- The History subject advisor who was the electoral officer.
- The outgoing executive committee who assisted the electoral officer during the election process.
- Some school management teams whose presence was acknowledged by the Deputy Chief Education Specialists when he was issuing the circular.

The division of labour among the members of the community (Deputy Chief Education specialist and subject advisors) during the election meeting seem to point out that the DBE was taking charge of the Commerce Teachers' Association and that it was not being steered by teachers.

The outcome: The outcome of the election meeting was the new executive committee elected, which consisted of the chairperson, deputy chairperson, secretary, treasurer, project coordinator and a public relations officer. Another outcome was the resolution that came with the member of the community (Deputy Chief Education Specialist) that each school should pay the subscription fee.

The seven elements of CHAT suggest that the election of the new executive committee (as the object of the activity system) was facilitated collectively by subjects (Commerce teachers)

and community (the DCES, the Economics subject advisor, the EMS subject advisor, the electoral officer and the outgoing executive committee using the mediating artefacts to arrive at an outcome (new executive committee of Commerce Teachers' Association). During the mediation process there were contradictions that occurred. The following section presents these contradictions.

5.3.2. Contradictions

The fourth principle of CHAT examines how different elements of the activity system are related appositionally, pulling in different directions (Timmis, 2014). The CHAT perspective posits that contradictions can be sources of change and development in the activity system. Also due to the multi-voicedness in the activity systems, contradictions are bound to occur. There are some contradictions that emerged from the previous sections of this chapter; this section highlights those contradictions that occurred in the election meeting. The contradictions within the different nodes of the activity are shown by dotted lines. Dotted lines were used in this study to illustrate contradictions because it proved technically difficult to draw the little lightning bolts in the triangle, which are traditionally used.

Tools: Constitution, nomination forms, ballot papers, programme of the day, circular, knowledge and language, certificates and gifts

Outcomes: New executive committee New

Subject: Commerce teachers and the executive committee

Object: Election of Executive

Rules: Constitution, attendance punctuality

Community: DCES, EMS subject advisor, Economics subject advisor

Electoral officer

SMTs

Division of labour:

Electoral officer conducted elections, teachers nominated, Economics subject advisor directed and DCES read the circular

Figure 15: CHAT model of contradictions during the election meeting

The election meeting illuminates several contradictions rooted in the division of labour by the subject (chairperson) and the community (comprising the Economics subject advisors and Deputy Chief Education Specialist). The chairperson was attending a DBE examination meeting which was held parallel to the election meeting. The DBE examination meeting was apparently more important than the election meeting. This importance of the DBE activity was further evident when the DCES requested to be excused from the election meeting to attend the DBE meeting.

Another contradiction between subjects and community arose when the chairperson of the Commerce Teachers' Association was absent from the meeting and therefore unable to coordinate the election meeting. The contradiction between the division of labour of the subject (chairperson and member of the executive committee) and object was created by the failure to call meetings for organising workshops. In the absence of meetings and workshops, the object is not enacted. The absence of the chairperson and other executive members (subjects) also created another contradiction between the subjects and the rules of the Constitution of the Commerce Teachers' Association. These rules state that all executive members should attend meetings. There was thus a contradiction between the division of labour, the members of community (DCES, and Economics subject advisor as ex-officio members) and the rules of the Constitution of Commerce Teachers' Association. The DCES and the Economics subject advisor were acting according to their DBE division of labour. For example, the DCES read and issued the circular which was about the subscription fee to be contributed by each school in the district. Although the subjects (Commerce teachers) enacted the object (electing the new executive committee), the role of the community during the election meeting seemed to point to the DBE taking charge of the Commerce Teachers' Association rather than it being steered by Commerce teachers. The DBE facilitated the meeting and provided the mediating tools (nomination forms, Constitution of Commerce Teachers' Association, gifts for the outgoing executive members, electoral officer). This situation tallies with what was stated earlier by the Economics subject advisor: the Commerce Teachers' Association was spearheaded by the Commerce subject advisors.

5.4. Conclusion

This chapter has discussed how the Commerce Teachers' Association was formed. The findings suggest that the Commerce Teachers' Association was formed by Commerce teachers and Commerce subject advisors. The idea of the formation of Commerce Teachers'

Association came from the Commerce subject advisors. The Commerce Teachers' Association has approximately 287 members; this is a big number of teachers when compared with the suggestion that a teacher learning community must be a small group. In relation to the size of a teacher learning community, William (2007) contends that when a group is too large, meeting time may run out before all members can talk about what they have been doing.

There are contrasting views about the reasons for the formation of the Commerce Teachers' Association. These contrasting views are between the objectives of the Commerce Teachers' Association and what was stated by the participants. As was indicated in the section on the reasons for the formation of Commerce Teachers' Association, these contrasting views illuminate contradictions between subjects (Commerce teachers) and tools (the Constitution of the Commerce Teachers' Association). The four participants that were interviewed stated that the association was formed to address poor performance of learners in the NSC grade 12 examinations. However, the objectives of Commerce Teachers' Association appeared to target content and teaching skills, and practical knowledge that Commerce teachers should acquire to support teaching activities. The literature on teacher learning communities maintains that participation in learning communities facilitates professional development driven by needs of teachers as they are naturally engaged in efforts to accomplish their goals (Vesco, Ross & Adams, 2008, p.86). However, Table 20 which gives the schedule and the focus of meetings held since the Commerce Teachers' Association was formed in 2010 up to 2013, shows that the focus was actually on revision programmes for grade 12 teachers. On the whole, the findings indicate that grade 12 revision programme to improve learners' performance is specifically the object pursued by the Commerce Teachers' Association. This object is in line with what the DBE wants, not really what is stated in the objectives of Commerce Teachers' Association, nor what teachers want.

The leadership of the Commerce Teachers' Association is evenly distributed because it comprised of Commerce teachers and DBE officials as ex-officio members. The election meeting has shown how the new executive committee was chosen. The CHAT nodes and principles were used to understand the election meeting as an activity system. The elements of CHAT during the election meeting suggest that the Commerce Teachers' Association is organized by Commerce teachers and the DBE in order to help Commerce teachers with different revision strategies. One of the characteristics of a teacher learning community is that members of a teacher learning community take collective responsibility, which helps to

sustain commitment (Thomas, 2006, p. 226). The findings seem to suggest that the DBE authorities have assumed a major role in terms of decision making related to the functioning of the Commerce Teachers' Association, such as the calling of meetings and the determination of the subscription fees. This was also evident from the background history which suggested that the idea of forming an association came from the Commerce subject advisors. Furthermore, contradictions that were mostly rooted in the division of labour between the members of the community (Deputy Chief Education Specialist, Economics subject advisor, and electoral officer who was also a DBE official) also suggest that the DBE is in charge of the Commerce Teachers' Association.

The next chapter discusses one of the workshops (activities) of Commerce Teachers' Association that I observed which shows how learning happens, and the kind of teacher knowledge that was learnt.

CHAPTER SIX: TEACHER LEARNING IN THE COMMERCE TEACHERS' ASSOCIATION

6.1. Introduction

In this chapter I intend to show how teacher learning happens and the kind of teacher knowledge that was learnt in Commerce Teachers' Association. I am answering the three research questions which I have reformulated based on the main research questions of this study.

1. How does teacher learning happen in the Commerce Teachers' Association?

2. What kind of teacher knowledge is learnt in the Commerce Teachers' Association?

3. What is the nature of the collaborative relationship in this teachers' association?

I use the CHAT elements to discuss teachers' actions and operations that take place in the Commerce Teachers' Association. As indicated earlier, CHAT focuses on how people learn through collective engagement in a particular activity and in this case I use the activity system triangle as a tool for data analysis. In CHAT the concept of the activity system is the main unit of analysis which explains what individuals or small groups do in a variety of contexts, using psychological and tangible tools. In this study each meeting or workshop is an activity system. Commerce teachers and Commerce subject advisors, who are members, reported that Commerce Teachers' Association had several meetings/ workshops that took place since 2010 (these meetings are shown in Table 20 in Chapter Five).

One of the limitations of the CHAT model as highlighted in chapter three, is that it is unable to provide the language of understanding the type of knowledge that is learnt in an activity system. Since CHAT is a flexible multidisciplinary theory I argue that types of knowledge learnt can be traced from the CHAT elements during the object (learning) enactment by subjects (Commerce teachers) with the assistance of the community (facilitator) using the different types of mediating tools such the language. Hence, I use Grossman's (1990) domains of teacher knowledge to explain the kinds of teacher knowledge that were learnt in the content-based workshops of the Commerce Teachers' Association in a Commerce teacher learning community.

This chapter has three sections; the first section discusses the revision workshop which is followed by a discussion on the kinds of teacher knowledge learnt in the Commerce Teachers' Association. The third section of this chapter discusses the nature of collaborative relationships in the Commerce Teachers' Association.

6.2. The revision workshops of Commerce Teachers' Association

This section uses CHAT elements and principles to explain and to conceptualize what was happening   during the revision workshops of Commerce Teachers' Association. In 2013 there were three activities organized by Commerce Teachers' Association namely planning meeting, Business Studies and Economics revision workshops and of these three activities I observed one meeting and one workshop. However the planning meeting is not discussed in detail in this report because it was not addressing any of the four research questions of this study. The main thing that came out from the planning meeting was that there should have been three revision workshops for the Commerce Teachers' Association. The Accounting revision workshop did not take place in 2013 because of the teachers' strike action. In the CHAT context, this suggests a quaternary contradiction between the planning activity and the teachers' union's activities. In line with Joo (2014), this situation suggests that the quaternary contradictions occurred between the central activity system and the juxtaposed one that can be related to the activity systems of each element of the central activity system. In this situation, one of the Commerce teachers' activities (the Accounting revision workshop) was scheduled to take place on the same day as the strike action. However, the Accounting workshop was cancelled.

The activity system discussed in this section is the Economics revision workshop that took place on 27th August 2013 in a central venue. I also elaborate on the tasks of the Business Studies revision workshop which arose from the interview session held with the Chairperson and the Secretary of Commerce Teachers' Association. Figure 14 below shows the activity system model of the Economics revision workshop. Seventy-two Economics teachers were seated at ten tables. In addition to these tables there was a table for the Department of Education officials and one for the laptop and the projector used by the facilitator.

Tools: classroom, tables, power point presentation, handouts, chalkboard, flip charts, graphs, subscription fees, experiences, knowledge

Outcomes: Knowledge and skills to revise in Grade 12

Subject: Economics and Business Studies teachers

Object: To revise certain topics

Rules: Constitution, attendance punctuality

Community:

CES, DCES, Economics subject advisor

Executive committee

Subject Expert

Division of labour:

Teachers engage in tasks

Expert lectured

Economics subject advisor monitored teachers
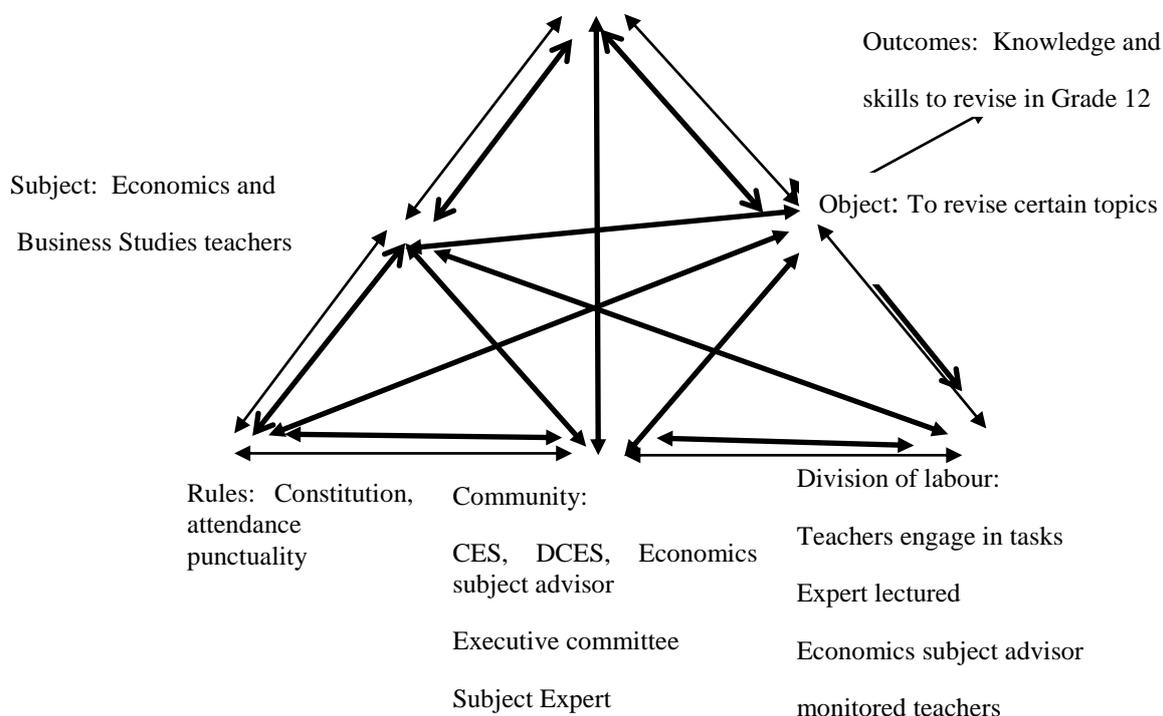
Figure 16: Activity System model for Revision workshop of the Commerce Teachers' Association

6.2.1. Subject

In line with Feldman and Weiss (2010), Economics and Business studies teachers are subjects of the revision workshops because it is the group of teachers whose action I seek to understand. In some cases, during the mediation of some activities, teachers become the subject of activities as individuals or collectively. Therefore, for the purpose of this study the subjects of the activity of the Commerce Teachers' Association during the Economics and Business Studies revision workshops were the FET teachers who teach Business Studies and Economics. The revision workshops' attendance registers provided evidence that Commerce teachers together with their Chief Education Specialist (CES), Deputy Chief Education Specialist (DCES) and three BCM Subject Advisors (SES), came together in the central venue for enrichment by the external experts (community). For example, Sebenzile seems to believe that the external facilitators can help them to improve the poor performance of grade 12 in Zethembe District. She reported that she attended two workshops organised by Commerce Teachers' Association in 2013. She attended the Business Studies revision workshop as a subject teacher and the Economics revision workshop as an executive member

of the Commerce Teachers' Association. When she talks about the history of the formation of Commerce Teachers' Association she says:

> There is a need to uplift the performance of our learners in Commercial subjects since our district was always number 11 when compared to other districts so we felt that there is a need to do something together to assist one another.
>
> (Interview held on the 23rd September 2013)

In terms of the learning of Commerce teachers teaching the subjects of Business Studies and Economics activity systems, CHAT posits that: "Human action is understood as the foundation and the core reality of development and learning mind and knowledge" (Taylor, 2014, p. 98). In line with Taylor (2014) Economics and Business Studies teachers learnt through acting in and on their world by participating in the revision workshops facilitated by the external experts.

6.2.2. Object

The object is the motive of any activity system. The object of activity is that which is collectively shared problem space that community members and the subject transform during the unfolding activity (Hardman, 2007). In other words, the object is something that the subjects (Economics and Business Studies teachers) and community (external experts) were working on. According to Ahmed (2014) exploring the object of activity provides understandings of both the nature and the motive driving the activity. The object of the Economics revision workshop was comprised of several revision tasks which were based on the following topics:

- Questions for Market structures and Cost-Benefit Analysis
- Porters, a new topics that came with CAPS in Business Studies
- How to answer examination questions

<u>Questions for Market structures</u>

In the second meeting that was held with the Economics teachers, the object of activity was the Economics grade 12 content and how to teach difficult topics. As CHAT posits that the activity system does not stand in a vacuum but within the networks of other activities (Taylor, 2010). The difficult topics were identified during the planning meeting by the Chairperson, Deputy Chairperson and the Economics subject advisor. The following topics: Markets, Costs-Benefits Analysis and Environmental Sustainability were identified as difficult. These topics were identified by the Chairperson and the Economics subject advisor of the Commerce Teachers' Association during the planning meeting. Although the topics were chosen by the Chairperson (subject), from a CHAT point of view it appears as contradictions of subjects (Economics teachers) and the object (content) because the subjects (teachers) could not enact the object (teaching the topic for the community (learners) to understand. The literature on teacher learning communities states that the focus of what is learnt in teacher learning communities should focus on teachers' choices that are driven by learners' need (William, 2007). One of the subjects, female Economics and Business Studies teacher, Sbusisiwe, who is a post level one teacher and has taught Economics for eight years, spoken about the Economics content workshop, in this manner:

> .....there was a presentation by someone out of our district on a topic called Perfect Market which we did. He taught us of graphs and gave us reasons why certain graphs, we drew certain graphs and he also taught us certain characteristics of graphs e.g. why we have got normal profit taking place, what happens and who produces a perfect market, what happens to the supply chain, why it shifts to the right and why it shifts to the left and he also helped us identify the long term equilibrium point on the graphs.

This suggests that the Economics revision workshop was facilitated by an expert in Economics from outside their district. From the CHAT perspective, as stated in Brayko (2013), it shows that this revision workshop is an activity in which the subjects (Economics teachers) and the community (Chief Education Specialist, Deputy Chief Education specialist, Economics subject advisor and Commerce Teachers' Association executive committee) engaged, which took place with the cooperation of an external facilitator. This cooperation with a particular community was further confirmed by the Chief Education Specialist when he thanked the facilitator for networking between districts. Furthermore the extract also highlights that the external facilitator, with his knowledge and

experience as tools for mediation, facilitated different tasks such as showing the shift of the cost curves of perfect and imperfect markets. The motive behind this enactment was for Economics teachers to learn strategies to revise with grade twelve learners. Mr Khambule, the facilitator, appeared to be meeting the goal of improving learners' performance in Grade 12 final examination. This was evident in his introductory remarks like:

> **Mr Khambule:** How do we make learners pass, colleagues? The language that we are going to use today will be graphical representations, cartoons, data and sets of questions that a learner must know.

From this extract the facilitator (community) confirms the main object of the Commerce Teachers' Association was to help Economics teachers with revision skills in order to make learners pass the final examination. He also mentioned the mediating tools such as graphical representation, cartoons, data, and sets of questions that they were going to use during the workshop (activity system). The facilitator opened the discussion about Markets by explaining the concept of market (when buyers and sellers meet and negotiate about the price) and he drew the graph on the next page and asked teachers to complete the questions below the graph individually:

PRICE

QUANTITY
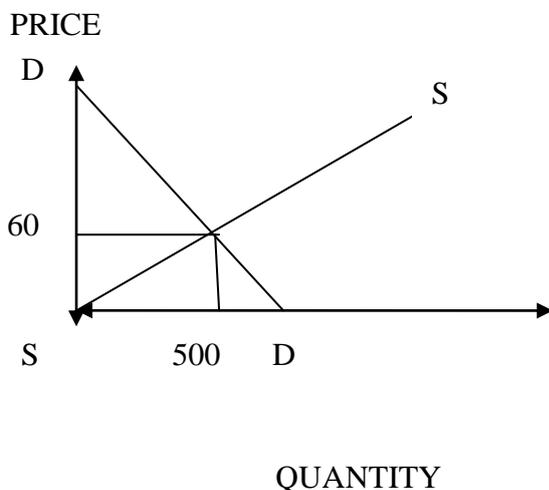
 Graph 1 (This graph is taken from the facilitator's power point presentation)

- What is price elasticity?
- What type of market does the graph represent?
- Explain how the price is determined in the above market.
- Show what would happen if new firms enter this market.

Figure 17: Learning materials from the Commerce workshop

The CHAT framework provides a rich holistic understanding of how people learn in joint engagement in activity. However, CHAT also posits that a task can be carried out individually (Karpov 2013). CHAT suggests that learning can take place through internalisation and externalisation. In simple terms, internalisation represents mastery or understanding which develops a person's capacity to imagine, view alternatives to problems, perform mental simulations, reflect and improvise. This understanding is enhanced by mediational tools. On the other hand, externalisation is the ability to perform concrete actions, drawing on what has been internalized without an immediate problem situation in mind (Saka, Southerland & Brooks, 2009). In relation to the individual task in an activity system, the above-mentioned questions were answered by teachers individually after the facilitator's explanation of the concept of market. First this individual task internalisation happened, and then externalisation occurred when the Economics teachers were working on the questions together. However, the Economics teachers were also drawing from their previous knowledge of Economics content.

Furthermore, the above graph and the questions were mediating artefacts used by the facilitator to help teachers understand how price is determined in a perfect market. The discussion continues between teachers and the facilitator. The teachers shared their answers with one another which the facilitator then summarised and explained to the teachers that they should also expose learners to the above mentioned questions. Drawing from Engeström (2005) this sharing of answers suggests that the individual actions were later transformed into a shared collective object through interaction with the community (the facilitator) and the subjects (Economics teachers). The interaction further manifested the multi-voicedness of the activity because teachers were giving their different answers. Engeström (2005) also says that the multi-voicedness may be positive as multiple perspectives may enrich the points under discussion. Enrichment of the information is illustrated by the following excerpt:

> **Mr Khambule**: What is price elasticity? Yes, price elasticity is grade 11 work, so start by exposing learners to responsiveness of price to demand before introducing the markets. What type of the market does the graph represent?
>
> **All the teachers**: Perfect market.

Mr Khambule: Yes, perfect market, Teachers, learners need to know how to identify and they cannot identify if they do not know the graphs of different market structures. Let us move to the next question.

Teacher: The price is determined by the interaction of demand and supply,

Mr Khambule: Thank you. It is very important to explain to the learners the difference between the individual firms and industry or market, by showing the demand curve and supply curve of the industry that leads to the horizontal demand curve of the individual firm. After this graph what graph must follow?

This episode shows the interaction between the subjects (the Economics teachers) and the community (Mr Khambule, the facilitator) where the facilitator was explaining to the teachers how to introduce the Markets and what causes the learners a problem mastering the graphs of market structures. It appears that Economics teachers lacked pedagogical content knowledge (PCK) because they did not understand the reasons why learners have a problem in mastering the graphs of the market structures. Pedagogical content knowledge includes understanding what makes the learning of specific topics easy or difficult, and the conceptions and the pre-conceptions. According to Adler (2002), teachers should have a broad knowledge of their subject to be able to answer any questions from different areas of the subjects that they teach, such as Business Studies topics. This kind of teacher knowledge was evident when the facilitator was explaining to the teachers the importance of explaining the difference between the individual firms and industries. The Economics teachers continue to respond to Mr Khambule's questions (mediating artefacts):

Teacher: The graph that must follow is the demand curve of the individual firm.

Graph 2 This graph shows the demand curve of the individual firm from the industry

PRICE

60   p=AR=MR

123
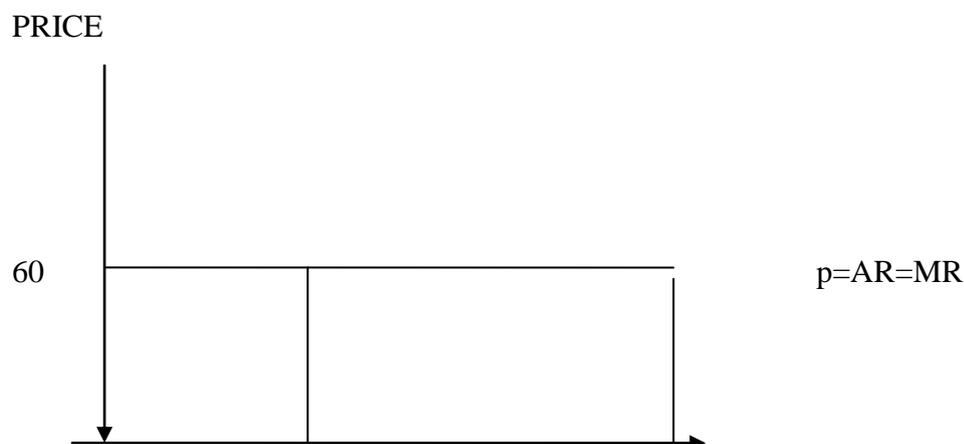
500   600

QUANTITY

Mr Khambule: Thank you Sir. Teachers, do our learners know this? Now who can show us what would happen if new firms enter at this market?

Teacher (from another table draws the following graph and the facilitator elaborates).

Graph 3

Price

60 ———————————————————— *p= AR=MR*

40 ————————————————— p=AR=MR

       500   550   600

Quantities
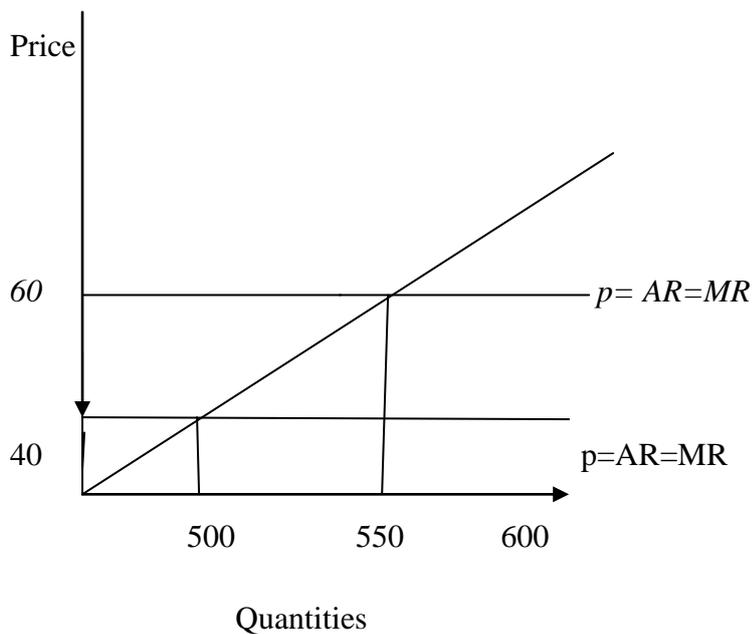
Mr Khambule: Yes, if the new firms enter the market then the price will drop because of abundance in the market.

(Observation held on the 27[th] August 2013)

The above excerpt suggests that Economics teachers as subjects were performing concrete action by drawing graphs and explaining these graphs to peers (other subjects). The graphs, discussion and questions were important mediating artefacts that were used for enactment of object. In a CHAT perspective, the tasks performed by the subjects show how the internal representations become externalized through speech and graphs. Saka, Southerland & Brooks (2009) suggest that the ability of subjects to perform concrete actions without an immediate present problem situation in the mind is externalisation. Furthermore, the performing of the above actions by subjects (Economics teachers) and community (facilitator) also suggest collective learning; collective learning is the main aspect of CHAT. The facilitator used questions to create interaction between him and the subjects.

Although Mr Khambule touched certain aspects of pedagogical content knowledge such as why learners do not know the graphs of market structures, he did not show the teachers how to teach the graphs of different market structures. Mr Khambule gave teachers questions that learners should know. Most of the time the teachers applied their psychological tools (Economics content knowledge) to answer the questions.

<u>Porters, a new topic that came with CAPS in Business Studies</u>

There is evidence from interview data that Business Studies teachers also had a content workshop in August 2013. Celokuhle, the chairperson, and Sebenzile the secretary, reported that there they learnt the new topics that came with the Curriculum and Assessment Policy Statement (CAPS). Sebenzile attended the Business Studies workshop as a Business Studies teacher and attended the Economics workshop as an office bearer of the Commerce Teachers' Association. She reported about the Business studies workshop that the focus was on the content and the examination questions, which teachers felt was challenging to them. She puts it in this way:

> There is this thing that I call Porters, that topic is a new topic, is a new topic and its very challenging to teach learners who are not Economics learners because in some schools there are learners in the General stream who are doing only one Commercial subject which is Business Studies. So it's very challenging to teach that subject to them because Porters is something that is completely new. Unlike Economics learners, Porters has been a challenge to teach to General learners but with Commerce Teachers' Association… (Interview held on the 23rd September 2013)

In Sebenzile's school there are learners who are in the general stream but doing Business Studies (Commerce subject) as an additional subject. These learners had a problem in understanding the topic: Porters. In terms of CHAT the above interview extract suggests that the contradictions between the subjects and object which occurred when the secretary, a Business Studies teacher, (subject) had a challenge to enact teaching the unfamiliar topic (object). The solution regarding this contradiction came with the Commerce Teachers Association. The outcome of the Business Studies revision workshop was the learning of skills to teach the new topic that came with the new curriculum. According to Lee (2007) this kind of learning is in line with the CHAT principle of expansive learning. Expansive learning occurs during: "the expansion of the subject's action possibilities in pursuit of a meaningful

object in the activity system" (Lee, 2007, p.198). Generally expansive learning refers to the capacity to interpret and expand the meaning of the object of an activity taking appropriate action; in this case enacting it to transform it to the outcome indicates expansive learning.

Learning the new topic in the curriculum was also evident from the chairperson of Commerce Teachers Association as shown in the following interview extract:

> **Interviewer**: What were you learning during the Business Studies workshop? Just give me an example of what you have learnt recently.
>
> **Celokuhle:** I have learnt a lot because sometimes when we teach children, there are different concepts that are hard to make learners understand but when hearing from someone how to tackle a certain topic. So it enables me as a teacher now to teach my learners easily. In BS there is thing called porters that I learnt.
>
> **Interviewer**: What is Porter? Please tell me briefly about Porters Sir.
>
> **Celokuhle:** Porter is a new topic in BS. Porters are five forces that were developed by Michael Porter. Power of the buyer, power of the supplier, competition, substitute and rivalry. (Interview held on the 22and September 2013)

The object of the Business Studies' activity system was for the teachers to understand the new topic that came with the new curriculum. Lee (2007) states that expansive learning contributes to an enlargement room to manoeuvre for the individual where new learning possibilities are formed. In other words expansive learning increases individual's possibilities of change)   In line with Lee (2007) it seems as if expansive learning occurred when the chairperson was externalising the Porters by explaining the concept. The chairperson summarised that Porters deal with: the power of suppliers, the power of buyers, and the threats of substitution, rivalry and competition. In this situation we find that the two Business Studies teachers (the Chairperson and the Secretary) as part of the subjects (Business Studies teachers) enacted the object which was learning the new topic in Business Studies. The outcome of this object enactment was the development a clear understanding of Porters.

How to answer examination papers?

Business Studies and Economics teachers reported that they were taught how to answer different questions of the examination. For example, Sbusisiwe, a Business Studies and Economics teacher and the secretary of the Commerce teachers' association, reported that during the Business Studies workshop the external expert in Business studies taught them

essay writing skills. The secretary of the Commerce Teachers' Association reported in this manner:

> **Sebenzile:** They focus on essay type questions and how to answer according to marks because you know learners, if they say it is a 40 marks question they will write an open ended things, so there he guided us on how to make learners write over 32 and not over 40 because if you start by writing the introduction to give 3 points you will get that 3 marks then you get to the body, you must make sure that if it's out of 27 how many points should we write per subheading. (Interview held on the 23rd September 2013)

The above quote elaborates on another object of the Business Studies revision workshop. The focus was how to teach learners to answer examination questions with a hope that if learners are able to answer essay questions they can perform better because essay the s carry more marks in question paper. The main concern of these Commerce teachers is to improve learner performance. Furthermore, in the Economics revision workshop, the facilitator stressed that teachers must do the tasks that he gave teachers with the learners. The Business Studies facilitator similarly guided the teachers on how to answer different types of questions. From a CHAT perspective the external Business Studies and Economics subject experts (community) acted as intermediary aids (Patchen & Smithenry, 2013) that helped Business Studies and Economics teachers by guiding them on how to teach learners to answer examination question papers.

6.2.3. Mediating Artefacts/ Tools

In CHAT the core of the activity is a dialectic relationship between subjects and the object, mediated with artefacts (Hasan, 2003). The mediating tools may enable or inhibit the activity when trying to attain the goals. During the mediation process in the Commerce Teachers' Association, material and psychological tools were used by teachers (subjects) to enact the object which was presented by experts (community) who were also using their material, experience and knowledge as psychological tools.

Material tools are tangible. The material tools that were used to enact the object were meetings, membership fees, power point presentations and previous examination question

papers. The classroom where the meeting was held had twelve tables with chairs, chalkboard and chalk. Economics teachers were seated in ten tables, the other table was occupied by the Department of Basic Education officials and the executive committee members, and the front table was used by the facilitator. The Economics facilitator used a laptop, projector and power point presentation to explain the Economics content. He also used these tools for questions. The teachers were given handouts and question papers. The teachers were answering the activities in their books and the charts and the chalkboard were used by teachers to illustrate the graphs whenever a teacher was asked to illustrate for the whole group.

The membership fee from each member of the Commerce Teachers' Association is also an important tool for enabling the mediation of objects. For the meetings to take place each teacher was expected to contribute a membership fee of R50 to cover the costs of transporting, accommodation and a token of appreciation for the facilitators. All the participants that were interviewed reported that the membership fees should be deposited by all members into the Bank account. The workshop was delayed because the secretary of the Commerce teachers 'association was explaining and requesting Economics teachers to pay the R50 membership fees. These are some of her words:

> The funding of this organisation is from its members, which are us teachers, so colleagues let us pay our membership fee. Money is needed for petrol, accommodation and the gift of the facilitator. For next year new executive will be elected teachers must come to the fore as it will enrich their CV. So please donate your membership fee so that we can cover these costs. Currently there are no sponsors. (Interview held on the 23[rd] September 2013)

The R50 issue seemed to be the issue that delayed the starting of the Economics revision workshop. The facilitator did not have enough time to do revision of all the topics as planned in the planning meeting. From a CHAT perspective this suggests object/subjects contractions. These contradictions emanate from the membership fees (mediating tools). In fact, the workshop started late because teachers did not pay their membership fees. Therefore, Economics teachers as subjects did not enact all the objects because there were no tasks that were facilitated on the other two topics. In other words, the Economics teachers did not learn all the topics that were scheduled for the workshop because the workshop started late.

During the workshops the facilitators used power point presentations to elaborate on the content and for projecting questions. The chalkboard was used more frequently to illustrate

calculations. The teachers were also given notes on the three topics. During the interview session held with the Economics subject advisor, the subject advisor stressed the importance of the notes from facilitators by stating that the group was formed, amongst other reasons, to get information. The 13 pages of photocopied slides were given to teachers and other teachers saved the presentation in their memory sticks which also formed part of mediation tools. The Commerce teachers reported that they were working with past examination question papers during revision workshops. When Sebenzile, the secretary of the Commerce Teachers' Association, talked about using the past examination question papers, she further elaborated about external examination moderators that were invited in 2010 by the Commerce teachers' association with the assistance of one the books publishers. She says:

> The book publisher assisted us in organising people who set question papers,.. In that workshop the external moderators who controlled in 2009, marking of grade 12 paper was helping us in those aspects that were seen to be neglected by learners.

The above quote reveals another community member (external moderator) that was also involved in object enactment by subjects (Commerce teachers). The external moderators guided teachers by highlighting certain questions that were found to be neglected by learners during the marking of final examination papers. In the CHAT context the above artefacts are material tools that were modified by human beings as a means of regulating subjects' interactions with the facilitator and one another (Blunden, 2010). These material tools were used in conjunction with psychological tools.

Psychological tools were also used as mediating artefacts. From the CHAT framework, psychological tools include representation, signs, language, experiences, knowledge etc. The language that enables communication during mediation was English. The facilitator explained the topic after which questions followed. The facilitator enabled the interaction between him and the teachers with questions. The questions enabled the teachers to interact with one another as they were seated in groups. In this case it is the language, experiences, skills and knowledge of both facilitator and subjects that came into play. This is shown in the following extract:

> **Mr Khambule**: If there is a shift in any curve it is in the long run, if there is shift it's a long run condition,

> **Mr Khambule**: What is the impact of the movement?

All teachers: The quantity increase.

Mr Khambule: Remember that the price will also drop because of abundance. (The facilitator projected the graph with AC and MC for teachers to calculate normal profit), learners must know that normal profit is a long term condition, when do firms make economic profits? Teachers must equip learners with such questions. The examiners are not sympathetic they just set the question paper

Mr Khambule: Calculate the total cost and the total revenue from the given graph. Learners must understand the dynamics. Show them the relationship between the graph of an industry and the individual firm's break-even point in normal profit. What drives people away from the business or what drive them out? Short term economic profit drives them in and long term losses drive them out or away, when they sustain long term economic loss. The firm's demand curve is perfectly elastic (while illustrating in a chart) what is the implication of a horizontal demand curve? (Observation held on the 27th August 2013)

The above extract shows that the facilitator's talk was more dominant than the teachers' talk but there were some instances where these Economics teachers share their experiences. The teachers shared how they teach some topics, especially the graphs. According to the CHAT perspective, the facilitator as a member of the community uses psychological tools which are the language, his knowledge, experiences and expertise to teach different curves of a perfect market. The subjects internalized what is taught and then externalization was evident when they engage with the tasks. For example, one of the male teachers seated in table 3 explained how he introduced the elasticity and inelasticity of the kinked demand curve of the oligopoly by stating that he first uses the real elastic to show elasticity before showing the elastic and inelastic part of the kinked demand curve. The facilitator continued to project the graphs and asked teachers to illustrate the answers in the graph in front of all teachers. The facilitator asked in this way:

Mr Khambule: Show what would happen if the new firms enter the market.

The male teacher from table 9 drew the graph on the board. The facilitator applauded the teacher and asked the rest of the house if learners knew how to draw the graph drawn by one of the teachers. Again, the facilitator added another curve in the same graph (graph 2) the horizontal curve that corresponds with R40) and asked another question:

Mr Khambule: Which curve represents long term equilibrium?

> Seeing that there was no response from teachers, he explained that if there is a shift in any curve it is the long term equilibrium and he immediately asked another follow up question:
>
> **Mr Khambule:** What is the impact of the move in the price and quantity?
>
> **All teachers**: The quantity increase.
>
> **Mr Khambule**: The price drops because of abundance.

The above-mentioned observation extracts show that the facilitator opened the discussion with teachers by using questions. Questions and answers were the main mediating artefacts which enabled interaction between Economics teachers and the facilitator for Economics teachers to develop more understanding of graphs and concepts of the market structures. Furthermore, questions, knowledge and sharing of answers were the mediating artefacts that also lead to collaboration and engagement between teachers which occurred when they were demonstrating their answers on the board for the house at large. In terms of the CHAT multi-voicedness principle, this task reflects an interchange where one was being a resource for others while drawing on others as resources during collective engagement in activity.

This collaboration and engagement of Economics teachers seem to show a relationship between knowledge as possession of individuals and knowledge as the collective activity of knowers (Ahmed, 2014). This relationship is in line with Engeström (2005) when he contends that the centrality of relational dimensions and interdependence in CHAT involves both learning from and with each other and exploring the activity jointly. In this Economics activity system, the subject- object relation was not only mediated by psychological and material tools and artefacts, but also by the community and division of labour in interaction

6.2.4. Division of labour

In the CHAT orientation division of labour explains the roles and tasks that subjects and the community perform. Division of labour also caters for division of power during enactment of object.

Mrs Mathe the Economics subject advisor was co-ordinating the programme and acting as a member of the community and a DBE official. The facilitator explains the Economics content in the form of graphical representation, cartoons and data from newspapers. The facilitator seemed to be dominant and Mrs Mathe asked teachers if they understand and moves around to see if teachers were doing the activities. In a CHAT context, the actions of Mrs Mathe may

suggest that revision workshop was a collaborative activity between Mr Khambule and the Economics subject advisor. However, a contradiction of division of labour and rules played up when Mrs Mathe was directing or coordinating the programme, which is the duty of the chairperson of the Commerce Teachers Association.

The pacing of the content and the tasks were determined by Mr Khambule. The facilitator gave questions after the explanation and the teachers respond to questions by writing the answers on the board or chart then the facilitator elaborates on teacher's answers and ends the activity. The sequencing of tasks during the mediation was also determined by Mr Khambule because at the beginning of his facilitation he stated that he was going to start with markets, Cost-benefit analysis, environmental sustainability and South African growth and development policies. The first topic; Markets took most of the time. There was little interaction among teacher themselves. There were little informal interactions between teachers when there was a lack of understanding between the facilitator (community) and subjects which led to contradictions rooted on psychological tools. Lack of understanding facilitated the contradiction between the subjects and object which emerge when the facilitator as a member of the community enacting the division of labour was elaborating on graph 2. The following extract shows contradiction of community, object and subjects:

> **Mr Khambule:** You are a price taker is taking the price from the industry. The profit maximisation point (while showing MC=MR on the graph) learners must know all the points. Above profit maximization point the profit of a firm will decline not that the firm will make a loss. Note the AC and the price line. How do you differentiate long run and short run? Why is the industry known as the price maker? (Teachers were speaking to one another after this question)
>
> **Male Teacher from table 9**: I don't agree that the industry is the price maker.
>
> **Male Teacher from table 10**: If we say the industry is the price maker in the perfect competition, what about monopoly in the imperfect market? (Observation held on the 27[th] August 2013)

This was a very interesting time when teachers were actively engaged with the facilitator by questioning, and not only by answering questions. There was a discussion amongst teachers about the issue of price maker they seemed to be hesitant about the industry being the price maker; Mr Khambule continued to explain projecting the other graph showing the shutdown point.

Same teacher from table 9: But Sir these questions do not need a rush they need to be printed now you are in a rush… (Teachers in the house were laughing).

Mr Khambule: You are going to get a printed version.

In terms of CHAT the above observation extracts show a collaborative and dialogical process in which different perspectives and voices met, collided and emerged (Saka, Southerland and Brooks 2009. p. 1017). This situation is in line with Blunden (2010) when he states that an activity is a multi-voiced formation because of multiple voices from subjects are prompted when they were not agreeing with facilitator that the industry is a price maker. it appears as if there is also a contradiction of object, subjects and community that occurs because of lack of understanding of concepts from the explanation of Mr Khambule. Mr Khambule's response towards the above-mentioned contradiction was telling the teachers that he was going to give teachers printed explanation about the price maker and price taker. The authority and power carried by the facilitator ceased the debate between him and the Economics teachers.

The CHAT framework also posits that division of labour can show power dynamics during the enactment of the object. The two main concepts of CHAT namely horizontal and vertical division of labour are used to trace power dynamics. Vertical division of labour during Economics workshop is evident from the roles played by Chief Education Specialist, Deputy Chief Education Specialist and Economics subject advisor because they were enacting division of labour as DBE officials. The facilitator focused on markets, brief explanation of environmental sustainability, costs–-benefit analysis and growth and development policies of South Africa. He also presented a set of questions that teachers must do with their learners. So he stressed the importance of questions in this way. The facilitator also carried DoE authority because he is an Economics subject advisor of in another district.

There is also some evidence of horizontal division of labour which occurred when the subjects were reporting back their answers to other subjects and the facilitator. According to Bryko (2013) the structure of an activity system is shaped and constrained by cultural factors such as community's establishment procedure of rules as well as division of labour within the community. In line with Bryko (2013), it seems as if division of labour in Commerce Teachers' Association is also one of the factors that constrained the structure of the activity system in that the subjects cannot enact roles accordingly because of the strong vertical division of labour of the community. The vertical division of labour of DBE officials imply

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that Commerce Teachers' Association is shaped by DBE culture. Culture in CHAT refers to the dialectical nature of instrumental human activity in particular, the way in which people act upon their social context aided by cultural tools (Saka, Southland and Brooks, 2009). For example, the Economics subject advisor co-ordinated the programme of the day, Deputy Chief Education Specialist explained the object of the activity, the facilitator was lecturing and the Chief Education Specialist did the vote of thanks. This situation is in contrast with what takes place in an ideal teacher learning community where the members act on equal basis.

6.2.5. Community

According to Murphy and Rodrguez-Manzanares (2008), a community refers to the group of actors who are engaged in joint activity and who have a common object of the activity. The community was comprised of the external facilitator, Chief Education Specialist, Deputy Chief Education Specialist, the book publishers and Economics subject advisor.

External facilitators

Both Business Studies and Economics content workshops were facilitated by an external person from another community. According to CHAT, tools are created and chosen by individuals and social groups and they shape interaction. In line with Postholm (2014), the Business Studies and Economics facilitators as community were chosen by Commerce subject advisors to help subjects during the enactment of the object.

The book publishers

The book publishers seemed to share the same object as the Commerce teachers. The division of labour of the book publishers is to sell books. The book publishers provided sponsorship to the Commerce Teachers' Association. However, they were not part of the Economics revision activity system. It appears as if the books publishers became involved   because during the meetings or workshops they got a platform to sell their books to the teachers.

The Economics subject advisor

The Economics subject advisor coordinated the programme of the Economics revision workshop. She introduced the facilitator to the Economics teachers and dictated the rules. The contradictions of division of labour, community and the chairperson occurred because the Celokuhle, the chairperson was not coordinating the programme. These contradictions

seem to confirm that the Commerce Teachers' Association is shaped by the DBE culture. In other words, the activities of the Commerce Teachers' Association are run like any DBE activities. The subject advisor also checked if the teachers were doing the questions that were posed by the facilitator. Sometimes the Economics subject advisor asked teachers if they understood and moved around to see if they were doing the activities. The vertical division of labour assumed by the Economics subject advisor was in line with her division of labour as a DBE official.

Deputy Chief Education Specialist (DCES)

As mentioned earlier on, the DBE officials were enacting their division of labour as DBE officials rather than being a part of the workshop in a different capacity. The DCES gave the purpose of the workshop as a revision workshop for teachers to revise difficult topics so that they would be able to revise with learners.

Chief Education Specialist (CES)

The Chief Education Specialist joined the Economics workshop towards the end. In his vote of thanks he commented on the contribution of the three Commerce subjects toward the improvement of district performance in Grade 12 results. He commented in this manner:

> The Commerce subjects form the base of the pass percentage of the District. The last three years have shown, the district is in the top 3 of the subjects in KZN Economics is 85%.

In a CHAT context the above quote appears as if the CES was giving credit for the outcome that was achieved after the Commerce teachers' learning from the workshops that were organized by Commerce Teachers' Association. In other words object enactment by subjects (Economics teachers) which has led to the improvement in learners' performance in Economics. However, the improvement of grade 12 results may be due different factors.

6.2.6. Rules

From a CHAT perspective, the activity is shaped by rules such as the established procedures and norms. In this case, the constitution of the Commerce Teachers' Association forms an important part of the rules that govern the enactment of the object. In relation to the Constitution of the Commerce Teachers' Association, it was Sebenzile, the secretary of the association who announced the need for membership fees. The activities of the Commerce

Teachers' Association are shaped by the Department of Basic Education regulations and policies. The rules that governed the Economics revision workshop were dictated by Mrs Mathe in this manner:

> Teachers must sign attendance register, teachers are required to participate fully, no movement up and down, cell phones must be on silent mode, behave as responsible adults.

The above extract also suggests a vertical division of labour. From a CHAT context, there are rules that are not announced which are often called tacit rules, for example respect of one another. The Economics subject advisor spoke, followed by the DCES, and then the CES, who was the most senior official, spoke at the end of the workshop. The DBE protocol was honoured where the highest senior in the line function speaks at the end.

6.2.7. Outcome

CHAT posits that the: "outcome is the product, from the subject enacting the object using the mediating artefacts" (Trowler & Knight, 2002, p. 30). The outcomes should link with the objectives of the Commerce Teachers' Association which target the content and general pedagogical knowledge. The different types of knowledge are discussed in the second section of this chapter. One of the reasons for the formation of the Commerce Teachers' Association was for networking purposes and mostly to get information that other schools in developing areas are getting. Three Commerce teachers reported that they received a lot of information about the curriculum and revision skills during the Economics content workshop. This information consisted of handouts of power point presentations and past examination questions and memoranda. This was highlighted by the chairperson, Celokuhle:

> So we are able to help all educators in the district as a rural district and some schools are in the deep rural areas, so they can get information that other schools in urban areas are getting. (Interview held on the 22[nd] September 2013)

In addition, 44 Commerce teachers who participated in the survey also stated that learning opportunities organised by the Commerce Teachers' Association enabled them to get information and teaching resources. Dissemination of information and resources was also evident in the Economics revision workshop that I observed. Economics teachers were given power point handouts, notes and Economics past examination question papers from one of

the provinces that are leading in Grade 12 results. This outcome of the revision workshops is in line with the same objective of the Commerce Teachers' Association.

Contribution to improvement of Grade 12 results

Towards the end of the meeting the CES addressed the Economics teachers on the improvement in the learners' performance. According to him the improvement in learners' performance in Commerce subjects has contributed to the overall improvement of grade 12 results. He stated that since the Commerce Teachers' Association was formed there has been an improvement in the Grade 12 results of the whole district. However, it should also be remembered that in the CHAT context achieving the outcomes of the object is an ideal situation which occurs when all the nodes of an activity system are acting according to their division of labour.

This section has given a picture of what took place in the Economics revision workshop as an activity system organized by the Commerce Teachers' Association. The Economics activity system was discussed in conjunction with the Business Studies activity. The Business Studies activity (workshop) was not observed but it emerged from the survey and interview data. Economics teachers used their content knowledge to answer questions which were the main mediating artefacts. The facilitator elaborated on teachers' responses. The next section synthesises the contradictions

 In this study, it was not possible to establish whether or not teachers' practices changed as there was no empirical evidence that showed change in teacher's practices either. The teachers were not traced to their classroom situation to find out if their teaching practice changed. Again these teachers had not been observed before the learning started for anyone to establish the extent of their learning beyond the workshops. CHAT focuses on transformation in activity systems which take place when responding to contradictions.

6.2.8 Contradictions

Since contradictions are understood as historically accumulating structural tensions within and between activity systems (Saka, Southerland & Brooks, 2009, p. 1001) inner contradictions were also accumulating within the elements of the revision workshops activity systems. The following is Figure 2 shows the inner contradictions existing in the revision workshops of the Commerce Teachers' Association.

Tools: classroom, tables, power point presentation, handouts, chalkboard, flip charts, graphs, subscription fees, experiences, knowledge

Outcomes: Knowledge and skills to revise in Grade 12

Subject: Economics and Business Studies teachers

Object: To revise certain topics

Rules: Constitution, attendance punctuality

Community:

CES, DCES, Economics subject advisor

Executive committee

Subject Expert

Division of labour:

Teachers engage in tasks

Expert lectured

Economics subject advisor monitored teachers
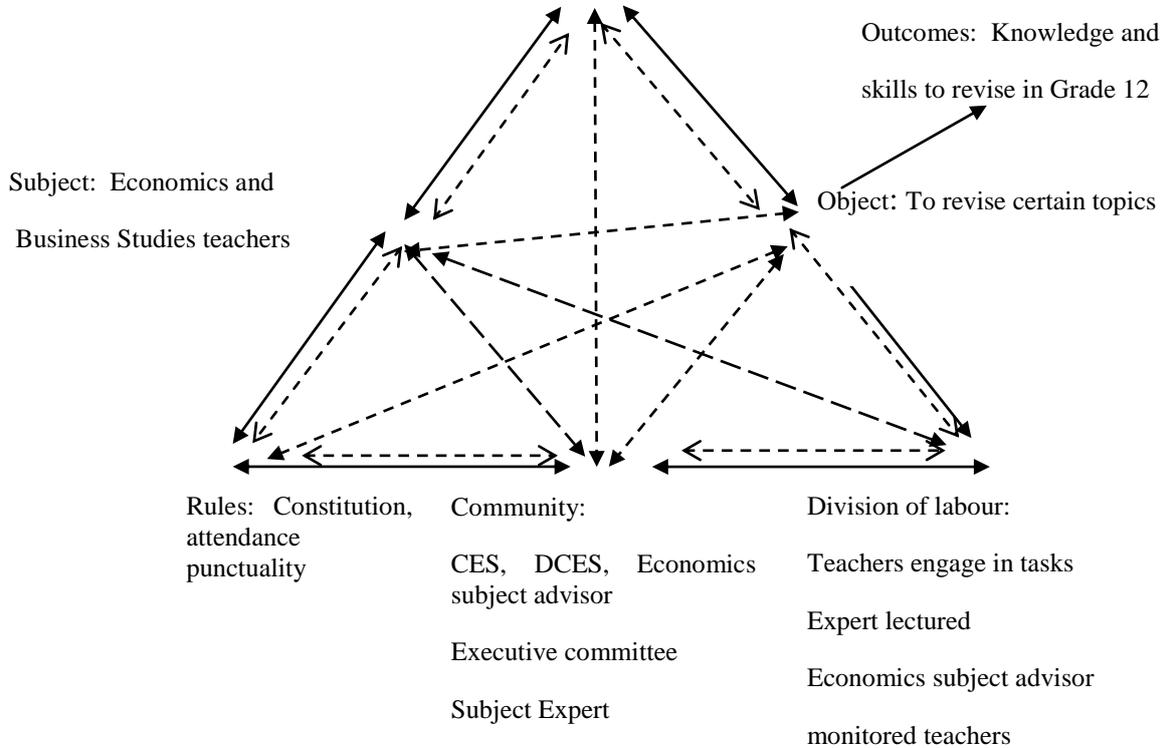
Figure 18: Flow of contradictions in the revision workshop

Firstly, there were subjects/objects contradictions (Business Studies teachers) and the object (Porters, a new Business Studies topic that came with the new curriculum) because subjects were having challenges when teaching this topic. These contradictions led to learning through the workshops although it was not possible to establish the extent of the learning. Another subjects/objects contradiction occurred due to learners' language barrier, this contradiction was evident when Sebenzile spoke about the language (English medium of instruction) challenge of their learners.

Secondly, subjects/objects of the activity/divisions of labour/rules contradictions occurred. The subjects did not enact (revise) all the topics because the starting time of the workshop was delayed as teachers had not paid their R50 membership fees. This meant that subjects did not act according to their division of labour. Yet another contradiction manifested between subjects and rules of the Commerce Teachers' Association because the Constitution of Commerce Teachers' Association stipulates that all individual members should pay membership fees. However, this type of contradiction did not lead to any learning.

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Thirdly, the contradictions that emanated from the division of labour and community (DBE officials) starting from the election and planning systems were also evident in the Economics revision activity system. The DBE were acting outside their division of labour as ex-officio members of Commerce Teachers' Association. Their presence appeared as that of monitoring a DBE workshop because of the leading role they took during the workshop. The Economics subject advisor appeared to be assuming the role of the Chairperson when she was coordinating the programme of the workshop.

Fourthly, misunderstanding between the facilitator (community) and the subjects about the price maker (in the topic on markets) manifested contradictions of subjects, community and object because Economics teachers did not understand the meaning of the concept, hence enacting the object (learning) did not take place. These contradictions resulted in multi-voicedness which had a positive impact because it raised the participation of teachers from where they probably benefitted some learning. However, the multi-voicedness became negative when the subjects were making a noise (when the Economics teachers were talking amongst themselves without being allowed to do so). In this case multiple views further promoted contradictions between the subjects and the rules because teachers were unable to listen to each other. According to Engeström (1999), learning is a long process of internalization and externalization in response to contradictions as well as appropriation of available cultural resources to design a novel form of practice. Contraction of subject, community and object occurred in the process of internalization. When teachers were trying to understand, they could not and this created a contradiction. Due to this contradiction they then needed to read more or get clearer explanations to internalize, thereby addressing the contradiction. In other words, more reading and more consultation is the appropriate response to contradiction.

From a CHAT perspective for a variety of reasons, contradictions may be resolved, unresolved and ignored. There is little evidence from the findings which shows how some contradictions were resolved. The CHAT literature states that ignoring the contradictions may have a negative impact on the activity system. However, it is possible that the activity system would continue to exist and operate in a kind of unstable equilibrium (Feldman and Weiss, 2010. p. 39).

This section has synthesized contradictions that were emerging from the elements of the activity system. Most of the contradictions (embedded in the division of labour were issues

which arose between DBE officials and Commerce teachers) were evident in all three activity systems that were observed. In conclusion, the findings suggest that tasks that were facilitated by the external facilitators during the revision workshops were an attempt to overcome poor performance of learners in grade 12 final examinations. However the contradiction did not lead to the expansive learning as envisaged by CHAT. The findings suggest that there was reproductive and repetitive learning rather than expansive learning. This was evident from both Economics and Business Studies tasks. For example in the Business Studies Sebenzile reported that they were taught how to answer examination question, this was a repetition of what they have already seen. In the Economics workshop the dominance of the facilitator and little teachers' interactions suggests restricted learning than expansive learning. Therefore the actions during the Economics workshop did not follow the order presented in the seven steps of expansive cycle in Figure 4 of Chapter 3.

In this section I have used CHAT elements to show the picture of the revision workshop as an activity system of the Commerce Teachers' Association in order to understand how learning happens in the Commerce Teachers' Association. The activity system, together with the schedule of meetings discussed in chapter five, suggest that Commerce teachers as subjects come together normally in the third term to enact the object (to learn to revise with grade 12. The object was not enacted fully because the workshop ran out of time before teachers could revise all the topics that were scheduled for the workshop. Jita and Mokhele (2014) argue that the sharing and exchanging of expertise are improved when teachers learn together and solve problems collaboratively. However, in the Economics workshop the interaction was mainly between the expert and teachers. In line with William (2007), the workshop appeared to run out of time before the Economics teachers were able to talk about what they had been doing. Furthermore, the group was too large; it would not have been possible for 72 teachers to interact individually with the expert.

The literature maintains that: "teacher learning depends on the extent to which teachers can integrate their knowledge drawn from both school and in professional development context" (Pournara, Hodgen Adler & Pillay, 2015, p. 4). However, the findings seem to suggest that the learning of the Economics teachers during the revision workshop is in line with the cognitive perspective because teachers were not interacting with one another but were expected to transfer their learning to their Grade 12 learners. This learning is facilitated by

the expert, a member of community, in cooperation with the Commerce subject advisors who are also members of the community. In the Economics workshop, the expert was using his experience, knowledge and questions as mediating artefacts to facilitate the object. The subjects were using their knowledge of Economics to answer the revision questions. There is little evidence that suggest that they engage in more conceptual issues, this is evident from the two Business Studies teachers who reported that they have learnt very little of the difficult topic. The next section discusses the kinds of teacher knowledge that is learnt in Commerce Teachers' Association.

6.3. Kinds of teacher knowledge that is learnt in Commerce Teachers' Association

This section discusses the kinds of teacher knowledge that was learnt in the workshops within the Commerce Teachers' Association. I use Grossman's (1990) four domains of teacher knowledge; subject matter knowledge, pedagogical content knowledge, general pedagogical content knowledge and contextual knowledge, to describe the kinds of teacher knowledge that was learnt in the Commerce Teachers' Association workshops.

6.3.1. Subject matter knowledge

According to Grossman (1990), subject matter knowledge is comprised of knowledge content of a subject, and knowledge of the substantive and syntactic structures of the discipline. From the historical background of the Commerce Teachers' Association I found that the association was formed in order to develop different types of teacher knowledge.

The survey findings state that 58% of the survey respondents responded to the question about the value of the learning opportunity organised by the Commerce Teachers' Association stating that they have acquired subject content based knowledge but they did not specify the topics. The findings also reveal that 53% of the teachers said that they developed content knowledge in the workshops while 47% said that they did not.

Interestingly, the survey findings are in contrast with the findings from Economics workshop observation and interviews, which suggest that there was more focus on general pedagogical knowledge than on content knowledge. The three teachers that were interviewed reported that the Commerce Teachers' Association activities helped them to gain confidence to teach

difficult topics. Sibusisiwe talked about the Economics workshop, saying that it was educating for her because she learnt more about the topics that were very challenging for her.

> I find it educating, I have learnt a lot of things that I was not aware of. I have faced difficulties with certain topics but because of this Commerce Teachers' Association I have learnt a lot and I am now confident in those aspects which I wasn't confident in before. For example, the graphs on Perfect market and Oligopoly, now I am more confident in that topic.

The above quote suggests that the Economics revision activity system provided Sibusisiwe an opportunity for learning graphs for perfect and oligopoly market structures. These two topics were part of the object where mediating artefacts (questions and graphs) were employed during the Economics revision activity system. Sibusisiwe has learnt major facts and concepts (oligopoly, perfect markets) within Economics. Furthermore, the two Business Studies teachers stated that their content knowledge was broadened because the Business Studies facilitator assisted them in acquiring a deep understanding of the difficult topic (Porters) that was introduced by the new curriculum.

The findings on subject matter knowledge seem to suggest that the focus of the workshops were more on the mastery of major facts and concepts within Business Studies and Economics. The content of each topic came from the revision tasks undertaken with the expert.

6.3.2. Pedagogical content knowledge (PCK)

In terms of PCK, Grossman (1990) maintains that teachers need to psychologise their subject matter for teaching, to rethink disciplinary topics to make them accessible to students. In other words, teachers need to know what makes the learning of any particular topic easy or difficult. There is little evidence that suggests a focus on PCK during the revision workshops. The Commerce teachers did not discuss their beliefs about the purpose of teaching each of the Commerce subjects at different grades such as grade 10 and 11. The focus of the workshops is specifically on grade 12 revision strategies in preparation for the final examination. Another aspect of PCK is the knowledge of students' understanding, conceptions and misconceptions of any particular topic in a subject matter (Grossman 1990, p.8). The two Business Studies teachers reported that they had learnt essay writing skills and how to structure an essay. They learnt the essay writing skills in a Business Studies

workshop which was facilitated by an expert from another district. Celokuhle externalizes what he learnt in this manner:

> Our essays are out of 40 marks, we have got a layout and the structure the children need to follow. You start by writing the introduction where you have to give 3 points in order to get 3 marks. The body of the essay must have subheadings and the essay has to end with a conclusion. Learners should take 25 minutes to write for 40 marks.

This quote seems to be in line with the knowledge of the curriculum and particularly the assessment guidelines in the curriculum. According to Grossman (1990) curriculum knowledge is part PCK.

There is evidence from one Business Studies teacher that she has knowledge about what causes some of her learners not to understand the topic (Porters). She realized that her Business Studies learners that were taking the subject within the general stream did not understand the topic because they are not familiar Commerce concepts.

In relation to the Business Studies topic on Porters, the same teacher, Sebenzile says that she acquired instructional strategies for teaching this topic

> (The) facilitators have given me ways how teach Porters, they have made it practical to even take learners and their home situation and put it in a classroom situation and make them understand Porters to be really applicable so it has helped a lot. (Interview held on the 23rd September 2013)

When Sebenzile says that the Business Studies facilitators have provided ways to teach Porters, it relates to her knowledge of instructional strategies and representations for teaching a particular topic (Grossman 1990, p.9). In this case Porter is the topic which she has learnt to teach. However, the findings do not indicate how she learnt the instructional strategies. According to Grossman (1990) the instructional strategies and representations for teaching any particular topic are a component of PCK.

There is also evidence from Celokuhle, the chairperson, that curricular knowledge is a component of PCK. Grossman (1990) highlights that curricular knowledge includes knowledge of curriculum materials available for teaching particular subject matter, and knowledge about the horizontal and vertical curricula for a subject. Celokuhle, responding to the question about what he has learnt in Commerce Teachers' Association that makes him a better teacher, says:

> In all the sections for my subject I know exactly how to teach it and I know the way to make learners understand it. Through the Commerce Teachers' Association I know the easy ways to make learners understand. I know now which resources to use which make it easier because certain textbooks are hard for the children. I know which textbook to use for a certain topic in Business Studies and Economics. I use notes from the Commerce Teachers' Association.

Celokuhle draws upon his knowledge to select from available textbooks for teaching particular subject matter in a way that will help his learners understand. This quote also points to the knowledge and beliefs concerning learning and learners (general pedagogical knowledge) when Celokuhle says that certain textbooks are hard for the children. Similarly, Commerce teacher number 33 (C33) responded in the survey that she acquired knowledge of how to choose textbooks for the learners.

Curriculum and Assessment Policy Statement (CAPS) knowledge

There is evidence from the data that at least one Commerce teacher has learnt how to use the CAPS documents. For example one of the sixteen teachers who responded to the survey question about valuable learning opportunities:

> C20: I got assistance on how to meet matric needs and to be on line with subject policies, CAPS.

This statement, made by Commerce teacher No.20, is in line with curriculum knowledge which is the understanding of principles underpinning the curriculum.

Skills to revise with grade 12 learners

Participants felt that workshops organized by the Commerce Teachers' Association enabled them to acquire different skills such as revision strategies, how to teach learners to tackle examination questions and examination expectations. This was evident from the survey, for example Commerce teachers no 03 and 41 wrote in response to the question concerning what they had learnt:

> C03: Essay writing skills, analysing and answering question. Linking marks and answers.

> C41: Techniques on how to tackle some questions during exam; and expectations during the exam.

The skills to revise with grade 12 learners were also evident in Celokuhle and Sebenzile when they were talking about their valuable learning in the activities (workshops) of the Commerce Teachers' Association. For example, the Secretary said

> …it helped us with essay writing skills because that was a challenge in Business Studies.

The above mentioned survey and interview excerpts seem to suggest that PCK was learnt in order to improve learners' performance in the grade 12 final examination. Acquiring of skills to revise with grade 12 learners is in line with the object of the Economics revision workshop.

6.3.3. General pedagogical knowledge

General pedagogical knowledge includes "a body of general knowledge, beliefs and skills related to teaching, knowledge and beliefs concerning learning and learners, knowledge of general principles of instruction, knowledge related to classroom management and knowledge about the aims and purpose of education "(Grossman, 1990, p. 6). It appears that general pedagogical knowledge is the main focus of the Commerce Teachers' Association. This is evident from the nature of workshops; the workshops are referred to as revision workshops for Commerce teachers to master revision skills. The following are examples of general pedagogical knowledge.

The three Commerce teachers reported that the content related information and learning tasks that they were exposed to when they are in the meetings or workshops enables them to be on the same level of development as other teachers of other districts. They felt that the Commerce Teachers' Association serves as platform to enhance growth in their teaching profession.

> Sibusisiwe: It is greatly enriching my professionalism. Firstly I should be aware of what is happening around and relate it to what I teach in class. The manner in which I interact with my colleagues should be on the professional level of other teachers. We share work related experiences and nothing else.

Similarly, Sebenzile elaborated by saying that engaging in different activities helps a teacher to grow professionally and it adds value to teachers' curriculum vitae. She says:

What is important is we are going there for content based knowledge but you come out also with life skills knowledge because some of us as teachers we don't network we just work. When networking, it helps your CV to grow without you knowing. When you join these groups it helps you in terms of your CV because people for example will say, now I know this teacher from the Commerce Teachers 'Association meeting, she was the one that was raising this point and came with the idea... leadership qualities are identified in these meetings and other skills. (Interview held on the 23rd September 2013)

The above interview extracts, state that participation in the tasks during the workshop helps teachers to grow and it can add value to their curriculum vitae. The outcome in this case is enrichment of teachers' CV's.

6.3.4. Contextual knowledge

Grossman (1990) maintains that teachers should draw upon their understanding of the particular context in which they teach to adapt their more general knowledge to their specific school setting and individuals' students. In other words, contextual knowledge involves understanding the community, district and school context in relation to the learners that a teacher is teaching. There is evidence that the formation of Commerce Teachers' Association was as a result of contextual constraints of Zethembe district. This was evident from Celokuhle when he spoke about the reasons for the formation of the association and said that their district is rural. Mrs Mathe also commented about the proximity of locality of schools in Zethembe District as they are very far from one another. Similarly, Sebenzile displays knowledge of the district and learners. The following extract shows Sebenzile's contextual knowledge

The problems us as teachers we are facing is our learners don't understand what we are teaching. The main barrier is language. Now there, we get skills as to how to overcome that barrier so that our learners can become learners that are going to get better results especially in our district. We know that learners from our district most of them are coming from deep rural areas where they only use English during school hours, after that no English. So this association helps a lot to come up with ways that can make our subject to be practical and more enjoyable for learners.

The above extract suggests that Sebenzile has acquired skills to adapt to the specific needs of the learners and the demands of her district. Sebenzile seems to understands the context and the constraints of her district in which she works and the learners' language barriers. In relation to these constraints, Sebenzile reported that she has learnt how to overcome these

constraints when teaching Business Studies. This situation relates to the contextual knowledge, where teachers draw upon their understandings of the particular context in which they teach, to adapt their more general knowledge to specific school settings and individual students (Grossman 1990, p. 9).

This section has presented the kind of teacher knowledge that teachers learn in the Commerce Teachers' Association workshops. The findings show that there is more focus on general pedagogical knowledge and subject matter knowledge. There was little evidence of PCK, the PCK focussed on curriculum material for teaching. In relation to the contextual knowledge there was some evidence that knowledge of the district, of contextual factors and of knowledge about learners was gained. There was at least one teacher who displayed knowledge of the context in relation to the learners. The next section discusses the nature of collaborative relationships in the Commerce Teachers' Association.

6.4. The nature of collaborative relationships in the Commerce Teachers' Association

The literature on teacher learning communities indicates that collaboration between teachers is an important characteristic of a teacher learning community (DaFour, 2004). Thomas (2006) contends that collaborative learning is based on the idea that learning is a natural social act in which participants talk among themselves. In CHAT, collaboration is an important aspect of an activity system. Timmis (2014), one of the CHAT theorists, argues that the object of the activity and also the relationship between goals, are influenced by effective collaboration between actors in the activity system. Timmis (2014) further elaborates by stating that collaboration is essential to construct shared knowledge. However, learning or working together does not always mean collaboration.

In this section I will describe the nature of collaborative relationships in the Commerce Teachers' Association. The data about the nature of collaborative relationships largely comes from the survey that was administered during the election meeting. I also use interview and observation data to substantiate the findings that emerge from the survey. I describe collaborative relationships under the following classifications, which were derived from the survey: collaboration during workshops, extent of collaboration outside of the workshops, and types of support outside of the workshops.

6.4.1. Kinds of collaborative activities during the workshops

The term "activities" was used in the survey to refer to the tasks that Commerce teachers were jointly engaged in during the workshops. From a CHAT perspective, the term activity refers to the workshops. Therefore, the term activity was used according to the teachers' understanding that that is what teachers were doing when they were collaborating during the workshops. The question on the kinds of collaborative activities teachers engage in was classified into five options as shown in the Table 21 below. Respondents were at liberty to tick more than one answer, thus the percentages add up to more than 100%.

Kinds of collaborative activities	Number of teachers using this kind of collaborative activity	Percentage
Working with other teachers to solve problems related to the subject content	32	55.2%
Sharing ideas with other teachers about how to teach particular topics	30	51.7%
Sharing teaching resources with other teachers	14	24.1%
Working with other teachers to go through past exam papers	21	36%
Other collaborative activities	2	3%

Table 21: Respondents' views on kinds of collaboration during workshops

 The survey findings indicate that 32 of the 58 Commerce teachers stated that they collaborated with other teachers to solve problems related to subject content and 26 Commerce teachers did not include this option. There were 30 Commerce teachers who stated that during the workshops they collaborated with one another to share ideas about how to teach particular topics. Only 14 Commerce teachers responded that they shared teaching resources with other teachers. This implies that 75. 9% of teachers did not share teaching resources with other teachers. The findings further show that 21 teachers responded that during the workshops they worked with one another to go through past examination papers, tests and memoranda. There were 2 respondents that used other collaborative activities but they did not specify the kinds of collaborative activities.

The literature on teacher learning communities suggests that teachers act on an on-going basis to develop their knowledge of common interest or passion by sharing individual resources and engaging in critical dialogue (Priestley, Miller, Barrett and Wallace, 2011, p. 270). The findings seem to be in line with the literature, although one notices that there are

very few teachers that responded that they shared teaching resources during the workshops. Furthermore, the survey findings seem to oppose what was taking place in the Economics workshop which I observed. During the Economics workshop the Economics teachers were mostly interacting with the facilitator by responding to his questions. One of the vital aspects of collaboration is interdependence between people that are collaborating. The observation data suggest that Commerce teachers seemed to depend more upon the facilitator. Priestley et al. (2011) further highlight that the dialogue between teachers strengthens a teacher learning community and allows change which takes account of prior experiences and achievements of teachers. The findings from the observation do not have evidence to support that teachers engaged in critical dialogue with one another. This was shown by the second activity system discussed in this chapter.

6.4.2. Extent of collaboration outside of the workshops

In this section, I look at how often Commerce teachers collaborate with one another outside of the workshop. The findings show that the extent of collaboration between Commerce teachers outside of the workshops differs. The findings the from the survey show that 6.9% of Commerce teachers say they collaborate with one another at least once a week, and 53.4% collaborate about once a month. In addition, 34.5% of teachers responded by saying that collaboration in the Commerce Teachers' Association is not very lively as they only meet at workshops. A small 5% of teachers indicated that they do not meet at all outside of the workshops. It would seem that approximately 40% of Commerce teachers are not collaborating outside of the workshops of the Commerce Teachers' Association which might be because it is seen as only a DBE initiative.

6.4.3. Types of support outside of workshops

The survey findings suggest that Commerce teachers use various techniques to support one another outside of the workshops. This is shown in Table 22 below:

Type of support outside of the workshops	No. of Respondents	Percentage of Respondents
Share teaching resources like textbooks, worksheets and activities.	21	36.2
Share tests and examination papers	16	27.6
Work together to plan different ways in which to teach particular topics	25	43.1
Work together to design tests and examination	13	22.4
Observe one another teaching in order to develop practice	13	22.4
Moderate each other's learners' test and assignments	22	37.9
Other	1	1.7

Table 22: Respondents' views about the type of support outside of workshops

The findings show that 21 of the 58 participants share teaching resources comprised of textbooks, worksheets and activities, while 16 participants share tests and examination papers. Furthermore, 25 participants support each other by working together to plan different ways in which to teach particular topic. Only 13 of 58 participants work together to design tests and examinations and only 22% (13) of 58 participants observe one another teaching in order to develop their teaching practice. A significant number of 22 participants support each other by moderating each other's learners' tests and assignments. Lastly, one participant uses other methods which he specified as team teaching.

To sum up, these findings suggest that (40%) of Commerce teachers work together to plan different ways to teach particular topic. This finding seems to be in line with the second objective of the Commerce Teachers' Association which is to equip Commerce teachers with content knowledge and methodological skills (skills for how to teach). Furthermore, the findings suggest that 36% of Commerce teachers share different resources. Where the issue of sharing the resources and working together of Commerce teachers is related to teacher learning, the research literature suggests that developing new ways of working is achieved through collaborative acts of meaning making and ways of envisaging something as a mediational tool (Hermansen & Nerland, 2014). There was also a significant number of 22 participants (out of 58) who responded by saying that they support each other by moderating

each other's learners' tests and assignments. This kind of support seems to be line with one of the agendas of DBE clusters that suggests teachers' collaboration to moderate learners' school based assessment tasks. In a CHAT context, the subjects (Commerce teachers) use mediating tools to help each other to act on their object (teaching).

6.5. Conclusion

In this chapter I have presented the revision activity system of the Commerce Teachers' Association to explain how Commerce teachers learn and the kind of knowledge that is learnt when they are together. The last section of this chapter presented the nature of collaborative relationships amongst Commerce teachers during the workshops and outside of the workshops. I draw three implications from the findings.

Firstly, in relation to teacher learning in the Commerce Teachers' Association, the findings suggest that the learning takes place in the workshop is in line with the cognitive theoretical perspective. The learning is facilitated by the expert, and teachers are expected to apply this knowledge in their classrooms. Secondly, the findings attributed to the four domains of teacher knowledge suggest that the emphasis is on PCK and more specifically on curriculum knowledge and general pedagogical knowledge. This can be seen when Commerce teachers acquire the revision skills in order to enact revision with grade 12 learners. The literature on teacher knowledge states that different types of teacher knowledge are learnt in different spaces. For example, Bertram (2011) highlights that practical knowledge is often learnt informally from observing colleagues or by asking colleagues about their teaching methods. In this case the practical knowledge relates to Grossmans' (1990) knowledge of instructional strategies and representations for teaching particular topics. In relation to classroom observation, the survey findings suggest that there were 13 teachers who stated that they learnt from one another through team teaching.

Thirdly, the literature maintains that collaboration is very important to professional development: "as it not only provides the necessary support for learning but also provides teachers with feedback, and brings about new ideas and challenges" (Kwakman, 2003, p. 153). In relation to collaboration, the findings suggest that Commerce teachers collaborate outside of the workshops in different ways such as sharing teaching resources such as textbooks, worksheets and activities, sharing tests and examination papers, working together to plan different ways in which to teach particular topics, working together to plan different ways in which to teach particular topics, working together to design tests and examination,

observing one another teaching in order to develop practice, and moderating each other's' learners' test and assignments.

The next chapter discusses the history and formation of the Mathematics Group, the second of the two TLCs in this case study.

CHAPTER SEVEN: HISTORYAND FORMATION OF THE MATHEMATICS GROUP

7.1. Introduction

"History of an activity system helps to understand the problems and potentials of an activity system" (Murphy and Rodriguez-Manzanares, 2008, p. 444). In line with this quote which describes the third principle of CHAT, this chapter seeks to answer the first research question: How were the two selected teacher learning communities formed? In this chapter I focus on how the Mathematics Group was formed. The data that is analysed here was generated through observations, interviews and document analysis. The documents that were analysed were: Evaluation Report of Mathematics project 2012, Maths Leadership Evaluation Report, 2013 and Overview and Analysis of 2013 Grade 12 Results obtained by Schools in the NGOs' Mathematics Project, and attendance registers.

The chapter starts by describing the historical background and formation of the Mathematics Group. This is followed by a detailed explanation of who initiated the formation of the Mathematics Group. I describe the aims and workshop programmes of the Mathematics Group. I also give background information of the people that are involved in and leadership of the Mathematics Group. I conclude the chapter with the implications of the historicity and formation of Mathematics Group in relation to the formation of a teacher learning community.

7.2. Historical Background and Formation of the Mathematics Group

The study was conducted in the same district as the Commerce Teachers' Association, one of the 12 education districts in KwaZulu-Natal. The Provincial Department of Basic Education allocates schools to circuits. As shown in the historical background of Commerce Teachers' Zethembe (pseudonym) district in this study has four circuits. Each circuit has approximately twenty plus secondary schools. There are different types of teacher groups which are formed according to subjects. These groups are called clusters. This study focusses on a group of Mathematics teachers in one of these four circuits as shown below:
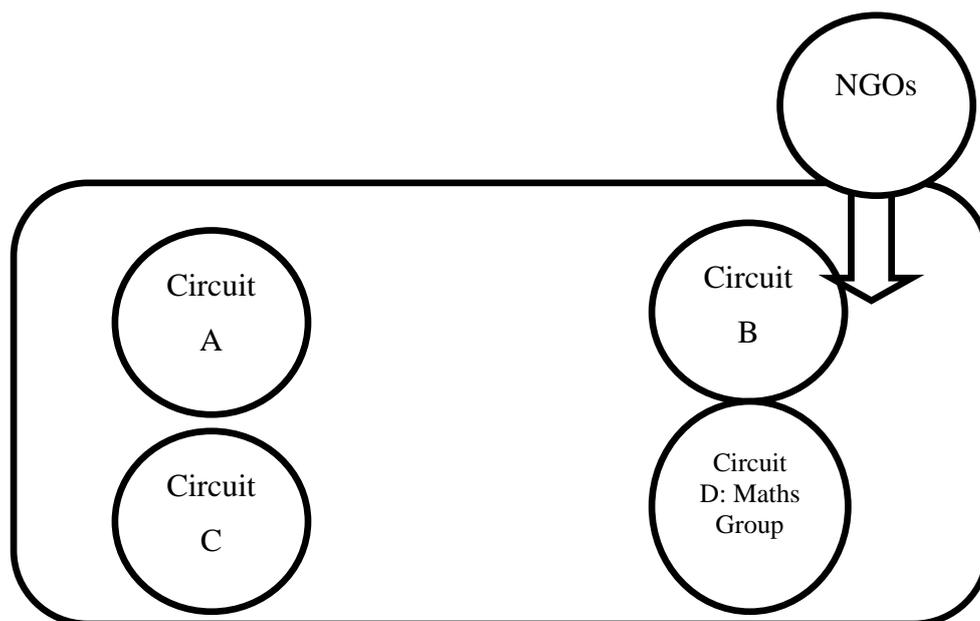
Figure 19: Location of Mathematics Group in a Circuit in Zethembe District

According to South African literature (Jita & Ndlalane, 2009) on the dynamics of teacher clustering, teachers' clusters are administrative organs of the Department of Education that help to simplify the management of schools. Findings from Jita and Ndlalane (2009) state that: "teachers' clusters are being used as a substitute for the traditional approaches to professional development in helping teachers reshape their professional knowledge and change their classroom practices" (Jita & Ndlalane, 2009, p. 58). The Mathematics Group is a of group approximately 28 Mathematics teachers teaching within a specific geographical area in a district. This Mathematics group was formed as one of the teachers' clusters initiated by the Department of Basic Education. In 2007, a Non-Governmental Organisation (NGO) became a part of the Mathematics Group. The involvement of the NGO in the Mathematics Group was driven by the crisis in the teaching and learning of Mathematics in South Africa, especially in rural and under-resourced schools which are the schools that prevail in the district under study. Although the four participants that were interviewed call themselves a cluster, I have decided to call them the Mathematics Group because of the involvement of the Non-Governmental Organisation which is not the case with the other clusters of teachers in the district.

The NGO became involved in the Mathematics Group in an attempt to address the crisis in the teaching and learning of Mathematics in South Africa (NGO's Evaluation Report of Mathematics project, 2012). The NGO targets the Mathematics teachers in selected schools in under-resourced areas of KwaZulu-Natal. There is no evidence of the exact number of

Mathematics teachers in the Mathematics Group. In 2011, the number of schools that participated in the Mathematics workshop programmes decreased to 25 schools because three schools closed Mathematics as a subject and offered Mathematical Literacy instead. Mathematical Literacy is a Grade 10 to 12 subject which is generally taken by the learners who are not performing well in core Mathematics. According to the Department of Basic Education (DBE) (2003b), Mathematical Literacy equips learners with and sensitises learners to an understanding of the relevance of Mathematics in real-life situation. Currently there are 22 schools whose Mathematics teachers are in the Mathematics Group.

From a CHAT perspective, the historical background of the Mathematics Group suggests that the 28 Mathematics teachers are the subjects of the activity systems. However, there were 14 teachers in the two NGO workshops that were observed. According to Engeström (2001), the activity systems comprise of mediated actions through which subjects engage, enact and pursue the object. The Mathematics Group engages in several activity systems organized by the NGO. The DBE is also linked to activity system (workshop or meeting) that involve learners. The object that was pursued in the DBE moderation meeting was the checking of the learners' continuous assessment while the object that was pursued in the NGO workshops was the learning of Mathematics in order to teach it more effectively. For the purpose of this study, the focus is on how Mathematics teachers learn how to teach Mathematics. In other words, meetings and workshops were organized by the NGO and the Department of Basic Education. This section has shown that the Mathematics Group differs from the other subject teachers' groups, known as clusters, because it has the NGO as part of the community. The next section gives explanations on who initiated the Mathematics Group.

7.2.1. Who initiated the Mathematics Group?

Some international studies on teacher learning communities state that teacher learning communities are initiated by teachers themselves. Studies by William (2007) and Hargreaves et al. (2013) show that teacher learning communities tend to be more successful if they are initiated by the teachers themselves. Furthermore, Owen (2014) states that a teacher learning community is a group of teachers who come together as a team to help one another improve student learning. She elaborates that when a teacher learning community is initiated by teachers themselves, a collegial culture is facilitated which can lead to ownership and participation in continuous professional debates. A collegial culture means that teachers in a teacher learning community are all at an equal level in terms of power dynamics. Hence,

understanding who initiated the Mathematics Group is one of the important aspects of this study on this teacher learning community in order to confirm the claim made in the above studies.

The participants who were interviewed had different views about who initiated the Mathematics Group. The two Mathematics teachers, Jabulani and Bongani, reported that the Mathematics Group was initiated by the NGO. Bongani, a Mathematics teacher (who comes from a neighbouring country and has taught in South Africa for five years), stated that the Mathematics Group was initiated by the NGO which is an outreach project of one of the private schools in KwaZulu-Natal (KZN). Therefore the NGO is part of the private school.

According to Hlengiwe, the cluster coordinator, and Siza, the NGO facilitator, the Mathematics Group was initiated by the Department of Basic Education (DBE) as one of the Mathematics clusters. However, this Mathematics Group differs from the other subject clusters as highlighted by Hlengiwe below:

> In our case there is a lady we were working with, Siza (pseudonym), who is working for a certain NGO, who started to work with us at the time when we formed our Mathematics cluster.

According to the participants that were interviewed, the Mathematics Group differs from the other subject groups because of the Laptop project. The Laptop project is another activity within the Mathematics Group, organised by the NGO facilitator, which aims at equipping Mathematics teachers with computer- based teaching methods. Jabulani commented about the Laptop Project when he was elaborating on the difference between the Mathematics Group and other subject groups:

> There is a computer group, where teachers are being taught how to use technology for the teaching and learning situation of Mathematics.

From a CHAT perspective, the Laptop project represents mediational artefacts in an existing activity system whose object is learning to teach Mathematics using the laptop, projector and Mathematics software. The NGO Mathematics facilitator, Siza, also stated that the Mathematics Group started with the Mathematics project in 2007, has been on-going since 2007 in two sites, and one of these two sites is the Mathematics Group in this study. This was confirmed by the Overview and Analysis Report of 2013 Grade 12 Results compiled by the NGO:

It was started in 2007 in an attempt to address the crisis in the teaching of Mathematics in South Africa

Jabulani (who has taught Mathematics for five years) further highlighted how the Mathematics Group differs from the other subject clusters:

> We have clusters in each and every subject. So I belong to the Mathematics and Physics clusters. However, these clusters are clusters where all the teachers have to be part of it as educators of a specific subject. The Mathematics Group is a specific group that I am part of. It is another part of the Maths project organised by NGO which is called the Laptop project.

These interview excerpts suggest that the NGO became part of the Mathematics Cluster which I now call Mathematic Group. In addition to these comments, there are a number of aspects of the Mathematics Group that makes it different from the other subject clusters, such as the frequency of workshops (NGO workshops take place twice a term and during school holidays) that are organized by the NGOs within and outside the circuit, the provision of material for Mathematics teachers and learners, and learning to teach Mathematics by using technology (some of these changes will be discussed in depth in Chapter 8). From a CHAT perspective, this situation suggests several layers of contradictions within and beyond the central activity system emanating from the crisis in the teaching of Mathematics. This is in line with the fifth principle of CHAT which posits that contradictions which are dilemmas or dissonances between and among aspects of activity systems are the driving force of change in the activity systems (Feldman and Weiss, 2010). In this case, the teaching and learning of Mathematics is the dilemma in the cluster as an activity system, the district and the country as a whole is the broader activity system. Figure 19 below illustrates the different layers of contradictions. As highlighted earlier, broken lines illustrate the contradictions.

Tools: teaching and learning resources

Outcomes: mastery of Mathematics concepts and teaching techniques

Subject: Mathematics teachers

Object: learning /teaching of Mathematics

Rules: DBE policies and expectations

Community DBE, NGO, principals learners

Division of labour

Teachers learn and teach Maths
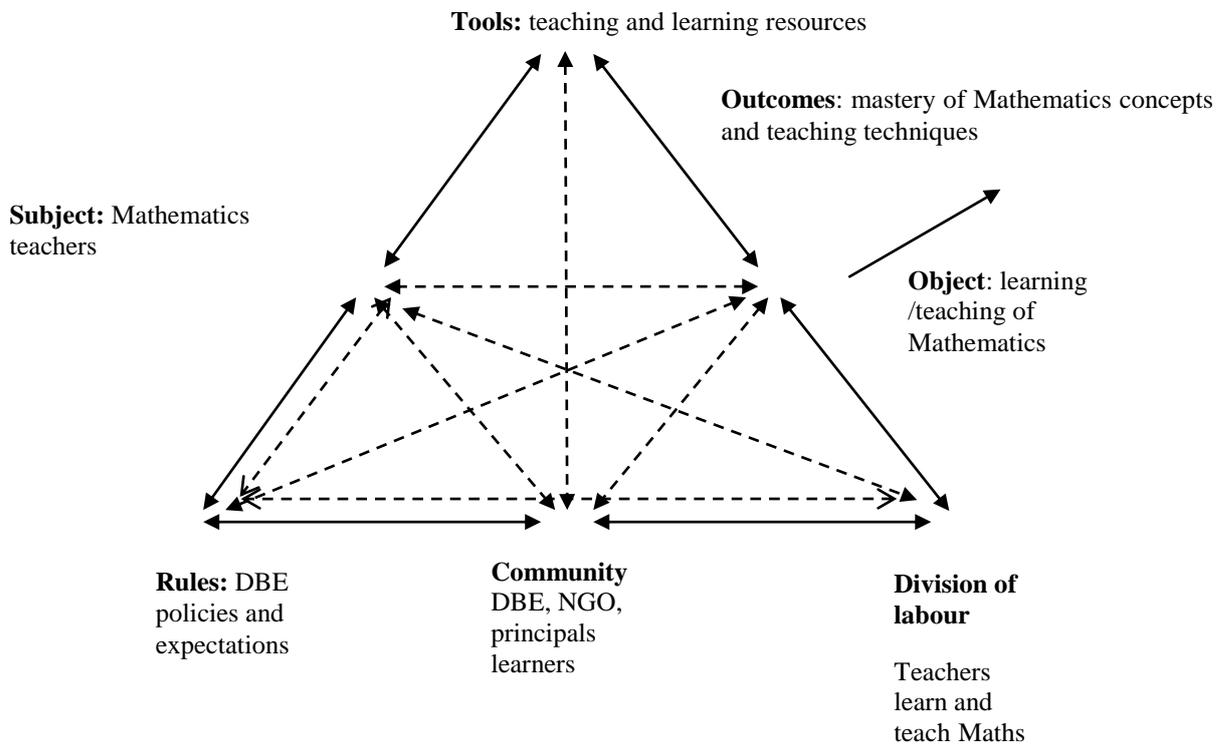
Figure 20: The flow of Contradictions in Mathematics Group

The contradiction of mediational tools, object, subjects, rules and division of labour which emerged from the data is further highlighted in the Overview and Analysis Report of 2013 Grade 12 Results as a crisis in the teaching of Mathematics. This contradiction has created another layer of contradictions of object (learning and teaching of Mathematics) and community (DBE, parents, principals and learners) due to poor performance of learners in Mathematics. The NGO provided   laptops to the Mathematics lead teachers this shows that they believed there was a shortage of resources.   The shortage of resources such as mediational artefacts also suggests another contradiction between the object (learning and teaching of Mathematics) and subjects (Mathematics teachers), because without adequate mediational artefacts like laptops, Mathematics teachers would be limited in their teaching to achieve DBE expectations. For the purpose of this study, the focus is on a certain group of Mathematics teachers in a circuit. Therefore, in terms of the CHAT framework, the NGO is part of the community of the Mathematics Group. From a CHAT perspective, the

Mathematics teachers represent the subjects of the activity and learning of Mathematics is the object that is enacted by the Mathematics teachers. The outcome of the object enactment is mastery of Mathematics concepts and teaching techniques after having learnt through participation in different tasks. The NGO as a community provides an on-going support for the Mathematics Group by facilitating content based, laptop project workshops for teachers. The NGO facilitator also facilitates Saturday classes with the lead teachers, for learners selected from schools where teachers participating in the Mathematics Group are teaching. These classes are conducted in a central venue within and outside the circuit. The NGO provides teaching and learning mediational artefacts such as worksheets, stationery, Mathematics equipment as well as refreshments at the workshops for teachers and learners, and it also subsidizes transport.

Therefore, the Mathematics Group was first initiated by the Department of Education as a Mathematics Cluster by grouping the Mathematics teachers of one circuit but then the NGO became a part of it to address learning and teaching of Mathematics. This formation of the Mathematics Group by the DBE seems to be in line with the contrived collegiality where there is: "administrative control of teachers' interaction, as teachers meet to work on curriculum implementation targets set by their superiors" (Jita & Mokhele 2012, p. 3). Generally, the poor performance of learners in Mathematics seems to shape the administration approach to the teaching and learning of Mathematics in the district. The departmental literature states that the clusters were also established as a method of ensuring that continuous assessment (CASS) of Grade 12 subjects is monitored. This monitoring of CASS takes place on quarterly basis (Jita and Mokhele 2012). Some findings in the study of teachers' clusters in the South African context suggest interactions within the clusters which promote construction of new knowledge by some of the members of the groups (Jita & Ndlalane 2009). In line with the findings of the study of teachers' clusters in South Africa, the findings about the historical backgrounds of the Mathematics Group seem to suggest that Mathematics teachers are engaged in the construction of new knowledge such as learning to teach Mathematics with laptops as mediational artefacts.

The next section describes the aims of the Mathematics Group.

7.2.2. The aims of the NGOs' Mathematics Project for the Mathematics Group

According to the Maths Leadership programme Evaluation Report for 2013, the following aims should be achieved in addressing the crisis in the teaching of Mathematics at both General Education and Training (GET) level (Grades 5 to 9) and the Further Education and Training (FET) level (Grades 10 to 12):

- The gaps in the teacher's own competence in Mathematics.
- The lack of on-going teacher development provided by the local education authorities.
- The limited appropriate resource materials available to teachers.
- The limited knowledge of, and exposure to, innovative educational practices, including computer-aided learning.

As stipulated in the Mathematics Project Evaluation Report, (2012, p. 6), it was hoped that the above aims would be addressed through workshop programmes organised by the NGO which are outlined below. In such an activity system, Mathematics teachers, subject advisors and learners would be subjects enacting the object (learning of Mathematics) and the NGO would be both the community and the provider of mediational artefacts. Achievements of the aims above would take place if all the nodes of the activity system performed according to the division of labour.

The NGO programmes include:

- Training of Subjects Advisors in curriculum content topics.
- Information sharing and materials.
- Liaison with representatives from the DBE.
- Participatory needs assessment of key content areas needing strengthening.
- Modelling of effective teaching practices during the training sessions.
- Further training and provision of Information Technology equipment to assist in the teaching of Mathematics of selected educators.
- Enabling attendance at Mathematics education conferences for selected educators.
- Identification of content areas that require strengthening.
- Targeted teaching in curriculum content topics.

- Mathematics Olympiad preparation work with learners.

- Residential workshops for teachers and learners with curriculum linked enrichment.

- Career day involving talk and exhibitions around Maths related careers.

The workshop programmes of the NGO Mathematics project also include the learners as community, where learners are taught in a central venue. However, this study focuses only on Mathematics teachers. From these programmes, one notices that the NGO Mathematics project also caters for the Mathematics Subject Advisors (community). From a CHAT perspective, this suggests relational dimensions and collaboration between the Department of Basic Education and the NGO. The collaboration and cooperation between the NGO facilitator is further evident when she talked about the relationship between herself and the Mathematics subject advisor in the DBE:

> I was with the Mathematics Subject advisor and there is a vibe going there. It is very exciting. The Mathematics Subject Advisor is working very closely with me now. I give him the stuff, I do get more time then he does. But then he can use it with the other Mathematics teachers in the district which is nice. He is very supportive and I admire him greatly.

From a CHAT perspective, this interdependence between the Mathematics subject advisor and the NGO facilitator suggests that the NGO is being the resource for the subject advisor and teachers. When the three teachers talked about the formation of the Mathematics Group they also seemed to focus on the NGO's aims and the Mathematics workshop programmes for these teachers. For example Jabulani responded:

> It specialises in professional development. This is where we are empowered especially when it comes to the topics which are challenging for us since we know that National Curriculum Statement (NCS) was new to some teachers. One of the challenges that they are trying to address in our Maths group is to help Maths teachers to master the Maths concepts as well as how to use technology to teach Mathematics.

The above interview extract suggests a contradiction between the object (teaching of Mathematics) and the subjects (the teachers). The Mathematics teachers as subjects were expected to enact the object (effective teaching of Mathematics) within their division of labour following the rules (NCS) of the activity system. But the subjects found certain topics challenging. The NGO facilitator also confirmed by elaborating:

> …So that they have more understanding of Mathematics concepts and how to teach them. I teach them things from different approaches by

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being very hands on, manipulative. My philosophy is that Mathematics is not a spectator sport but then I also use technology a lot.

From a CHAT perspective, the NGO facilitator was highlighting the physical and psychological tools which are used during mediation process in the Mathematics workshops. The psychological tools include the NGO facilitator's knowledge of different approaches and experiences in the teaching of Mathematics which is based on her philosophy about the teaching of Mathematics. She uses psychological tools in conjunction with physical (technological) tools, such as the laptop and data projector, to teach Mathematics. Furthermore, Hlengiwe, the coordinator of the Mathematics Group, confirms this by saying that Mathematics teachers (subjects) are given tasks to do collaboratively where they share how to teach a particular Mathematics aspect such as Mathematics strategies. She further highlights that they (Mathematics teachers) also believe that they learn not by sitting and folding their arms while listening, but by engaging with questions. Engaging with questions suggests the use of psychological tools in the mediation of Mathematics tasks. This situation is in line with CHAT, where people learn through collective, active engagement in a particular activity (Saka, Southerland & Brooks, 2009).

The Mathematics Group runs several workshops which are facilitated by the Mathematics Subject Advisor, the NGO facilitator and the Mathematics teachers themselves. In CHAT terminology, the workshops are the activity systems. I observed one workshop which was facilitated by the Mathematics Subject Advisor, and two workshops facilitated by the NGO representative. The Mathematics Subject Advisor (community) focused on the Mathematics Curriculum and Continuous Assessment (CASS). These workshops are run twice or thrice per term. In addition to the workshops held in a central venue, the Mathematics Subject Advisor visits each teacher in his or her school.

In this case the Mathematics Subject Advisor enacts the object, visiting mathematics teachers according to the DBE division of labour. Furthermore, workshops as activity systems of the Mathematics Group are designed to enable Mathematics teachers to enact the object (the learning Mathematics) and the community (NGO facilitator) enacts their division of labour which is the provision of mediational tools and also acting as a mediational tool. There are also workshops for the Mathematics Group that are facilitated by Siza, the NGO facilitator. The following is the list of workshops organized (and facilitated) by the NGO facilitator and other NGO facilitators as described in the Evaluation Report for 2012:

- One day workshops held twice a term with FET and GET Mathematics Educators within the circuit.

- A residential four-day holiday workshop for Mathematics educators from participating schools, held in the NGO.

- A residential four-day holiday workshop for selected learners from participating schools, held in the NGO.

- Regular two-day workshops, mentoring and technical assistance for Mathematics lead teachers in the Laptop project. The lead teachers in the Mathematics Group normally attend Laptop project workshops in the last week of each term outside their circuit at the NGO.

- Three-day workshops held once a term with subject advisors from the whole province.

- Saturday's workshops with learners in the central venue within a circuit.

- Chosen Mathematics teachers from the Mathematics Group are given a chance to attend Conferences and the Congress of the Association for Mathematics Education of South Africa.

Table below shows the total number of workshops attended by the 14 teachers of the 28 teachers in the Mathematics Group. It appears that seven teachers did not attend the workshops. There is no evidence that provides the reasons why they did not attend the NGO workshops. In a CHAT perspective, this is a contradiction of object, subject, and community which occurred because they did not take part in the workshops. The attendance figures are for the workshops held within the circuit in the central venue (Table 24) and were extracted from the Evaluation report compiled by the NGO.

Teacher (T)	2008	2009	2010	2011	2012	2013
Total workshops offered	13	12	4	9	4	4
*T1 (lead educator)	8	11	4	7	4	4
*T2 (lead educator)		4	2	8	3	3
*T3 (lead educator)		12	4	7	4	4
T4 (lead educator)		11	4	9	4	4
T5 (lead educator)		4	2	4	0	3
T6	13	11	4	7	3	4
T7				4	3	2
T8	6	4	0	3	3	3
T9	3					3
710		5	4	9	3	2
T11	13	10	4	6	3	3
T12			3	4	3	1
T13		1	3	5	0	3
T14					1	1

Table 23: Attendance Figures of the Mathematics Group, showing the total number of workshops attended by the 14 members (Adapted from NGO's Evaluation Report, 2013)

The first three teachers from Table 1 are the Mathematics teachers that were interviewed. More workshops were held in 2008, 2009 and 2011. Table 1 shows that some Mathematics teachers from the Mathematics group attended more workshops than others. Hence, they were chosen to be Mathematics lead teachers for the Mathematics group because regular attendance at workshops facilitated by the NGO facilitator was one of the criteria used by the NGO facilitator to select lead teachers for the Laptop project. The Laptop project involves all the teachers in the Mathematics Group, the lead teachers are trained by the NGO facilitator and then they train other teachers. Lead teachers attend other workshops for the Laptop project. Bongani, one of the Mathematics teachers who was interviewed, is a lead teacher in the Mathematics Group. He explained how lead teachers were chosen:

> The NGO also looks at your attendance. How often you attend workshops.
> If you attend regularly, this increases your chances of becoming a lead
> educator and a member of the Laptop Project. They also look at your
> understanding of Mathematics.

The Mathematics lead teachers were chosen on the basis of their regular attendance and participation in Mathematics workshops as well as for their psychological tools (Mathematics understanding) displayed during object enactment in the different workshops (activity systems). The findings from the survey that I administered in October 2014 show that the Mathematics teachers' attendance at workshops organized by the NGO differs from that at other workshops. While 40% reported that they have attended ten or more workshops, 30% of teachers reported that they have attended one to nine workshops. Table 1 also shows that at some stage some of the teachers did not attend for the whole year because of changes in their teaching load in their respective schools. For example, Teacher 14 noted that:

> Vele mina angisekho kwaMaths, sengikwaPhysics (I am no longer teaching Maths, I am now teaching Physics).

Teacher 14 made this comment when he arrived at the Maths workshop with Teacher 13. It appears Teacher 14 received training for Mathematics but is now teaching Physics. In a CHAT context, this situation suggests subject/object/division of labour contradiction (subject -Teacher 14, object - learning Mathematics and division of labour). The contradiction is that Teacher 14 is learning teaching of Mathematics yet he is not teaching Mathematics. This teacher (Teacher 14) was very much involved in different tasks during the workshop. The focus of these workshops was learning Mathematics concepts and topics (the object of the activity systems) that the teachers were finding difficult during their teaching, yet this particular teacher was teaching something else. The workshop tasks will be discussed in the next chapter.

This section has described the aims and the nature of the workshop programmes of the Mathematics Group. It has also shown the number of workshops attended within and outside the circuit by the 14 Mathematics teachers from 2008 to May 2013. However, the Mathematics teachers did not mention moderation of CASS as one of the aims of Mathematics Group. CASS moderation is the administrative duty of the DBE; it is required to monitor school-based assessments. Moderation happens in the cluster meetings but not in the NGO workshops. The next section presents the constituents of the Mathematics Group.

7.3. Stakeholders and Leadership of the Mathematics Group

The intention of this section is to give background information on the people who are involved in and who lead the Mathematics Group. The Mathematics Group engages in several workshops (activity systems) and these activity systems target different objects. For

example, the broad activity systems facilitated by the Department of Education seem to target improvement of learners' results. The CHAT triangle, Figure 20 is used to show how these people (subjects and community) are involved in the Mathematics Group.

Tools: Venues, Laptops, projectors, white boards, Mathematics equipment, handouts, curriculum documents, moderation tools, question papers, memory sticks and refreshments. Psychological tools**:** Language, experience, signs**,** graphs, demonstrations, modelling**.**

Outcomes: Mastery of Maths content and teaching skills / Mathematics resources / CASS moderated

Subject:

Mathematics

Teachers

Object: Learning Mathematics content and teaching strategies / CASS moderation

different strategies to teach Mathematics,

Rules: Curriculum guidelines / CAPS, Maths principles, DBE Rules and NGO expectations

Community: DBE and Subject Advisor, NGO, Principals Learners

Division of labour: Teachers do task, Subject Advisor facilitate, NGO facilitate and provide funding and evaluate, Principals organise Rooms

Figure 21: Model of a Broad Activity System of Mathematics Group

7.3.1. Mathematics teachers

As mentioned earlier in this chapter, the Mathematics Group is comprised of the Mathematics teachers who come from the 22 schools in the circuit. The group originally had 28 teachers who are teaching Mathematics in the GET and FET levels. In this study, I focussed on Mathematics teachers who are teaching in the FET (10-12) level. According to my observation notes there were approximately 15 teachers out of the 28 who attended the three workshops which I observed for data gathering purposes. From the CHAT stand point, these Mathematics teachers are the subjects whose action I want to understand (Feldman & Weiss 2010) when the community (Maths Subject Advisor, NGO facilitator) mediates Mathematics tasks using mediating means.

7.3.2. Mathematics Subject Advisor

In order to understand the relationship between the Mathematics subject advisor and the NGO facilitator in relation to the roles they play in the Mathematics Group, this section drew from Imants (2002) to highlight that collaboration differs from cooperation. The concept of collaboration is commonly used in CHAT. Imants (2002) highlights the distinction between collaboration and cooperation:

> Collaboration is characterised by high levels of interdependence and mutual empowerment, the parties involved share responsibility and authority to make decisions while cooperation involves low levels of interdependence because two parties with separate and autonomous programs have typically agreed to work together in order to make the programme successfully (Imants, 2002, p. 729).

The DBE, represented by the Mathematics Subject Advisor, is the community of the Mathematics Group. There is evidence from interviews that suggests cooperation rather than collaboration between the NGO and the Department of Education regarding the facilitation of Mathematic content workshops by the NGO through the NGO facilitator, Siza.

> I used to come every two weeks according to Department of Education time which is 12h00 onwards. The Department of Education said "would you rather go for two whole days every term." (Interview held with the NGO facilitator on the 22and of November 2014)

The quote states that one of the rules (rules for the broader activity systems) of the DBE was that the workshops should start at 12h00. However, the DoE permitted the NGO (community) to run the workshop from the morning. From a CHAT perspective, this implies collaborative efforts between the DBE and the NGO to facilitate the Mathematics workshop for the Mathematics Group in order to achieve the outcome. The outcome for the DBE is improvement in the teaching of Mathematics in order to improve learners' performance in Mathematics. While the suggestion to start at 12h00 implies power dynamics, the facilitator was subsequently allowed to begin the workshops in the mornings.

There is also evidence from the participants that suggests that in addition to moderation meetings there are Mathematics content related workshops that are facilitated by the Mathematics Subject Advisor. The Mathematics Group coordinator stated that in February 2013 they attended the Mathematics content workshop:

> Early in February we had a Maths content workshop facilitated by our subject advisor. And the focus was on the topics for the first term.

From a CHAT perspective, this relationship between the NGO facilitator and the Mathematics Subject Advisor suggests cooperation between them in the facilitation of workshops for the Mathematics Group. The Mathematics subject advisor also depends on the mediating tools such as Mathematics hand-outs with simplified methods to teach certain Mathematics topics, and tasks for different topics, which are used by the NGO facilitator during Maths workshops. The Mathematics Subject Advisor uses these hand-outs in other Mathematics workshops for teachers in the district.

7.3.3. Non-Governmental Organisation

In 2007 the NGO became involved in the Mathematics Group. As stated earlier, the aim of the NGOs' intervention in the Mathematics Group was:

> To target Mathematics teachers in under-resourced schools in order to improve their competence and confidence in Mathematics and to improve their enthusiasm for, and ability to teach Mathematics. (NGO, 2012)

In a CHAT context, these aims may be seen as the fundamentally important objects of the Mathematics activity systems pursued by the subjects (Group of Mathematics teachers in a circuit). There are three types of NGO that are part of the Mathematics Groups.

- NGO that is in charge of organising Mathematics Workshops in the central venue and in- house workshops for teachers and learners. The in- house workshops are held during holidays at the NGO institution. These NGOs include the Director of the Mathematics Project and the Mathematics expert teacher who facilitate during Mathematics workshop

- NGO that is funding the Mathematics Projects.

- NGO responsible for the evaluation of the progress of Mathematics projects in Mathematics Groups. The aim of the workshop programmes is to assist Mathematics teachers to learn Mathematics. According to the Mathematics Evaluation Report (2012) the external evaluation was commissioned to determine the impact of the work on educators participating in the project. The NGO facilitator, Siza further explained about the evaluators:

> As far as the learners' pass rate is concerned, it is quite difficult to correlate the pass rate with the workshops. We have an independent evaluator who is paid to evaluate us for funders. As she did the report about this Mathematics Group, definitely the more workshops that

teachers go to, the better pass we get. Of course, there are other factors that have contributed to the improvement of the pass rate in Mathematics. I think it was a 63% correlation, which is quite high (Interview held with the NGO facilitator on the 20[th] of November 2014).

From the CHAT perspective, these three groups of NGOs (community) act according to their division of labour to provide physical tools such as funding, and psychological tools such knowledge and experience to achieve the outcome (mastery of Mathematics concepts). This study focusses on the NGO that does training. The outcome of this learning is mastery of Mathematics concepts and strategies of teaching those Mathematics concepts. For example, Jabulani stated the outcome:

I think my level of understanding Mathematics has been enhanced through participating in these workshops. I am more confident, more competent and there are few topics, if any topics that I struggle with especially for high school Mathematics (Interview held on the 1[st] of October 2013).

The improvement in the Mathematics pass rate in schools appears to be one of the outcomes of the activity systems (workshops) in the Mathematics Group. However, there are other factors that may also have contributed. Table 25 below was adopted from the Overview and Analysis of 2013 Grade 12 results obtained by schools.

SCHOOL	TEACHERS	2012	2013	Change
A	T2	32.2%	15.0%	- 17.2%
B		100%	61.0%	- 39.0%
C	T1 and T8	42.3%	37.8%	- 4.5%
D		38.9%	83.8%	44.9%
E		35.3%	45.0%	9.7%
F	T5	35.3%	41.7%	6.4%
G		11.8%	13.2%	1.4%
H	T3	33.3%	78.9%	45.6%
I		15.0%	31.0%	- 16.0%
J		19.0%	18.5%	- 0.5%
K		50.0%	38.5%	- 11.5%
L		100.0%	100.0%	0.0%
M	T4 and T9	60.0%	42.1%	- 17.9%
N		28.6%	8.3%	- 20.3%
O	T11	62.5%	51.2%	- 14.3%
P	T12 and T14	38.5%	20.05%	- 18.0%
Q	T6	16.7%	30.0%	13.3%
R		50.0%	100.0%	50.0%
S	T7	1.8%	11.5%	- 9.7%
T		28.3%	37.3%	9.0%
U	T10	20.0%	100.0%	80.0%
V	T13	18.8%	0.0%	- 18.8%

Table 24: Grade 12 Mathematics results obtained by schools of the Mathematics Group

The above Table 25 was adapted from the Overview and Analysis of Grade 12 compiled by the Director of NGO. It shows the pass percentage of the Mathematics of 22 schools that are members of the Mathematics Group. The Table shows that the Mathematics results in 11 out of 22 schools dropped. The analysis of Mathematics results shows that some of these 11 schools whose results dropped had learners who were supposed to do Mathematics Literacy. From the 14 Mathematics teachers who were in the Mathematics workshops whom were observed for data collection purposes, in six schools, Mathematics results dropped in 2013 although other schools the Mathematics results increased. Using the CHAT perspective, the dropping of Mathematics results suggest a contradiction between the community (learners, parents, DBE) and the object (performance/results) because learners did not perform as well

because they were doing Mathematics instead of Mathematical Literacy. According to the report on the Analysis of Grade 12 results, the average Mathematics results of the Mathematics Group shows a slight improvement in each year starting from 2011;

2011– 37.1%

2012 – 38.1%

2013 – 43.9%

Although the NGO, through its director, maintains that the Mathematics results are closely linked to teacher competence, this study did not track teachers to their classroom to check their competence in teaching Mathematics. From a CHAT perspective, the improvement in the Mathematics pass rate and the high correlation when compared with workshops appear to be the outcome of Mathematics activity systems. In this case, Mathematics teachers learnt and became competent in teaching new and difficult topics hence there was a slight improvement in the Mathematics results. For example, one of the participants highlighted the results of participating in Mathematics workshops:

> … With the material we get from the group, the support from our co-ordinator and the support we get from the other educators who are also members of the group that creates a positive atmosphere for you as an individual. For example if there was a concept I am not sure about or a concept that I have been teaching incorrectly or a concept s that was a challenge to you as an individual. (Interview held with Jabulani on the 1st of October 2013)

The object pursued by the subjects (Mathematics Teachers) is learning Mathematics; therefore, this quotation suggests the outcome of object enactment by subjects (Mathematics teachers).

7.3.4. School community (Learners, principals)

The four participants, who were interviewed, stated that they also work with learners on Saturdays. There are workshops for learners that are facilitated by subjects (Mathematics lead teachers in the Mathematics Group) For example; Jabulani spoke about other learner- based workshops:

> We also run workshops, two Saturdays a term for kids. We do grade 11 one year and we take them to grade 12. This is the third lot that we have done. Hlengiwe, our coordinator and teachers who are part of the Laptop

project) runs the workshop (Interview held with Jabulani on 1st of October 2015).

Jabulani has introduced another Mathematics activity system which includes learners. The Saturday workshops are held twice a term in a central venue within the circuit. These workshops are run by the NGO facilitator and teachers who are part of the Mathematics Group. The lead teachers who are in the Laptop project facilitate in the workshop after being guided by the NGO facilitator. The Laptop project, as mentioned earlier in this chapter, is the project within the Mathematics Group aiming at equipping Mathematics teachers with the technological skills of teaching Mathematics in the classroom situation. Siza, the NGO facilitator, also highlighted how the learners that are now in grade 12 were selected from the member-schools.

> There are grade 12 learners that we started with Mathematics teachers. We take 10% of Maths learners from each school, 10 best learners from each school. They come here and they meet with other schools with educators and work through Mathematics the whole day.

I did not observe the Saturday Mathematics workshops (activity systems) for learners, given that the focus of the study is on Mathematics teachers who are the subjects of the activity. The following CHAT triangle, Figure 19, draws from the interviews held with the four participants, and is used to explain how Mathematics teachers as subjects, enact the object (learning and teaching of Mathematics).

Tools: Physical tools: Laptops, projectors, Handouts and learners Psychological tools: Language, knowledge, experience, Maths signs

Outcomes: Mastery of Maths concepts /teaching skills / Maths software /Maths room

Subject: Lead teachers Mathematics teachers

Object: Learning and teaching Mathematics

Rules: Maths Rules Attendance

Community:

NGO Facilitator

Principals

Division of labour

NGO Demonstrate, organise resources, Principals organise Maths room, Maths teachers do the task, learn Maths, Observe, supervise learners. Lead teachers teach other Maths teachers, Lead teachers teach learners while other teachers observe

Figure 22: Model of Activity System for the Mathematics Group

Mathematics teachers as *subjects* enact the object learning of Mathematics. The subject of the activity is not fixed, it depends on the object. In this case, Grade 12 learners are the community and the Mathematics teachers teach them in the central venue. In this activity system, chosen learners pursue the learning of Mathematics. However, the Mathematics teachers (lead teachers) still remain as subject because they enact the object teaching of Mathematics after the NGO facilitator (community) has demonstrated what and how to teach a certain topic. The *Object* of the activity system is the learning of Mathematics which is facilitated by the NGO facilitator and the Mathematics teachers (lead teachers). *The mediating tools* that are used during the enactment of the object (learning Mathematics) consist of physical tools such as laptop, data projector and screen.

> I take the material, power point presentation, I show teachers what I want them to do and how, and they do that.

From this quote it is evident that the NGO facilitator organises the physical tools such as the power point presentation. The psychological tools consist of knowledge and skills demonstrated by the NGO facilitator when she shows the lead teachers how to teach a certain Mathematics topic. From a CHAT perspective, internalisation seemingly occurred when the Mathematics lead teachers observed demonstrations of topics by the NGO facilitator. Externalisation is manifested when the Mathematics lead teachers are able to teach learners what they have been taught by the NGO Facilitator. Furthermore, the lead teachers also get an opportunity to practice their internalised knowledge during the workshops while other Mathematics teachers observe. *Division of labour* during the Saturday workshops is visible as the NGO facilitator demonstrates what should be done, Mathematics lead teachers observe and teach the learners, other Mathematics teachers of the Mathematics Group bring the chosen learners to the central venue and observe the lessons. There is evidence that suggests another division of labour is the Mathematics lead teachers, who also conduct workshops for the Mathematics Group. Bongani, who is a Mathematics lead teacher, discusses the role of the Mathematics lead teachers:

> And we conduct workshops on our own. We come together as Mathematics lead teachers and discuss how the workshop will be conducted, depending on the need, what is needed by the teachers. We then organise the workshop for the Mathematics Group.

In this case, the subjects (Mathematics teachers) enact the learning of Mathematics themselves. The Mathematics rules govern the object enactment by the subjects (lead teachers). This situation concurs with Maistry (2009) who says that teacher learning communities allow teachers to come together and learn from one another and to engage with curricular issues. The *outcome* of this activity is the mastery of Mathematics concepts by learners as *the community*. The Mathematics lead teachers further acquire different strategies to teach Mathematics. For example, one of the Mathematics lead teachers said:

> I have learnt cyclic geometry and how to teach it using a computer especially the software that we are using. There is Mathematics software called a Geometal Sketch Pad. I have learnt how to use the Geometal Sketch Pad in the classroom.

This outcome is tentative because the Mathematics lead teachers, as well as other Mathematics teachers of the Mathematics Group, were not tracked in their classroom to find out if they were applying what they have learnt. The principals are part of the community of

the Mathematics Group because they are responsible for organizing the Mathematics rooms in the schools. Siza, the NGO facilitator explained:

> Then what I do is, I talk to the principals and ask them if I can ask one of their educators to be part of the laptop group of the Mathematics Group. I then tell them what they have to do which is to support the teacher and the teacher must teach in a room that should be turned into Mathematics room. In return I lend them a laptop and the data projector. They come every term usually in the last week of the term for two days training. There are five of them in this Mathematics Group (Interview held with the NGO facilitator on the 20th of November 2014).

Here, the NGO facilitator elaborated on the division of labour of the principals as part of the community of the Mathematics Group. The laptop and the data projector are physical mediational tools for the subjects to mediate the object (Mathematics) in their schools. The findings have shown that the stakeholders of the Mathematics Group include the Mathematics teachers, Mathematics subject advisor, the Non-Governmental Organisation and principals. These stakeholders seem to be the same as the key player in PLCs that are envisaged in the Integrated Strategic Planning Framework for Teacher Education and Development (ISPTED). However the ISPTED focusses on the PLCs that are inside of the school. According to the DBE and DHET (2011) these stakeholders need to work together in order to change professional practices and improve learning outcomes.

7.4. Leadership in the Mathematics Group

According to Engeström (2001), activities in which individuals engage take place as a result of collaboration with a particular group of people. There is evidence of collaboration in leadership to facilitate the Mathematics workshops (activities) for the Mathematics Group.

Facilitators of Mathematics workshops

- The Mathematics Subject Advisor who acts within the Department of Basic Education division of labour. He also collaborates with the NGO Facilitator in terms of mediating artefacts.
- The NGO Facilitator who facilitates Mathematics activities in the central venue and during holidays.
- The Coordinator of the Mathematics Group, Hlengiwe, who is also a lead teacher and liaises with the Mathematics Subject Advisor, the NGO facilitator (community) and the Mathematics teachers (subjects) to enact activities for the Mathematics Group.

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- The Lead Educators are five teachers from the Mathematics Group (subjects) who facilitate the Laptop Project as part of object enactment to the rest of the Mathematics Group.

This situation suggests a distributed leadership and interdependence in the Mathematics Group. According to some studies (William 2007, Owen 2014) on teacher learning communities, distributed leadership is one of the characteristics of teacher learning communities. However, distributed leadership must incorporate support, which is evident from the NGO facilitator and the Mathematics Subject Advisor. Furthermore, this distributed leadership in Mathematics Group also suggests horizontal division of labour in the entire Mathematics activity system. From the discussion above, the leadership in the Mathematics Group is comprised of the NGO Facilitator, the coordinator, the Subject advisor and lead Mathematics teachers.

There are four interesting issues that have unfolded in this chapter. Firstly, the Mathematics Group has plus or minus 25 Mathematics teachers; this size is small which is in line with the size of a teacher learning community (William, 2007). Secondly, the NGO workshops which were observed were attended by 14 teachers while the survey findings show that the CASS moderation workshop was attended by nineteen teachers. This situation seems to suggest that the DBE administrative activities are more important to the teachers than the NGO activities. It could also be that some teachers were not able to attend due to other commitments. Thirdly, the interview findings suggest that in some instances Mathematics teachers assume a major role of facilitation in some workshops which is not always the case with the DBE subject groups. The findings show that the workshops are facilitated by the subject advisor, the NGO facilitator and the lead teachers (Mathematics teachers).This situation is in line with one of the characteristics of a teacher learning community, namely that members of a teacher learning community take collective responsibility which helps to sustain commitment (Thomas , 2006, p, 226). Lastly, distributed leadership and division of labour of subjects (Mathematics teachers) and community (Mathematics Subject advisor and school principals) suggest collective engagement in practical tasks to improve teaching and learning of Mathematics which is line with a characteristic of a teacher learning community.

7.5. Conclusion

This chapter has presented information on how the Mathematics Group was formed and when the NGO became part of the community of the Mathematics teachers. The chapter has used the CHAT model to show the broad and central activity systems of the Mathematics Group. The historical background of Mathematics suggests that the Mathematics Group was formed in line with the administrative purposes of the DBE characterized by administrative regulation of teacher collaborations, "where district officials from the DBE provide instructions and set agendas and goals regarding teacher collaboration" (Jita & Mokhele, 2012, p. 3). The NGO became involved in the Mathematics Group in order to assist Mathematics teachers to master Mathematics content knowledge and to make them competent in the teaching of Mathematics in rural schools faced with a shortage of resources. Figure 2 shows the level of the contradiction between object, subject, community, division of labour and tools that were the driving force behind the involvement of the NGO in the Mathematics. From a CHAT perspective, it appears that the Mathematics Group activity systems are built upon the basis of internal (internal contradictions occurring between or within the nodes of activity system) and external (contradictions between two activity systems) contradictions (Joo, 2014, p.100), for example, external factors such as rural and shortage of resources. The findings have shown that there are several workshops that are facilitated by the NGO facilitator (community). From the CHAT standpoint, the NGO forms part of the community which supports by enacting the division of labour. However, the Mathematics Group still operates according to DBE administrative purposes. In relation to DBE administration the Mathematics teachers attend content-based workshops and CASS moderation workshops which are facilitated by the subject advisor who acts within his division of labour as DBE official in addition to those facilitated by the NGO.

The next chapter discusses how learning happens and the nature of collaborative relationships in the Mathematics Group.

CHAPTER EIGHT: TEACHER LEARNING IN THE MATHEMATICS GROUP

8.1. Introduction

In this chapter, I show how teacher learning happens and the kinds of teacher knowledge that was learnt in the Mathematics Group. I am answering the three research questions which I have reformulated from the main research questions of this study.

How does teacher learning happen in the Mathematics Group?

What kind of teacher knowledge is learnt in the Mathematics Group?

What is the nature of the collaborative relationships in this group?

I use CHAT elements to discuss teachers' actions and operations that take place in the Mathematics Group. Central to CHAT is how people learn through collective engagement in activity. This theoretical framework allows me to assume that there is learning that takes place in the Mathematics Group because what happens conceptually is not isolated from practical collective activity (Worthen & Berry, 2004). I use the CHAT activity system triangle and Hurrell's (2013) Mathematic analytical framework as tools for data analysis. The historical background of the Mathematics Group indicates that the group has had several meetings/ workshops taking place since 2007, as shown in Chapter Seven. This chapter is organized into three sections: the first section discusses three activity systems, the second section describes the kinds of teacher knowledge that are learnt in the Mathematics Group and the last section discusses the nature of collaborative relationships in the Mathematics Group.

8.2. The three workshops of Mathematics Group

This section explores what happened during the workshops of the Mathematics Group. These workshops are summarised in Table 26 below.

Date of the workshop	Nature of the workshop	Number of teachers in attendance	Facilitator of the workshop
14 May 2013	Continuous Assessment Moderation of the first quarter	19	Mathematics Subject Advisor
21 May 2013	2013 March Control Test Papers for Grade 12	14	Non-Governmental Organisation Facilitator
17 February 2014	Grade 10 Mathematics Topics	14	Non-Governmental Organisation Facilitator

Table 25: Dates and topics of the three workshops

These are the workshops that were observed for data collection purposes for this study. According to CHAT principles these workshops represent three activity systems and each workshop is taken as a unit of analysis comprised of seven elements (subjects, object, tools, community, division of labour, rules and outcome).

8.2.1 Continuous Assessment Moderation (CASS) activity system

The CASS moderation workshop /meeting was an administrative endeavour by the DBE where learners' school- based tasks (SBA) were monitored and checked. The CASS moderation workshop was held in one of the high schools in a circuit. The 19 Mathematics teachers, from approximately 11 high schools, and the Mathematics subject advisor were seated at four tables. The subject advisor, Mpilo (pseudonym), coordinated the moderation workshop which had two phases. There were firstly, a CASS moderation workshop, and subsequently, the moderation dates were discussed. In the second phase, teachers were seated in pairs checking each other's learners' tasks and the teachers' assessment files. I now use CHAT elements to give a picture of what was happening in the moderation workshop. Figure 22 1 below illustrates this moderation activity system:

Tools: The physical tools: venue, learners' portfolios, educators' portfolios, Mathematics CAPS document and hand-outs. Psychological tools: facilitators' and teachers' knowledge and experiences, language

Outcomes: grade 12 CASS of the six schools moderated.

Object: Moderation of CASS for term one

Subject: Mathematics teachers

Rules:
Curriculum and Assessment Policy Statement (CAPS) and programme of assessment (POA), maths group rules

Community: Mathematics subject advisor, Principals, Heads of Department and grade 12 mathematics learners

Division of labour: HODs check the CASS and moderate at school level, Principal check the CASS, The Maths subject advisor explained moderation aspects, selected the dates for moderation of term two. Maths teachers check each other's work.

Figure 23: Activity System model for Mathematics CASS Moderation

8.2.1.1. Subjects

According Feldman and Weiss (2010), the subjects undertake an activity towards a certain object. In line with Feldman and Weiss (2010) Mathematics, teachers are the subjects of the moderation workshop (activity system) because they enact moderation of learners' continuous assessment, of term one, using mediating artefacts. The Mathematics teachers as subjects enacted the object by working in pairs. This is shown by Mpilo's instruction to the Mathematics teachers.

> Teachers pair up with one another to check each other's work. Then cluster coordinator will check and sign the CASS grid.

From a CHAT perspective, this quote suggests a division of labour of the subjects, which was assigned by Mpilo, the Mathematics subject Advisor in Zethembe district. As the Mathematics teachers checked each other's work as per Mpilo's instruction, this suggests contrived collegiality, which is an enforced collaboration (Jita & Mokhele 2012). However, from a CHAT perspective this mandatory collaboration is acceptable as it promotes not only enacting the object but also observing rules and division of labour within the community. Thus, the Mathematic teachers as subjects collaborated in order to work on CASS moderation, which is part of CAPS requirement. CASS moderation is an administrative process used by the DBE for monitoring purposes.

8.2.1.2. Object

According to Hardman (2007), the object of the activity is what the subjects and community work on. CASS moderation is the object that is collectively shared by subjects (Mathematics teachers) and community (Mathematics subject advisor, Principals and Heads of Departments of schools). This is transformed starting from the unfolding of the moderation workshop, and ending with the outcome. The object was categorised into two tasks. Firstly, the subject advisor explained the aspects of moderation after which the teachers break into groups where they check each other's work.

The subject advisor explained that moderation for each term occurs in two phases; there is pre-moderation which is facilitated by the cluster coordinator; and the second moderation is the facilitated by the subject advisor where he confirms and verifies what was checked by the cluster coordinator. The subject advisor then asks teachers to choose the dates of the pre-moderation (pre-moderation is the moderation that takes place without the subject advisor, it is coordinated by the cluster coordinator)

> Mpilo: Let us first talk about moderation of term two. Would you like to suggest the dates of term two moderation?
>
> Teacher: I suggest that Sir to give us the dates.
>
> Mpilo: These dates are tentative. I will give you the dates for all the four circuits.
>
> 10 June 2013 – Moderation for Circuit C (that is the moderation for the Mathematics Group)
>
> 11 June 2013 – Moderation for Circuit B

Within CHAT, the above observation extract suggests that Mpilo invited multiple points of view from the teachers, this is in line with the principle of multi-voicedness. However, multiple points of view from the subjects did not take place because one of the teachers suggested that the subject advisor should give them dates for moderation. Mpilo then informed teachers that he would send circulars to schools informing teachers of the moderation. This may suggest the vertical distribution of roles, since the date came from the officials. He explains the aspects that should be covered during the moderation, using the hand-outs as mediating tools which were also given to the teachers.

> … Colleagues, make sure that the educator portfolio and the correct number of learners' portfolios are available, 10% of the total number of learners. Make sure all the tasks for the term are completed. For example, what you are checking today is the assignment and March Examination. Take note of the difference between the investigation and the assignment. The assignment is the work learners do from the work that they have learnt. For example, first term in the Grade 12 we are having an assignment based on Trigonometry. The learners are to use their books and study guides to get answers. But in the investigation learners have to do the research using what they have learnt. From the research they must do conclusion on their findings. For example, in term two grade 12 are investigating functions and their inverse, the graph of $y = x^2$ and $x = y^2$.

The above quote viewed from CHAT standpoint shows that Mpilo was using physical tools (hand-outs) and his psychological tools (knowledge and experience) to explain the object (aspects covered during the moderation). He continues to explain the other aspects:

> Check that the educator has marked tasks according to the memorandum and the rubric; moderate all tasks in the learners' portfolio. Check if the teachers' work was moderated at a school level. Attach signatures to learners' tasks to validate the work. Check educators' mark sheets thoroughly. Check that marks from learners' portfolio have been transferred correctly to mark sheet. Conversions must be correct according to guidelines. Sign where the mark has been checked by you. Another thing that is also important is the diagnostic analysis where the teacher shows how learners perform in different questions, what they find difficult and how the teacher is going to address the identified problems. Complete the SBA (School-Based Assessment) moderation document for educator and comment. Be truthful but considerate when making comments.

This observation extract seems to suggest operations which are described: "as the mechanics of pursuing the goals that describe what has to be done and are used to realize the actions" (Nussbaumer 2012, p. 40). These operations may also be regarded as rules that teachers need to adhere to when enacting the object (moderating learners' work) for moderation. There are certain mediating artefacts such as educators' portfolios, learners' portfolios, mark sheets, diagnostic analysis, and the School-Based Assessment (SBA) moderation document that are supposed to be used by the subjects (the Mathematics teachers) to enact the object. In CHAT, power is shown by the vertical division of labour. During the moderation, power dynamics were evident from the vertical authority when the SES distributed the roles. However, horizontal division was also evident when the subject advisor used 'colleagues' to address the group. The Mathematics teachers then broke into groups of two and three to enact the object. From a CHAT context, Mathematics teachers, as subjects, internalised what was explained by the subject advisor. This was followed by externalisation which occurred when they used the information provided by the subject advisor to check each other's work. According to Saka, Southerland and Brooks (2009), externalisation is the ability to perform concrete actions without immediately facing a problem situation.

8.2.1.3. Mediating artefacts / Tools

According to Hasan (2003), the core of the activity is a dialectic relationship between subjects and the object mediated by artefacts. In relation to the moderation meeting as an activity system, mediating artefacts are the items or practices that were utilized to enact the object. The mediating artefacts are comprised of physical tools and psychological tools. The physical tools consist of the venue where the moderation took place, the learners' portfolios containing the learners' tasks, educators' the portfolios containing the Mathematics CAPS document, the Programme of Assessment (POA), and the mark sheets, grids, handouts, tasks and memorandum. In addition, the teachers used green pens and calculators. Psychological tools that were used by teachers and the subject advisor include language, signs (like ticking and crossing learners' scripts during moderation) knowledge and experience. English was used as means of communication. According to Joo (2014), mediation of an object employs both physical and psychological mediational artefacts created socially, culturally and historically, and developed in the particular context. In relation to physical and psychological

mediational artefacts, the findings suggest that mediational artefacts, especially the physical mediational artefacts were historically developed according to the DBE parameters.

8.2.1.4. Division of labour

The division of labour element states who is doing what and who holds authority to do what. In this moderation meeting, the Mathematics subject advisor held authority as a DBE official and he acted according to this division of labour. He explained the moderation instruments and chose the dates of the next moderation meetings for the four circuits. Regarding the moderation process, the subject advisor seemed to use his leadership position to tell teachers from six high schools to engage in checking each other's work. The Mathematics teachers enacted the object with mediational artefacts learners' and educators' portfolios. The teachers then submitted their files and moderation instruments to the subject advisor to ascertain whether checking was done according to the moderation instruments. The situation where teachers checked each other's work suggests horizontal division of labour and, the vertical division of labour is evident from the role played by Mpilo, coordinating the programme and determining what should be done and from the tone of his voice in explaining the requirements. Further evidence of the vertical division of labour was revealed when the teachers went to the subject advisor for the last verification after completing their moderation. Vertical division of labour of the subject advisor implies that this moderation was a DBE activity. Furthermore, it also confirms the findings that the formation of the Mathematics Group was initiated by the DBE.

8.2.1.5. Community

Murphy and Rodriguez-Manzanares (2008) describe community as a group of actors who are engaged in a joint activity. The Mathematics subject advisor represents the community during the moderation meeting. He facilitated the moderation process as per the DBE division of labour and also the DBE as part of the community. The principals and the Mathematics heads of department (HODs) at schools are also part of the community involved in the moderation. This was evident when the subject advisor told the teachers to make sure that the work of the teachers and learners was checked at school level.

> Mpilo: Check if the CASS grid, mark sheets, moderation document, learners' scripts and tasks were checked at a school level. There should be a moderation report compiled by the HOD and the CASS grid should also

> have the principal's signature. If there is work that is not moderated at school level do not moderate it but bring it to my attention.

The above quote confirms that school principals and HODs are also part of the community. The principals and HODs act within the DBE requirements and within the division of labour of this activity system when they check and verify teachers' CASS records. Learners are also part of the community because it is the work that they have accumulated during the first term that is moderated. In other words they are also interested parties.

8.2.1.6. Rules

From a CHAT perspective, the activity is shaped by the rules such as established procedures and norms within the activity system. In this case the Curriculum (and CAPS) and, the programme of assessment (POA) forms an important part of the rules that govern enactment of the object, which is the moderation. The rules that governed Mathematics moderation were also evident as the aspects of moderation that were explained by Mpilo, the Mathematics subject advisor. The Mathematics moderation meeting as an activity system was therefore shaped by the DBE regulations and policies as stipulated in CAPS documents.

8.2.1.7. Outcome

According to Postholm (2014), the outcome of the activity is produced from the subject enacting the object using mediating artefacts. In CHAT, achievement of the outcome is an ideal situation which occurs when all the human elements (subject and community) and the non-human elements (object, tools, rules, division of labour) of the activity system act according to expectations (Postholm, 2014). It appears that the elements of the moderation activity system acted according to the required DBE expectations and in this case according to the division of labour because grade 12 CASS of the six schools was moderated.

8.2.1.8. Contradictions

As already mentioned in Chapter Three that: "contradictions are understood as historically accumulating structural tensions within and between activity systems" (Saka, Southerland & Brooks, 2009, p. 1001). Contradictions may be visible or invisible. During the moderation, teachers were quietly talking, in particular when dates were given, but it was not clear what exactly they were talking about. This may also suggest invisible contradiction. The invisible contradictions may also include cultural assumptions about how things are done and how

relationships are managed. In relation to the invisible contradictions, Tylor (2014) argued that it is not all the time that contradictions can lead to change or development because contradictions may be ignored.

This section has presented the moderation workshop/meeting as an activity system of Mathematics Group that was facilitated by the Mathematics subject advisor as a member of the community. Ahmed (2014) suggests that the object of activity provides understanding of both nature and motive driving the activity. The object of the moderation workshop was checking learners' CASS; this is one of CAPS requirements where Mathematics teachers check each other's work to make sure that it complies with the policy. The Mathematics Group in this case served as an administrative organ of the DBE for monitoring Grade 12 CASS (Jita & Mokhele, 2012). In this workshop, Mathematics teachers as subjects enacted the moderation of CASS using mediating tools such as moderation instruments, learners' portfolios, signs and language. The moderation was shaped by the programme of assessment as per CAPS. The Mathematics subject advisor, a member of the community, coordinated the moderation and acted within his division of labour as a DBE official. The object was successfully transformed because CASS was moderated. However there was no evidence to support that teacher learning developed in the process. The next section discusses the content workshop.

8.2.2. The Content Workshop of the Mathematics Group held on 21st May 2013

This section presents the content workshop of the Mathematics Group which was facilitated by the NGO facilitator, Siza. I developed this section with the observation and interview data. The content workshop took place three days after the moderation workshop. The workshop was held in a resource centre in a circuit. The four participants, Hlengiwe, Jabulani, Bongani and Siza that were interviewed were part of the workshop. The focus of the workshop was on Grade 12 Controlled Test Papers and introduction to the cyclical geometry. Controlled Tests are tests that are set by the Department of Basic Education at provincial level. All the schools that achieved an overall result below 60% in grade 12 the previous year are compelled to write Controlled Tests set by the DBE. Figure 21 below shows the activity model of the content workshop.

Physical Tools: venue, white board, long tables, laptop, projector, notebooks n mathematics instruments, Hand-outs, graphs, calculator, refreshments and R50 for the transport.

Psychological Tools: representations, signs, language, knowledge and experience

Outcomes: understanding content of 2013 March controlled test questions and basics of cyclic geometry.

Subject: Fourteen Mathematics teachers

Object: 2013 March Controlled papers and Introduction to cyclic geometry.

Rules:

CAPS, Mathematics rules such as coco-rule and strategies. Participation

Community:

NGO facilitator

Resource centre staff Department of Basic Education, Mathematics subject advisor principals, other teachers

Division of labour

Facilitator explained and demonstrated the tasks, provided resources teachers engaged in tasks resource centre staff photocopied   DBE provided the venue   Maths subject advisor supports teachers

Figure 24: Activity System model for Mathematics Content Workshop

8.2.2.1. Subjects

The subjects of this content workshop are 14 Mathematics teachers from one of the four circuits in Zethembe district. These 14 Mathematics teachers were seated in two rows in a resource centre room which had two white boards, one in front and the other one at the back of the two rows of tables. There was another table in front that was for the laptop and the projector used by the facilitator. As the subject of the activity is the individual or group whose view point is adopted (Engeström, 2001), there is evidence from the interview held with Hlengiwe after the workshop that suggests that the view point of these 14 teachers was

adopted. When Hlengiwe responded to the question about who decided on what was learnt during the workshop she reported that they requested Siza to assist them with the 2013 March Controlled test question papers:

> The teachers decided, normally the facilitator decides on what the topic for the day is but she is flexible, which means it can change with the teachers if there's any need to do any other thing just for today, she was only prepared for the cyclic geometry but we saw the need to do the papers, last term's papers for Grade 12, because they were very difficult (Interview held on the 21st May 2013).

The above interview extract confirms that the subjects of the activity system as shown in Figure 20 are the 14 Mathematics teachers because their view point of doing the 2013 March Controlled papers was adopted. Furthermore, for the purpose of this study the Mathematics teachers constitute the group of teachers from a circuit whose action I seek to understand. The CHAT principle of contradiction posits that contradictions arise when ways of thinking and doing come into conflict, within the elements, between the elements or among activity systems resulting in tensions within the system (Abboud-Blanchard & Cazes, 2012). There is contradiction of subject/object/ community that occurred because the March Controlled test (object) was difficult for subjects (Mathematics teachers). From Siza's point of view the object was supposed to be geometry, but then changed to accommodate the teachers (subjects) and teach something else. Siza changed the object of her facilitation which could still be a contradiction because of subject/object (geometry)/community.

In addition, it appears these Mathematics teachers believe that if they are together they will share more information on how they can improve in their teaching practices. This was evident from Hlengiwe when she was talking about what makes the Mathematics Group differ from the other teachers' subject groups:

> We just go to the workshop as teachers who are willing to learn who want to be confident with the subject. As we know that Mathematics is a scary subject to learners. Fortunately we have dedicated teachers who love to interact and after interacting we get some information that will help us when we deliver any topic or lesson in class.

The quote also seems to suggest that the 14 Mathematics teachers, as subjects, not only rely on the facilitator (community) to enact the object (learning Mathematics) but also enact the object through interaction with one another during the workshops.

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8.2.2.2. Object

In line with Hardman (2007), that the object of the activity is the collective shared problem that is transformed during the unfolding of an activity, the collective shared problem was the 2013 March Mathematics Controlled test papers. Hence, the subjects (teachers) requested Siza to assist them to learn the topics that were covered in these question papers. One of the teachers after the workshop commented on the memorandum of the question papers:

> Teacher 2:… though the memorandum came out, the memorandum in most of the times doesn't talk to you and tell you the steps, you will see the steps and sometimes you just keep on working and you don't understand the whole thing, as to what they were doing but when we were discussing about it then it becomes a little bit better than it was before.

Siza also confirmed at the end of the workshop that the papers were difficult:

> Be honest to your learners that the papers were difficult. We spend five hours doing them. Setting a hard paper is a disaster for learners; consider the level of the learners.

These two quotes seem to be in line with the principle of contradictions, that the contradictions are at the centre of learning and development, as they can either enable learning to progress or disable it, depending on "whether or not they are acknowledged and resolved" (Murphy & Rodriguez-Manzanares, 2008, p. 445). In this case the subjects (Mathematics teachers) and the community (Siza) acknowledged that the March papers were difficult. In the CHAT context, the contradiction between object and mediational tools is at the centre of learning in this activity system. Therefore, the motive driving the activity system was the need of the teachers to understand the topics that were covered in the question papers.

Engeström (2001) highlights that the object entails different goal oriented action mediated by the subjects (Mathematics teachers) and the community (the facilitator). The subjects enacted the object by engaging in different tasks that were facilitated by Siza. There were individual and group tasks. These tasks were based on following topics: algebra differentiation, algebra maximum and minimum, algebra cubic function, algebra calculus, algebra linear equations, trigonometry strategies and cyclic geometry. In this section I will show two tasks to give a picture of how the subjects enacted the object. The following is the task that is based on algebra maximum and minimum, which was question 4.1. to 4. 3. from the question paper:

In the diagram below, AE is defined by y + 3x = 12 and x, y ≥ 0

B(x; y) is any point on AE. F is the point (0; 6). BD is parallel to the y-axis.

4.1   Write down the y-coordinate of B in terms of x. 4.2 Show that the area of quad BDOF is given by 4.3   Calculate the maximum area of quad BDOF
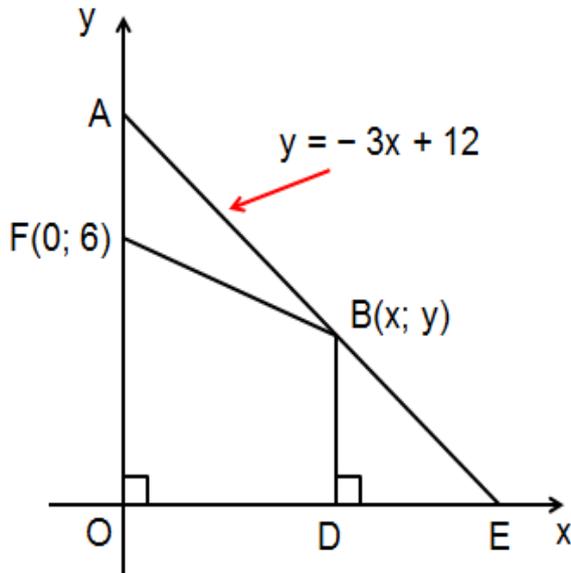
Siza showed the teacher by showing the calculations and the y-coordinate in the following diagram below.

Area trap = ½ sum // sides + distance between them
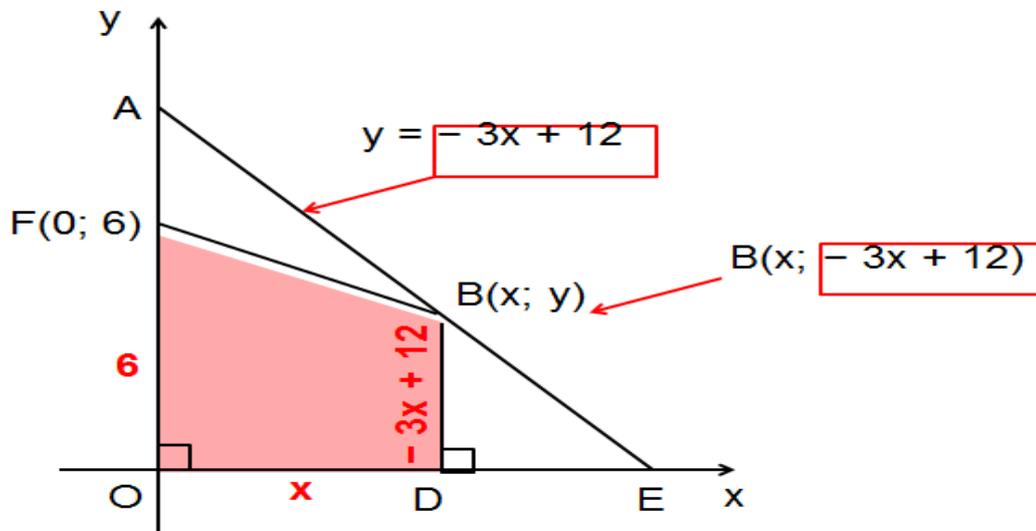
Siza: Did you see how I came up with the coordinates then, what is FBOD area?

All teachers: Trapezium

Siza: Learners must know the shapes and formula such as

Area trap = ½ sum // sides + distance between them

The above excerpt suggests that Siza was performing concrete actions by drawing graphs, using the laptop and indicating the coordinates. The graphs and questions were important mediating artefacts were used for enactment of the object. For example, in the above excerpt Siza was demonstrating the algebra maximum and minimum. Siza asked questions to ensure that the concept was understood. In a CHAT perspective, the tasks performed by the community were internalised (absorbed) and subsequently externalized when the subjects (Mathematics teachers) were able to identify that the shape of the shaded area was a trapezium.

For the algebra linear programming task, the facilitator projected question five and ask teachers to do it.

5. The daily production of a sweet factory consists of at most 100g of chocolate-covered nuts and at most 125g of chocolate-covered raisins which are then sold in two different mixtures

Mixture A consists of equal amounts of nuts and raisins and is sold at a profit of R5 per kg

Mixture B consists of ⅓ nuts and ⅔ raisins and is sold at a profit of R4 per kg

Let there be x kg of mixture A and y kg of mixture B

5.1   Write down the constraints represented by the above system

5.2   Write down the equation of the profit function

5.3   Represent the above graphically on the attached diagram sheet. Clearly indicate the feasible region.

Siza: Who will show us how to do this one? If somebody wants to do it…

Hlengiwe (coordinator): I suggest that we do it together.

Siza: The white board at the back can be used.

Teacher 2 (male): The mixture B is a problem for the learners, let's start with 5.1. This is how I normally do it:

	Nuts	Raisins
A	1 2	1 2
B	1 3	2 3

If you picture it like this it will be easy for the learners

Hlengiwe: The way I understood it, it should be half per kg and half per kg is connected with the given information.

Jabulani (lead teacher): Hlengiwe, elaborate please.

Hlengiwe: I emphasise the point of half half

All teachers: It should be half half.

Teacher 2: Guys, lets us come up with constraints and form the equation.

Teacher 1: At most it is represented by 1/2x +1/3y

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Teacher 2: Next constraint is 1/2x + 2/3x ≤ 125. This is what confused learners, let us rather do it on the table for learners not to be confused.

Hlengiwe: Then 5.2, is P= 5x+4y profit

Siza: Thanks. Rather use the table. It will have everything except the profit. This was the most confusing one for the learners.

The above extract appears as a collective comprehension task in which teachers as subjects solve a problem as a whole group (Patchen & Smithenry, 2014, p. 608). Learning through engagement in collective activity is at the centre of CHAT. In this task, it appears that Siza moved away from her division of labour, a leadership position, to ensure that the teachers take charge of the question. The teachers took turns sharing the methods of how to come up with the constraints and the equation of the profit.   This sharing of methods suggests that the individual actions were later transformed into a shared collective object through interaction between the subjects and facilitator (community) (Engeström, 2005). The interaction further manifested the multi-voicedness of the activity because teachers gave their different ways of finding the solution. Teachers used their teaching knowledge and experience to come up with the answers. This situation is in line with Engeström (2005) who believes that multi-voicedness may be positive, as multiple perspectives may enrich the points under discussion. Enrichment of the information seems to be confirmed by the facilitator when she states that teachers should rather use the table so that learners will not be confused. In terms of the CHAT multi-voicedness principle, this task reflected an interchange where one was being a resource for others while drawing on others as resources during the collective engagement in activity.

Furthermore, there are contradictions that play up during this interaction. When Hlengiwe (one of the four participants interviewed) produced the profit equation without showing the steps on the table, this created a contradiction (of subject/object (profit equation) and mediational tool (table). The teachers raised the problem that they did not understand how she arrived at the profit equation. Hence the contradiction between the subject/object/ and the tools occurred. The contradiction was acknowledged by the facilitator who resolved it by explaining that the table must be used to be easier for the learners to understand. This task shows that the Mathematics teachers' efforts in solving a problem were interdependent. This

collective engagement of Mathematics teachers as subjects in a practical task is one of the characteristics of a teacher learning community (Owen, 2014).

8.2.2.3. Mediating Artefacts / Tools

The physical tools consisted of the room with two white boards two rows of long tables, a small table for the laptop and projector, teachers' notebooks, mathematics instruments, calculators, hand-outs, question papers, and teachers' laptops. The facilitator provided lunch refreshments and chocolate slabs to reward teachers after demonstrating the task. The facilitator also gave each teacher R50 for transport. During the workshop, the facilitator used a laptop and white board to illustrate Mathematics formulas, and solutions. Another whiteboard was used by the teachers to show how to do the sums. The facilitator also used the laptop and projector to teach the Mathematic teachers how to use these to teach Mathematics. For example, Bongani one of those teachers talks about the laptop:

> It empowers us with skills of how to use the advanced technology in our classroom teaching. I was given a computer and a projector which I use for my teaching and learning. I don't only use my computer and projector at my school. However, I also use it at other schools as well.

The interview script also suggests that the laptop and projector were used by the facilitator as a knowledge object to demonstrate how to use technological devices when teaching Mathematics. The facilitator issues hand-outs during the workshop for the teachers to work through. Other physical tools were the March Controlled test papers. The questions in these question papers were determinants of the tasks in which the Mathematics teachers as subjects, and the facilitator as community, engaged. These question papers are also the source of contradiction between the subjects and the object. In line with Engeström (2010), the questions in the March Controlled tests became the driving force of the activity (meeting) because of the contradictions between the subjects (Mathematics teachers) and the object (Mathematics questions in March Controlled test). As mentioned when describing object of activity, the contradictions between the subjects/ the object (March controlled test) occurred because teachers did not understand the March controlled test, thus the controlled test became a motive of the activity.

The psychological tools were used by both the facilitator and the Mathematics teachers. From the CHAT framework, psychological tools include abstract patterns of action such as facilitators and teachers' knowledge and experience, representations, signs and language.

These are the psychological tools that were used in this activity system. Representations used include graphs and models. The knowledge and experience used by the facilitator and the teachers both play a crucial role in mediating the object.

The language that enables communication during mediation is English. The facilitator asks questions then gives the explanation and representations of the Mathematics concept. The questions enable the interaction between the facilitator and the teachers and the interaction among subjects, in particular during group work. In this case it is the language, experiences, skills and knowledge of both the facilitator and the other subjects that came into play. This is shown in the following observation extract on trigonometry identities when the facilitator was showing teachers solving triangles in trigonometry:

> Siza: What do you see?
>
> Teacher 12: Two semi-circles.
>
> Siza: You must show the kids the six steps

STEP 1   Write an 'r'' on all the line segments equal to the radius and fill in all the angles in terms of x

STEP 2   Use the sine rule in ΔROQ to find 'RQ in terms of r and x'

$$\frac{RQ}{\sin(180° - 2x)} = \frac{r}{\sin x}$$

$$RQ = \frac{r\sin(180° - 2x)}{\sin x}$$

$$RQ = \frac{r\sin 2x}{\sin x}$$

$$RQ = \frac{r\,2\sin x \cos x}{\sin x}$$

$$RQ = 2r\cos x$$

1 + 1 > 2
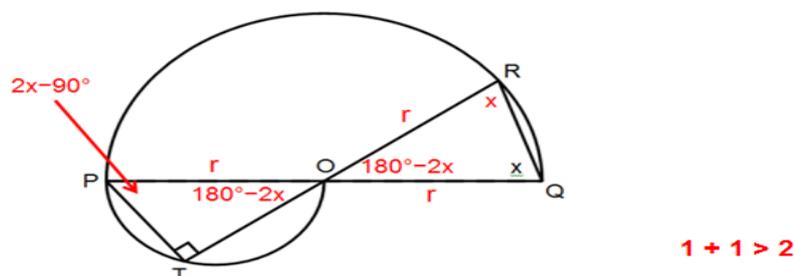
> Siza: You must also do the same thing with the kids, the kids must first analyse the diagram. Now, could you try that one, you have a space below.

In the above observation extract the facilitator, as a member of the community, was using her knowledge and experience to demonstrate the steps for trigonometry triangle solving. In other words she was demonstrating how to enact the object. This also seems to illustrate the teachers' knowledge as a psychological tool. A teacher's knowledge is evident when teacher 12 answered the question.

8.2.2.4. Division of labour

Division of labour specifies the roles and tasks that subjects and the community perform. The distribution of labour in an activity system also gives the power structure which is revealed by vertical and horizontal roles and responsibilities (division of labour). The facilitator, as a community member, coordinated the programme. However, the input from the Mathematics teachers as subjects was allowed. The teachers participate in tasks individually, as groups or as a collective of the whole group of participating teachers. The facilitator explains the Mathematics content, using graphical representation, triangles and Mathematics strategies, to the whole group. The teachers take notes. The following observation extract shows the example of one of the Mathematics strategies that the facilitator used as a mediating artefact for the object (trigonometry identities):

If tan2x = 2,4 and 2x ε [180°; 360°] determine, with the aid of a sketch and without the use of a calculator, the value of

Siza: When you are doing this one remember the Pythagoras Strategy

> PYTHAGORAS STRATEGY
> - To recognise it: "aid of a sketch" "no calculator"
>   Pythagoras type, Cartesian plane
> - 2 facts
> - decide on quadrant
> - identify x, y and r
> - substitute

Siza: Why do I say remember this strategy? It is because it is the key so you must always use it.

She demonstrated how to teach Mathematics with a laptop, and the software. She taught the Mathematics teachers easy ways to teach difficult topics in Mathematics. The facilitator also provided mediating artefacts such as hand-outs. For example, the facilitator gave individual work after explaining the strategy:

Siza: Do you want me to draw the graph?

All teachers: No, we understand the graph.

Siza: Make a list of collection of the sum from question1.1.1. up to 1.1.3. Write them in your notebook. Remember the Pythagoras and strategy.

The above extract suggests that the Mathematics teachers, as subjects, internalized the Pythagoras strategy that was explained by the facilitator (community). Externalisation then took place when they were practising in their notebooks (mediating artefacts) and they performed the task without any problems.

Pacing of the content and the task that was done during the workshop (activity) was determined by Mathematics teachers because they requested the facilitator to help them with the 2013 March controlled tests. Furthermore, the interview data also suggests cooperation between the facilitator and the Mathematics teachers in choosing the topics that should be dealt with during the workshops. When Bongani responded to the question about who decides on the topics that should be studied said:

> Siza comes with the programme. We as educators also give our input on what we think about what is on the programme. For example, Siza may pick a topic on past exam questions. Then we as educators will discuss about what is it that we want to look at when it comes to past exam questions and the challenges. So basically the way I see it, it is a group effort that we use. We decide what we are actually going to learn.

This quote seems to suggest that the Mathematics content that is covered during the NGO workshops caters for the Mathematics teachers' needs and their teaching and learning challenges. This suggests horizontal division of labour because the Mathematics teachers are involved in deciding what should be covered in the workshops. This aspect is elaborated in the section; 8.4. on the nature of collaborative relationship in the Mathematics Group. The sequencing of tasks was based on the chronological order of questions of the two question papers and the understanding of the teachers was also taken into consideration by the facilitator when planning the programme.

The horizontal division of labour that prevails during the workshop seems to be in line with the organisation of a teacher learning community. The literature on teacher learning communities highlights that: "the organisation of a teacher learning community can allow greater or lesser participants' choice and decision making" (Hargreaves, Berry, Leung, Scott & Stobart, 2013, p.22). In line the with literature on teacher learning communities, the

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horizontal division of labour that is evident during the workshop seems to suggest that the Mathematics teachers focused on object enactment that was identified by themselves as useful for their own classroom practice.

8.2.2.5. Community

Seaman (2008) believes that the community, as another element of the activity system comprised of multiple individuals or subgroups who share the object of the activity. The Mathematics workshop, as an activity, had several individuals and groups with an interest in the object. The historical background of the Mathematics Group has shown that the community consisted of the NGO Facilitator, the resource centre staff, the DBE, the Mathematics subject advisor, principals, the heads of departments, other Mathematics teachers, and the learners. Some of these individuals were not directly involved with current workshop while the NGO facilitator, as part of the community, was directly involved in this workshop. The resource centre staff members were acting within the DBE division of labour to organize the room and provide photocopying facilities for the teachers.

8.2.2.6. Rules

In a CHAT context, rules that govern the activity may be implicit and or explicit. In other words, they provide guidelines and parameters within which the subjects and community members carry out their roles and responsibilities (division of labour). The facilitator announced that teachers should participate, and interact with one another. She also used incentives, such as chocolates and calculators, to encourage participation. During the interview session, Jabulani also mentioned incentives when he talked about the structure of the workshop:

> If you get a certain problem correct you will get an award like a chocolate or even calculators or a Maths text book. It depends on what is on offer for that particular day. (Interview with Jabulani)

This situation suggests that observing rules of participation during the workshop earned teachers mediating artefacts such as Mathematics books and calculators According to Feldman and Weis (2010), implicit and explicit rules act as a constraints and affordances within activity systems. In line with these authors, the explicit rule seems to appear as an affordance within the Mathematics activity system because it promoted participation in the activity and teachers benefited with knowledge and mediating artefacts. The activity system

was also governed by explicit rules such as the CAPS policy, and Mathematics rules such as coco-rule and strategies. On the other hand, things like respect or punctuality are the implicit rules.

```
STRATEGY
    • Have to change angles:
    • no negative angles
    • no angles > 360°
    • need acute angles
    • Rules
    • reduction rules
    • co-co rules
    • double angles
    • Change tan to "sin/cos"
    • Special angles
```

Figure 19. Extract from the power point presentation of the NGO facilitator

The above strategy and rules were followed by the community - the facilitator and subjects. These rules and strategies directed how to do tasks.

8.2.2.7. Outcome

The seven elements of the activity system permit the subjects to transform the object to produce an outcome (Lee, 2011, p.40). However, an outcome is only produced when all the elements of an activity system act according to their division of labour within the rules of the activity. The intended outcome for this activity system was that teachers should understand the 2013 March controlled test question papers. Therefore, the object was transformed to an outcome when teachers understood the 2013 March controlled test questions and the content that was covered by the questions. During the workshop, the facilitator as community used her knowledge, experience and physical tools such as the Mathematics hardware and software to enact the object. New mediating tools, which in this case consisted of the new ways of solving the Mathematics sums, gave rise to new ways of enacting the object which led to transformation into an outcome. For example, Hlengiwe talked about the workshop during the interview:

> It boosts our confidence because now when you go back to learners, you'll have many methods as to how to deal with one question, for example, as we were doing the papers today, though the memorandum came out, the memorandum in most of the times they don't talk to you and tell you the steps, you will see the steps and sometimes you just keep on working and

> you don't understand the whole thing as to what they were doing but when you talk about it then it becomes a little bit better than it was before.

The above quote seems to be in line with the CHAT principle of expansive learning. According to Engeström (2001), generally expansive learning in CHAT occurs through engagement with psychological and material mediational tools and artefacts to transform the object and also when addressing contradictions. It was mentioned earlier that lack of understanding of the question paper created contradictions between the object, the subject and the division of labour, in that teachers could not enact teaching or revising the question papers with the learners. In this case, the teaching of control test questions was the object. Thus, understanding and working through the 2013 March control test questions, which was the objective of the workshop, suggests the enacting the object successfully and transforming it into the outcome. Transformation of the object goes with expansive learning. In CHAT expansive learning occurs "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured" (Hord, 2003, p. 18). There were some signs of expansive patterns reflected by learning together new ways of teaching Mathematics. However one may not say that expansive learning was completely achieved because there were no new model that were developed by teachers themselves but the NGO facilitator provided the teachers with the worksheets and notes for teaching different Mathematics topics.   .

8.2.2.8. Contradictions

The contradictions that occurred during the workshop seem to be mostly rooted in the object of the activity. The dotted lines in Figure 25 below show the contradictions existing in the Mathematics workshop:

Physical Tools: venue, white board, long tables, laptop, projector, notebooks n mathematics instruments, Hand-outs, graphs, calculator, refreshments and R50 for the transport

Psychological Tools: representations, signs, language, knowledge and experience

Outcomes: understanding content of 2013 March controlled test questions and basics of cyclic geometry.

Subject: Fourteen Mathematics teachers

Object: 2013 March Controlled   papers and Introduction to cyclic geometry.

Rules:

CAPS, Mathematics rules such as coco-rule and strategies. Participation

Community:

NGO facilitator

Resource centre staff Department of Basic Education, Mathematics subject advisor principals

Division of labour

Facilitator explained and demonstrated the tasks, provided resources teachers engaged in tasks resource centre staff photocopied DBE provided the venue   Maths subject advisor supports teachers

Figure 26: CHAT model of contradictions during the Mathematics workshop

The first level of contradictions was the object/community/division of labour contradictions (emanating from 2013 March controlled test question papers). The 2013 March controlled test question papers, together with their memoranda, were difficult for the teachers to enact revision with their learners. This situation manifested contradiction of object/division of labour /subjects/community. The major contradiction was due to lack of skills by teachers which then caused another contradiction based on facilitator's deviation from plan.   The second level of contradictions occurred when the subjects enacted the object which was mediated by both community and subjects with mediating artefacts. The contradiction affecting the subjects, the mediating artefacts, and the object (Mathematics differentiation task) occurred when the subjects found it difficult to apply the strategies. However these

contradictions could be said led to learning as teachers were taken through the controlled question papers and their memoranda to help them prepare their learners.

The following observation extract shows an example of contradictions:

Teacher 4: If I have may be

and $\quad f(x) = \cos(x + 30°) \qquad g(x) = -2\sin x$

You cannot use the coco-rule…

Teacher 13: "Kwenzekani vele? Yini i coco- rule, ngifuna ukwazi ukuthi u Teacher 4 ususwe yini vele endaweni yakhe… mina angisekho kwaMaths eskoleni ngika Physics, Physics is straightforward angisekho" (What is happening? What is the coco-rule? I want to know why Teacher 4 was moved from his place. I am no longer teaching Mathematics. I now teach Physics at school, Physics is straightforward).

Teacher 4: What I am saying is sinx =2sin30^0. It is very impossible to use the coco-rule if you have the number in front,

There are several contradictions evident in the above observation extract. The object/subject/Mathematic rule contradiction occurred when Teacher 4 was unable to apply the coco-rule that should be used to solve a trigonometry angle. A further contradiction also occurred, while Teacher 4 was busy with the sum, when Teacher 13 and Teacher 14 arrived. Again, Teacher 13 commented in isiZulu that Mathematics is difficult and he was now teaching Physics. As mentioned earlier, the fact   that Teacher 3 came to attend a workshop for Mathematics teachers when he was teaching physics is a contradiction in itself, and mentioning that mathematics is difficult is another contradiction. The comment gave rise to a contradiction of the subject/rules/tools/object, in that the subject (Teacher 13) used a language (tool) that is not generally used as a means of communication. The contradictions of the subject/ (Teacher 4), object/ the entire activity occurred because Teacher 4 was disturbed and workshop stopped for some few minutes as Teacher 13 and Teacher 14 walked in. From a CHAT perspective, this situation gives rise to contradictions related to dis-coordination in the interaction between the subjects and community (Murphy & Rodriguez-Manzanares 2008, p. 445). The facilitator resolved the contradiction between the subject (Teacher 4) and the object (working out sum) by working out the sum herself. Apart from the dis-coordination caused, coming late for the workshop was a contradiction as it also suggests going against the rules of punctuality.

In this section, I have used CHAT elements to show a content workshop as an activity system of the Mathematics Group in order to understand how learning happens in the Mathematics group. The object of this activity system was for the 14 Mathematics teachers to understand the March Controlled tests question papers. This object was mediated with physical artefacts such as Mathematics instruments and hand-outs; psychological tools (knowledge and experience). The findings show that the subjects (14 Mathematics teachers) learnt new ways of solving Mathematics problems and easy ways to teach certain topics, such as differentiation. The literature maintains that: "teacher learning depends on the extent to which teachers can integrate their knowledge, drawn from both the school and the professional development context" (Pournara, Hodgen Adler & Pillay, 2015, p. 4). In line with the literature, the seven elements of the Mathematics activity system suggest that the Mathematics teachers integrated their knowledge drawn from school and the workshop through engagement in different tasks that were facilitated by the NGO facilitator. The teachers participated in these tasks individually and collectively. For example, integration of Mathematics teachers' knowledge was evident when they were engaged in the collective comprehension tasks. In these tasks, teachers used their knowledge and experience as mediating tools to show one another how they present a Mathematics problem to their learners.

The motive of the workshop was to resolve the contradiction between the object and the subjects (The 2013 March controlled tests question papers were challenging for the teachers). The contradictions analysis in this section seem to suggest that the object enactment (learning) by 14 Mathematics teachers as subjects during the workshop was transformed into outcome. The object was transformed into outcome through creation and expansion of knowledge. In a CHAT context, this situation confirms that expansive learning and enhanced professional practice occurs in an activity setting that enables expansion of the object of the activity (Daniels, 2004, p. 191). Engeström (1999) describes expansive learning as a long process of internalization and externalization in response to contradictions, as well as appropriation of available cultural resources to design a novel form of practice.

The next section discusses another workshop of the Mathematics group.

8.2.3. The Mathematics content workshop held on the 18th February 2014

This section presents another content workshop of the Mathematics Group which was facilitated by the NGO facilitator, Siza (Pseudonym). The data used in this section comes from the videotaped observations. The videotape was used in order to capture workshop events such as demonstrations, dialogues and activities. In this section, I use the CHAT model and a detailed vignette to show what happened. I also elaborate using the PowerPoint presentation that was presented by the NGO facilitator. Figure 26 below shows the activity model of the demonstration content workshop.

Physical Tools: venue, white board, long tables, laptop, projector, notebooks n mathematics instruments, Hand-outs, graphs, calculator, coloured papers, scissors ,refreshments and R50 for the transport
Psychological Tools: representations, signs, language, knowledge and experience

Outcomes: understanding of the Content and teaching skills

Subject: Fourteen Mathematics teachers

Object: 2013 March Controlled papers and Introduction to cyclic geometry.

Object: Midpoint Theorem, Ratios, Proportions and Similarities

Rules:

CAPS, Mathematics rules Strategies. Participation

Community:

NGO facilitator Resource centre staff Department of Basic Education, Mathematics subject advisor principals

Division of labour

Facilitator explained and demonstrated the tasks, provided resources teachers engaged in tasks resource centre staff photocopied DBE provided the venue Maths subject advisor supports teachers

Figure 27: Activity System model for the demonstration Mathematics content workshop

The 14 Mathematics teachers are the *subjects* of the activity system. These teachers were considered grade 10 and 11 learners in the demonstration of Mathematics content. The NGO

facilitator, who is a *community* member, represented a Mathematics teacher. In line with Hardman (2007), the *object* is what is to be accomplished; the object of the workshop was for the teachers to learn how to teach Grade 10, 11 and 12 content. Table 27 below, shows the categories of the object:

Time	Topic	Task	Grade
8h00 — 10h15	Midpoint Theorem and Ratios	Demonstrations	10 and 11
10h30 – 13h00	Proportional Intercept Theory	Demonstrations	12
13h30 – 15h00	Similarities	Demonstrations	10
15h00 – 15h45	Assessment in all the topics	Group work/ pair work	10,11 and 12

Table 26: Topics demonstrated during the workshop

8.2.3.1. Midpoint theorem

From these tasks I use vignette on Grade 10 midpoint theorem and Grade 11 ratios to show how the subjects enact the object. The facilitator makes connection across the three topics (object):

> Siza: I am going to look at three areas because I don't think you can look at them in isolation. The first area is the midpoint theorem which is Grade 10 work. The second is the proportional intercept theory for Grade 12 and the similarity. In between the first area and the second area we have Grade 11 work where we are doing circle geometry. In the curriculum when the CAPS start they say you must teach the midpoint theorem at Grade 10. Then when you get to Grade 12 they say the midpoint theorem is the special case of the proportional intercept theorem, I think that does not make sense. I think it is just confusing for the kids, and I think that you should teach them as totally separate things. You will see why. After that you do similarity and when you do similarity that when you bring in your circles. You have got precisely two weeks to do all of this, which for you is a serious problem. Do you agree?

> All teachers: Yes

> Siza: I have always taught at places where you have the freedom to change things. However, that is difficult for you. But if I were you I would try and fit in the proportional intercept theorem (Area 2) into Grade 11 because it is very straight forward, so that when you get to your two weeks in Grade 12 you would be revising the proportional intercept theory

From the above vignette, the facilitator, as community, explains how the subject could enact the object (teaching of three topics): midpoint theorem, the proportional intercept theorem and similarity (Object). There is a contradiction between the community, the rules (CAPS), the tools and the object which occurs when the facilitator does not agree with the arrangement of the three topics in the CAPS document. The facilitator, as community, then resolves the contradiction with a suggestion that teachers should teach the three topics separately. The facilitator starts with the midpoint theorem. The facilitator distributes the papers to the teachers who represented Grade 10 Mathematics learners:

Teacher: The first thing we are going to do is fold, cut and measure. We are starting with the midpoint theorem. You need some pink paper, pencil, and scissors. Draw two diagonal lines on two rectangles in the paper. Then I am going to cut along the diagonal lines. Remember that you are not teachers but you are grade 10 learners. At the end you should be holding a triangle. Now take the vertex at the top and fold it down to the bottom, fold it in half top to the bottom then up again. As a teacher you see that you have folded the altitude height in half.
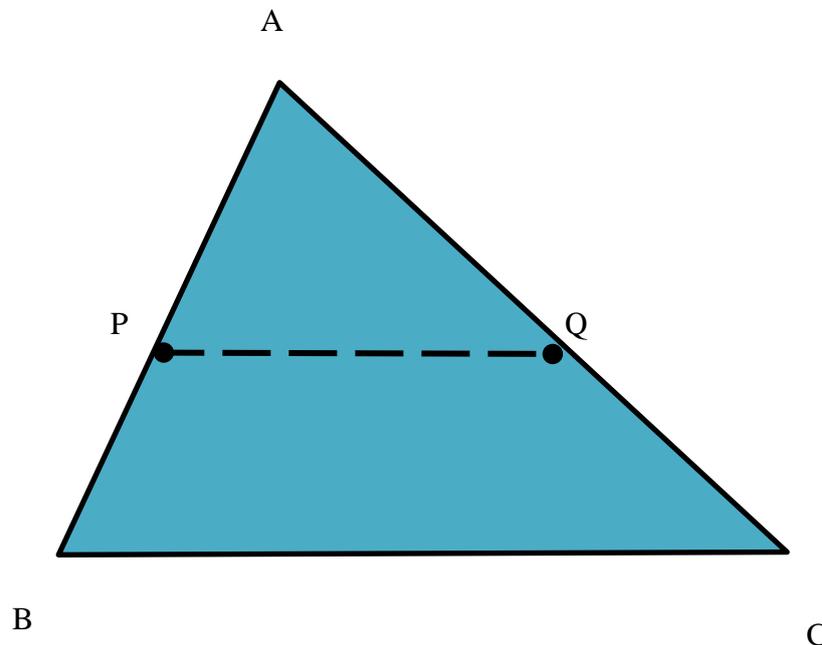
This is the triangle that was produced after cutting and folding. The facilitator (the Grade 10 Teacher) asks the Grade 10 learners to take measurements and compare their measurements:

Teacher: Take your pencil and write points, the main corners are A, B and C. The two points on the midpoint are P and Q. Do it inside the triangle not outside. Next thing I would like you to do is to take measurements of line segments and write the measurements inside. Do them in mm or in cm, correct to one decimal place. Measure the following line segments:

AP=   AQ= PB=   QC= AQ=   PQ= BC=

Teacher: The first person to finish, would you please come and write your measurements on the board. Remember I am not choosing you as teachers. I am pretending that you are my Grade 10 class.

Two teachers as Grade 10 learners wrote their answers on the board:

Learner 1: AP = 11, 8 cm   Learner 2: AP = 140mm

       BP = 11, 3 cm   BP = 142 mm

       AQ = 14, 2 cm   AQ = 118mm

       QC = 15, 0 cm   QC = 118 mm

       PQ = 14, 5 cm

       BC =29, 3 cm

Teacher: It is quite nice that they both worked in different units. As teachers we are trying to prove that AP and PB are the same measurements because P is the midpoint of AB. We are also trying to say that Q is the middle of the line AC.

The triangle and the answers that were written by the two teachers on the board are the evidence that suggests that externalisation occurred after the internalisation of procedures and the demonstration that was performed by the facilitator. Two teachers showing their answers also suggest multi-voicedness which means multiple points of view. The facilitator's comment that "it is quite good that they both worked in different units" seems to suggest that subjects (Learner 1 and Learner 2) modify the mediating artefacts by using different ways of solving the Mathematics problem to meet the intended object (Cole 2004). From the CHAT perspective, multi-voicedness may have a negative or a positive impact on the activity system (Feldman & Weiss, 2010. p. 39). However, in this task the multi-voicedness had a positive impact because two different approaches were used by the teachers which were an advantage for the other teachers. The facilitator, as a teacher, then uses the same information to teach ratios: Grade 11 work:

Teacher (facilitator): Now I want some ratios.

$\frac{AP}{PB}$ = What does it come to?

Class (teachers): 1

Teacher: $\frac{PQ}{BC}$ Shorter one over the longer one = $\frac{1}{2}$

$\frac{BC}{PQ}$ Larger one over the shorter one = $\frac{2}{1}$

Teacher: Now when you teach this to you class, when you do these measurements you can ask if $\frac{PQ}{BC}$ is approximately 0.5 cm and if $\frac{BC}{PQ}$ approximately 2 cm is. For everybody it is quite easy to convert the ratio into a fraction instead of a decimal. So what we find from the measurements is that, if you take the midpoint of line AB which is P and join it to the midpoint of line AC which is Q.

AP=   PB= $\frac{AP}{PB}$ = 1
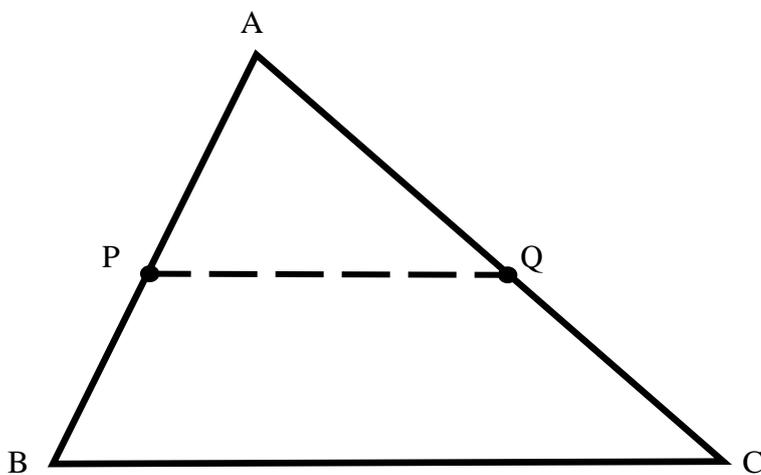
PQ=   AQ =

BC=   AC =

$\frac{PQ}{BC} = \frac{1}{2}$ $\frac{PQ}{BC} = \frac{2}{1}$ $\frac{AQ}{AC}$ =1

We have found that the line joining the two midpoints, line PQ, is equal to the half of the line BC, we have proved that P and Q are the midpoints of line AB and AC, that is the 2nd part of the midpoint theorem, What is the

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first part? The first is that line PQ is parallel to BC, in the triangle. If you have a midpoint of one side of the triangle then that line is parallel to the 3rd part of the triangle and = to the $\frac{1}{2}$ of it, now that that is the midpoint theorem. Remember with theorems that if you are given this, then this that is will happen, that what works with the kids. So put away your pink papers. Now I will give you more papers.

The above vignette shows how the object (Midpoint Theorem and Ratios) was enacted by the 14 Mathematics teachers as subjects. The community and subjects used *physical tools* which consisted of pink paper, pencil, scissors and Mathematics instruments. The facilitator as community representative was using her knowledge and experience (*psychological tools*) to show teachers the easy strategies to teach the midpoint theorem. In terms of *division of labour* the facilitator was explaining the demonstration process, asking questions and affirming and correcting teachers' responses. Acting according to their division of labour, the teachers were demonstrating the tasks according to the facilitator's instructions. The actions of the facilitator and teachers in pursuit of the object were shaped by the Mathematics *rules and strategies* that stipulate how midpoint theorem can be proved.

The other two topics were also demonstrated in the same manner as the midpoint theorem. The *outcome* of this activity was development of the understanding of the content and of easy ways to teach learners. This seems to have been achieved.

8.2.3.2. Contradictions

There were a few contradictions that emerged during the workshop emanating from the object and rules. Figure 27 below shows the levels of the contradictions.

Physical Tools: venue, white board, long tables, laptop, projector, notebooks n mathematics instruments, Hand-outs, graphs, calculator, coloured papers, scissors, refreshments and R50 for the transport

Psychological Tools: representations, signs, language, knowledge and experience

Outcomes: understanding of the

Content and teaching skills

Subject: Fourteen
Mathematics teachers

Object: Midpoint Theorem, Ratios, Proportions and Similarities

Rules:

CAPS, Mathematics
rules, strategies
Participation

Community:

NGO facilitator

Resource centre
staff Department of
Basic Education,
Mathematics
subject advisor
principals

Division of labour

Facilitator explained and
demonstrated the tasks; provided
resources
teachers engaged in tasks
resource centre staff photocopied
DBE provided the venue
Maths subject advisor supported
teachers
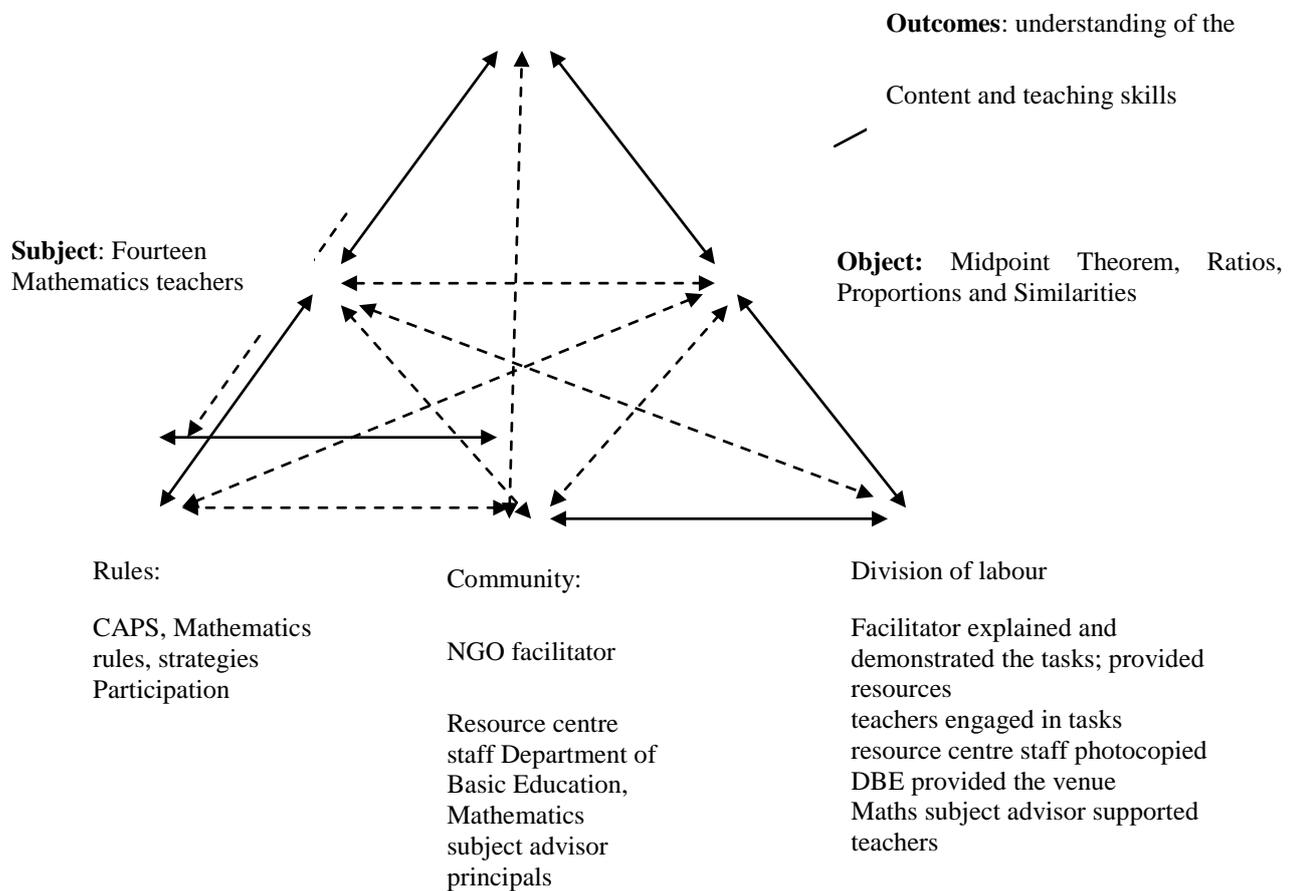
Figure 28: Levels of Contradictions

The contradictions are shown by the dotted lines accumulating within the elements of the content workshop activity system. The first level of contradictions –community /rules/tools/ object, occurred when the facilitator was explaining the connections across the topics

midpoint theorem, ratios, proportions and similarities have been discussed. Another contradiction of subjects/object/Mathematics rules/division of labour arose when the teachers (subjects) come with different answers. These contradictions were acknowledged and resolved by the facilitator leading to learning. For example, when teachers came up with different answers when they were doing the proportion intercept theory, the facilitator acknowledged them and made the following comments:

> Siza: We have got four different sets of results and looking at them we can say some ratios are the same and some are not. I think that when you are doing this with your class and your learners have made their middle line to be right at the bottom, you should make yours right at the top to avoid getting mixed different answers. All that we are looking for in the proportion intercept theory is the ratio of $\frac{AP}{PB}$ and $\frac{AQ}{QC}$. And I think we have found those ratios are equal. However, we are not so happy with the ratios of the 3rd side of the triangle, Ratios: $\frac{PQ}{BC}$ and $\frac{BC}{PQ}$. With the proportion intercept theorem we are not interested in the bottom two lines in the triangle.

In this situation, the contradiction occurred when the teachers as subjects did not act accordingly, because they did not use the Mathematics rules and strategies appropriately to enact the object, hence they come up with different sets of results. The facilitator used her knowledge and experience to expand on the teachers' responses by saying that if learners have made their middle line right at the bottom, the teachers should make theirs right at the top to avoid getting mixed with different answers. Hence these contradictions which gave rise to more explanations by the facilitator to help teachers realize their errors and understand the correct approach to the calculations led to learning.

The motive of the content workshop just discussed was not based on the contradictions as was the case with the other activity emanating from 2013 March Controlled tests question papers. The motive of the workshop was for the teachers to master content and teaching skills of the Mathematics topics (Midpoint Theorem, Ratios, Proportions and Similarities).

In this section I have used CHAT elements to show the picture of the three workshops as activity systems of the Mathematics Group, in order to address the second research question about how teacher learning happens in the Mathematics Group. The first activity system that was facilitated by the Mathematics subject advisor focused on the moderation of learners' CASS marks. There is minimal evidence that suggest that they engaged in more Mathematics content issues but they learnt how to apply moderation rules. This learning occurred through

absorbing the information that was facilitated by the subject advisor who was acting with his division of labour as a DBE.

The second activity system was facilitated by the NGO facilitator. The individual, group and collective tasks suggest that the Mathematics teachers were learning the Mathematics topics that were covered in the 2013 March controlled tests question papers. This situation seems to be in line with one the characteristics of a teacher learning community, that group as well as individual learning is promoted when all teachers are learners with their colleagues (Stoll, Bolam, Mcmahon, Wallace & Thomas, 2006, p. 227). The activity system suggests that learning was achieved through observations and demonstration which was also facilitated by the NGO facilitator.

The next section discusses the kinds of Mathematics teacher knowledge that is learnt in the Mathematics Group.

8.3. Kinds of teacher knowledge that is learnt in the Mathematics Group

This section discusses the kinds of Mathematics knowledge that teachers learn in the Mathematics Group. The analytical tool draws on Ball, Thames & Phelps' (2008) domains of teacher knowledge and Hurrell's (2013) revised supporting questions to describe the kinds of teacher knowledge that is learnt in the Mathematics Group.

I classify the kinds of knowledge according to the four domains of Mathematics teacher knowledge, which are described in more detail below:

Common Content Knowledge (CCK)

Specialised Content Knowledge (SCK)

Knowledge of Content and Students/ Teaching (KCS/KCT)

Knowledge of Content and Curriculum (Horizon)

8.3.1. Common Content Knowledge (CCK)

Common content knowledge is used in general settings, not necessarily for teaching. This knowledge includes the ability to identify incorrect answers or inaccurate definitions, and the ability to successfully complete the students' problem (Hill & Lubienski 2007, p. 753). The findings from the observations suggest that Mathematics teachers had previously learnt

common content knowledge in different ways. This is evident when the NGO facilitator was concerned about the way teachers used the term cancelling, instead of dividing, when they were doing the Mathematics problems on the board:

> Siza: The cancelling is a problem, cancelling does not exist. It is a swearing word in Mathematics. You do not cancel but you divide.

The above extract seems to suggest that Siza, the NGO facilitator, was showing the teachers an inaccurate term that is used by teachers and learners. The term cancel is used incorrectly in Mathematics, the correct term is dividing. According to Ball et al. (2008) division does not require any special knowledge to do it but is common knowledge for everyone who has studied the basics of Mathematics high school algebra. This is evident in the following quote:

> Siza: If learners cancel, they will cancel until they're left with nothing and they will not get the answer. They must divide.

The facilitator makes teachers aware of a common error that learners can make when they use the incorrect term. The common content knowledge was acquired when the facilitator showed the teachers how to use the Pythagoras strategy and rules. It seems as if the common content knowledge emerged from the task whose focus was on specialized content knowledge. This situation seems to show that: "common content knowledge can be built through an orientation that is focused on specialized content knowledge, knowing and doing Mathematics in the ways that are helpful for teaching Mathematics" (Venkat & Spaull, 2013 p. 9).

8.3.2. Specialised Content Knowledge (SCK)

"Specialized content knowledge includes finding an example, analogy, demonstration, and resources to make a specific mathematical point" (Hill, Schilling and Ball 2004). There is a great deal of evidence from the data that suggests that the teachers learnt specialized knowledge for teaching Mathematics. This knowledge was evident from two workshops that were facilitated by the NGO facilitator. The facilitator selected demonstrations as representations to show teachers how to teach the midpoint theorem, proportional intercept, and similarity using demonstrations.

Below is an extract from the demonstration of teaching similarity, when the facilitator gave yellow and green papers to each teacher.

> Siza: Fold them like before, not in the middle and in a landscape position. Draw diagonal lines and cut following the diagonal lines. Do this to both the yellow and green paper. Place them on the top of each other so they come out identical.

The teachers were following the instructions while asking one another where they do not understand. They came out with two triangles.

> Siza: Now what you got here are two identical congruent triangles, the yellow and the green, they have the same sides, same angles they are identical as you can see on the projector.

The above observation excerpt seems to suggest that teachers had been taught the specialized knowledge of Mathematics because the teachers were taught how to represent Mathematics operations using materials such as cutting the shapes of the two identical congruent triangles. Drawing from Hill and Lubienski (2007), this learning situation suggests that teachers were taught how to represent Mathematics ideas using pictures, models and manipulatives. Furthermore, learning of the specialized Mathematics knowledge was confirmed from the three teachers that were interviewed. For example, Jabulani talks about what he has learnt:

> We also do practical activities as well, if needed. For instance, if the topic is on shapes, we use something tangible in order to get a better understanding; we make models of some of the geometric figures that we are talking about for that particular day.

This suggests that the subjects (Mathematics teachers) enact the object (geometry) with physical tools such as models. Bongani also reported on his valuable learning in one of the NGO workshops:

> There was this topic that we did on the Pythagoras theorem. When I do the Pythagoras theorem, I usually use the triangles. I put the triangle on top of each other. That's how we usually prove the theorem. However, here they showed us a new way. Where we draw the square and inside this square we draw another small square starting from the lines of this other square and we take the midpoint of the end square to draw another square which is also inside of the 1st square which is larger. As soon as you draw the 3rd square inside and you look at the drawing, you will see that they form actually four triangles which have a square inside. So instead of using the usual process to prove the theorem, we use four triangles and a square which is more convenient and easier. So I liked that session. It was basically another way of working out the theorem. (Interview with Bongani)

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This suggests that object enactment by the Mathematics teachers as subjects resulted in the creation of new mediating artefacts because the teachers learnt a new way to prove the Pythagoras theorem. This learning seems to be in line with expansive learning. In relation to the specialized content knowledge, the above interview extract seems to tell us that the Mathematics teachers learnt a new way that is modified as an easier task (to prove Pythagoras theorem). The demonstrations and representations that were used by the facilitator seem to confirm that specialized knowledge of Mathematics is applied content knowledge that is developed through the work of teaching (Hill & Lubienski, 2007, p.753). According to these two authors the years of teaching experience might be a predictor of specialized content knowledge. The NGO facilitator is a Mathematics expert who has taught for more than thirty years. Her experience, expertise and knowledge appeared as specialized content knowledge which she has developed through teaching.

8.3.3. Knowledge of Content and Students/ Teaching (KCS/KCT)

There is evidence that suggests that during the Mathematics content workshops teachers also focused on Mathematics problem solving which learners find difficult, as well as the misconceptions and common errors that learners made (Ball, Thames & Phelps 2008). This was evident from the workshop that focused on the 2013 March controlled tests question papers:

> Teacher 2: The mixture B is a problem for the learners, let's start with 5.1.
> This is how I normally do it…

From the above quote it appears that Teacher 2 was anticipating what learners find it difficult in identifying the constraints. Then the facilitator came with the solution to the problem:

> Siza: Rather use the table; it will have everything, except the profit.

The facilitator's response seems to show how the task could be modified to be easier for the learners, which is in line with specialized content knowledge.

There is also evidence that the Mathematics teachers learnt knowledge of Mathematics content and teaching (KCT). According to Hill, Schilling and Ball (2004), KCT is that knowledge of particular tasks that could be used to introduce the topic. This is shown in the following task:

> Siza: Write any circle terms on the board, the one who will write the most will get a pie.

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Teacher 1: centre

Teacher 2: circumference

Teacher 3: tangent

Teacher 4: minor

Teacher 5: major segment

Teacher 6 Radius

Teacher 7: Chord

Teacher 8: diameter

Teacher 13 (wrote the most terms) angle at the centre, angle in the semi-circle, angle at circumference, cyclic quad, angles in the same segment.

Siza: Now, draw a chord. This is what you must also do in class when you are teaching. Take a child in class to draw a chord.

The above task was collective; almost all the 14 teachers participated. In this task the facilitator showed the teachers how to introduce the cyclic geometry.

8.3.4. Knowledge of Content and Curriculum (Horizon)

According to Ball et al. (2008), the horizon content knowledge is the knowledge of how Mathematics topics are related over the span of Mathematics. Horizon content knowledge in this study goes together with knowledge of content and curriculum because their meaning is the same. The knowledge of content and curriculum is evident in the moderation workshop as well as in the two content workshops. Firstly in the moderation workshop the knowledge of content and curriculum was evident when Mpilo, the Mathematics subject advisor, explained to the teachers the Mathematics tasks for term one and term two:

> If we look at the programme of assessment for grade 12, in the first term grade 12 was having an assignment which was based on the trigonometry. When the learners are doing the assignment, they can refer to their books. But in the investigation, the task for this term, learners are expected to do some research based on the topic done. They must come up with conclusion and their findings. This term they are investigating the functions and their converse. The graph of y $=x^2$ and x $=y^2$ etc.

This observation extract suggests the subject advisor was showing the teachers the arrangements of tasks in the programme of assessment for grade 12. The programme of assessment is organised according to topics in the curriculum (CAPS). In this case the subject advisor articulated the assessment tasks in the Mathematics curriculum.

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Furthermore, the NGO facilitator also equipped the Mathematics teachers with the knowledge of the content and the curriculum. This is evident from the following observation extract.

> Siza: What I always remind teachers, is that for midpoint theorem there is a relation between the base of the triangle and parallel line. However, with the proportion intercept line there is no relation with the base and the parallel line. Its only when we get to similarity that there is a connection between the base and the parallel line. Now if I was doing this with the kids I would not do this at the same time but now I am doing it with teachers.

This quote suggests that the NGO facilitator was showing the teachers the connection across the three topics, namely: midpoint theorem, similarity and proportion intercept. In other words, she was showing teachers that the base of the triangle and the parallel line will not fit into the proportion intercept but it will fit into the similarity.

The findings in these sections suggest that the different types of Mathematics teacher knowledge are learnt in the Mathematics Group. The different types of knowledge were acquired in the NGO workshops, but only curriculum knowledge was the focus of the DBE workshop. There is more focus on the specialized content knowledge although the other three types of knowledge; common content knowledge (CCK), knowledge of content and students/ teaching (KCS/KCT) and knowledge of content and Curriculum (Horizon) are also acquired. This is in line with literature on teacher knowledge that different forms of teacher knowledge may not be easily separable from one another (Brodie & Sanni, 2014, p.190).

The next section discusses the nature of collaborative relationships in the Mathematics Group.

8.4. The nature of collaborative relationships in the Mathematics Group

In this section I will describe the nature of collaborative relationships in the Mathematics Group. The data about the nature of collaborative relationships in the Mathematics Group largely comes from the survey, but I also use the interviews and the observation data to substantiate the findings that emerged from the survey. I describe collaborative relationships under the following classifications which were derived from the survey: collaboration during workshops, extent of collaboration outside of the workshops, and other types of support outside of the workshops.

8.4.1. Kinds of collaborative activities during the workshops

The survey asked about the tasks that mathematics teachers were jointly engaged in during the workshops. The term activity was used according to the teachers' understanding of it, that is, what teachers were doing when they were collaborating during the workshops and not how the term is used in CHAT. The question on kinds of collaborative activities was categorised into five options as shown in Table 28 below. Respondents were at liberty to tick more than one answer, thus the percentages do not add up to 100%.

Kinds of collaborative activities during workshops	Number of teachers using this kind of collaborative activity	Percentage
Working with other teachers to solve problems related to the subject content	14	73.7%
Sharing ideas with other teachers about how to teach particular topic	15	78.9%
Sharing teaching resources with other teachers	9	47.4%
Working with other teachers to go through past exam papers	14	73.7%
Other collaborative activities	1	5.3%

Table 27: Respondents' views on kinds of collaboration during workshops (N=19 teachers)

The survey findings report that 14 of the 19 Mathematics teachers stated that they collaborated with other teachers to solve problems related to subject content. There were also 14 teachers who stated that during the workshops they collaborated with one another to share ideas about how to teach particular topics. The findings further show that 14 teachers responded that during the workshops they worked with one another to go through past examination papers, tests and memoranda. Nine teachers responded that they share teaching resources with other teachers. This implies that 53% of teachers did not share teaching resources with other teachers. The literature on teacher learning communities suggests that teachers act on an on-going basis to develop their KCT, or passion, by sharing individual resources and engaging in critical dialogue (Priestley, Miller, Barrett & Wallace, 2011).

The findings from the three workshops suggest that a lot of collaboration takes place during the workshops. Firstly, the activity system that was facilitated by the subject advisor suggests that teachers collaborated when they were moderating learners' CASS. This kind of

collaboration is in line with the contrived collaboration because CASS moderation is part of the monitoring which is an administrative agenda of the DBE. Secondly, in the two activity systems that were facilitated by the NGO facilitator, teachers were collaborating about how to teach certain topics. In line with Timmis (2014), the two activity systems suggest that collaboration and knowledge creation practices were enculturated in the Mathematics Group. This is evident in the following observation extract:

> Hlengiwe: The way I understood it, it should be half per kg and half per kg is connected with the give information.
>
> Jabulani (lead teacher): Hlengiwe, elaborate please.
>
> Hlengiwe: I am emphasising the point of half half
>
> All teachers: It should be half halfs.
>
> Teacher 2: Guys, lets us come up with constraints and form the equation.
>
> Teacher 1: At most it is represented by 1/2x +1/3y
>
> Teacher 2: Next constraint is 1/2x + 2/3x ≤ 125. This is what confuses learners, let us rather do it on the table for learners not to be confused.
>
> Hlengiwe: Then 5.2, is P= 5x+4y profit

The above observation extract also shows the interaction between teachers about how to teach differentiation in a way that will be easy for the learners. This interaction between teachers suggests interdependence between the teachers which is one of the characteristics of a teacher learning community. According to Priestley et al. (2011), interdependence during collaboration entails dialogue between teachers that strengthens a teacher learning community, and allows change to take account of prior experiences and achievements of teachers. The three teachers that were interviewed reported that they collaborated during the workshops. For example, Bongani spoke about collaboration when he responded to a question which was about the structure of the workshops and the nature of tasks that teachers do during the workshop:

> The facilitator prepares some material for us. With that material she distributes to us, we get into small groups and discuss as educators how we could teach our learners with this material. When we are done we then all combine to discuss the material and come up with ways of how we could teach it to our learners. It's not only about learning a new thing. However, we learn various ways of imparting the material to the learners. So as educators we have various ways of imparting the material to the

learners. From one educator you can learn different ways of imparting the same information in different ways to learners. Although to us it is the same information but the way we teach it to the learner is different. So as a group we end coming up with three different ways of teaching the same information to the learners which is very convenient to the teachers and the learners.

This quote indicates that the 14 Mathematics teachers talk among themselves about teaching strategies and how to use the material which is prepared by the facilitator. This sharing of the resources and working together of the Mathematics teachers seems to be in line with the research literature on teacher learning, which suggests that: "developing new ways of working is achieved through collaborative acts of meaning making and ways of envisaging this as a mediational tool" (Hermansen & Nerland, 2014).

8.4.2. Extent of collaboration outside of the workshops

In this section I look at how often Mathematics teachers say that they collaborate with one another outside of the workshops. The findings show that 47% of Mathematics teachers said that they collaborate with one another at least once a week and 20% collaborate about once a month. A quarter of teachers responded by saying that their collaboration is not very much, as they only meet at workshops. There is 10% of teachers that indicated that they do not meet at all outside of the workshops. The general picture about the extent of collaboration between the Mathematics teachers is that 40% of Mathematics teachers in this group collaborate during the workshops and outside of the workshops at least once a week. The next section will show how these teachers support one another outside of the workshops.

8.4.3. Types of support outside of workshops

The survey findings suggest that Mathematics teachers use various techniques to support one another outside of the workshops. This is shown in Table 29 below:

Type of support outside of the workshops	No. of Respondents	Percentage of Respondents
Share teaching resources like textbooks, worksheets and activities.	11	57,9
Share tests and examination papers	14	73,7
Work together to plan different ways in which to teach particular topics	12	63,2
Work together to design tests and examination	10	52,6
Observe one another teaching in order to develop practice	9	47,4
Moderate each other's learners' tests and assignments	13	68,4
Other	1	5,3

Table 28: Respondents' views about the type of support outside of workshops (N=19)

The findings show that 11 of the 19 participants share teaching resources comprising of textbooks, worksheets and activities, while 13 participants reported that they share tests and examination papers. In addition, 12 participants support each other by working together to plan different ways in which to teach particular topic. There are 10 of the 19 participants who work together to design tests and examination. Interestingly, 9 participants of 19 participants observe one another teaching in order to develop their teaching practice. This is a higher percentage than in the Commerce Teachers' Association. A significant number, 13 participants, support each other by moderating each other's learners' tests and assignments. Lastly, one participant uses other methods.

Collaboration outside of the workshop is further evidenced by the three teachers that were interviewed. Jabulani talks about how they support one another outside of the workshop:

> Yes we do. We keep in contact with each other. For example, if you have a particular problem at your school in terms of the subject content. We go there as members of the group to your school to help out. We once formed a group in 2011 whereby we had to visit each other's schools. That group consisted of only four members. We would go to the other members' school and teach, and then on the next day we would go to the other members' school and teach as well. When we got there we would normally do revision. We would ask for the entire day to do revision with the grade twelve's. We would divide the topics amongst ourselves. We would then take turns when teaching, when the first one is done with a certain topic, the next steps in with a new topic. While the other one is in front teaching, the other three are going around the classroom giving the learners individual attention if they raise their hands of course. That is how we show support to each other. We do not just do it to

the members of the small group we formed but with the other schools of the other members as well. If a member has a problem they ask us to come and they make arrangements with his or her school for our coming.

The above interview extract show how the 14 members of the Mathematics Group who participate in the NGO workshops support one another and they support other teachers who are not members of their group. This collaboration and cooperation shown in the extract seems to be characterised by openness, trust and support among the participating teachers.

8.4. Conclusion

The findings from the historical background of the Mathematics Group in Chapter Seven suggested that the establishment of the group was associated with the DBE. This was further confirmed by the first activity system that was facilitated by the subject advisor. This activity system of CASS moderation was characterised by interaction when teachers were moderating each other's learners' work. The literature on collaborative learning states that learning is not just accomplished through interaction but it is constituted within the interaction of the participants (Timmis, 2014). This means that learning is not just achieved through interaction but it depends on what the interaction is about. It appears that in the DBE workshop, teacher learning was not accomplished fully because there were no practices of Mathematics meaning making taking place in the teachers' interaction.

However, the Mathematics Group, comprising of 14 teachers, nonetheless seems to function as a teacher learning community. This was evident from the several tasks of the two activity systems where the teachers were engaged as learners and the NGO facilitator was being the teacher. Furthermore, there is evidence from the interviews that suggests that some workshops are facilitated by the teachers. This situation suggest that the Mathematics Group operates as a teacher learning community to support teachers in building skills appropriate to changing role as co-learners and facilitators of their learning (Owen, 2014, p.71). These 14 teachers were involved in the decision making about what should be learnt.

The findings on the kinds of knowledge that are learnt in the Mathematics Group suggest evidence of all four kinds: specialized content knowledge (SCK), common content knowledge (CCK), knowledge of content and students/ teaching (KCS/KCT) and knowledge

of content and Curriculum (Horizon). As noted before, not all of these were learnt in the DBE workshop. Lastly, findings on the nature of collaborative relationships suggest that many of the teachers in the Mathematics Group collaborated during the workshops and outside of the workshops in different ways such as sharing teaching resources such as textbooks, worksheets and activities, sharing tests and examination papers, working together to plan different ways in which to teach particular topics, working together to design tests and examination, observing one another teaching in order to develop practice and moderating each other's learners' tests and assignments.

The research literature suggests that when teachers are mandated by education administrators to collaborate in teacher learning communities they may also be mandated to engage only in ways that are perceived to further the service of teaching (Servage, 2009, p. 155). Interestingly, the findings suggest that teachers collaborated by supporting one another with team teaching willingly without being instructed by the NGO facilitator or the subject advisor. This indicates that these teachers have taken ownership of their own learning and development trajectories.

The following chapter brings together the findings from both cases (Commerce Teachers' Association and the Mathematics Group) according to the research questions of this study.

CHAPTER NINE: DISCUSSION OF FINDINGS

9.1. Introduction

The study has used the cultural-historical activity theory (CHAT) to understand how teacher learning occurred in the Commerce Teachers' Association and the Mathematics Group. CHAT in this study was a flexible theory and an appropriate lens which also provided a useful methodological tool through its language of description in terms of analysing and understanding the interactions between various elements within the activity system.

One of the elements of contradictions, a key principle of CHAT is expansive learning. However, in this study, the aspect of expansive learning did not feature within either Mathematics Group or Commerce Teachers' Association. Expansive learning is learning that occurs when subjects involved in a collective activity take action to transform an activity system by reconceptualising the object and the motive of activity, and expanding the previous activity (Engeström, 2003). Thus, the capacity of participants in the activity is expanded to interpret and expand the horizon of the object of activity and enact it in greater depth producing an enriched or new object or outcome (create and come up with a new object of activity).

Expansive learning process did not take place because the teachers did not come up with anything new on their own. While it may not have been possible to create a new object and outcome during the workshops, possibly the teachers created new objects in their classrooms. But given that these teachers were not observed either before or after the workshops, it was not possible to establish the transformative learning or even to see whether or not their teaching practices had changed. Further, given the learning in these workshops was pre-determined, expansive learning related to the stages of the expansive cycle could also not be determined although the cycle could have been used to understand how teacher learning occurred in the Mathematics Group and Commerce Teachers' Association. Concomitant to this, transformative agency was also not evident in this study. Transformative agency involves both the ability of the subject(s) to share enacting the object and their capacity to transform it (Engeström, 2003). In other words, individuals in the activity system transform their understanding of the problematic situation (contradiction) into an abstract form, ascending it as the central contradiction, breaking it up into small components to make it more accessible. Then by addressing the component individually and in the process they

construct a renewed activity. Again such learning did not seem to feature apart from teachers reflecting internalization and externalisation of their learning through different activities that they engaged in during the workshops.

The concepts of internalisation and externalisation were used in relation to the second research question "How does teacher learning happen in the two selected teacher learning communities?" Furthermore CHAT in this study did not have the appropriate language of describing the kinds of teacher knowledge learnt in these two teacher learning communities. Consequently, I looked for a conceptual framework that could complement CHAT and help me understand the kinds of knowledge that teachers gained in from the TLCs. Hence the CHAT model and a teacher knowledge conceptual framework were used to unpack the data and answer the research questions. This chapter has two sections. The first section discusses the findings according to each of the research questions and the themes that emerged from the findings. The second section discusses the implications of this study and possibilities for future research. Finally, the chapter concludes with what can be learnt from this study.

9.2. Discussion of findings of each research question

This section discusses the findings according to each research question in relation to the literature and the Integrated Strategic Planning Framework for Teacher Education and Development (DBE & DHET, 2011). The research questions of the study were:

1. How were the two selected teacher learning communities formed?

2. How does teacher learning happen in the two selected teacher learning communities?

3. What kind of teacher knowledge is learnt in these teacher learning communities?

4. What is the nature of the collaborative relationships in the teacher learning communities?

9.2.1. How were the two teacher learning communities formed?

The Commerce Teachers' Association is an association of approximately 241 Commerce teachers and four subject advisors. The association was initiated by the DBE through the Commerce subject advisors. This was evident from the survey and the interviews data. Even

the formation of the executive committee was organised and coordinated by the subject advisors of Commerce. The main reason for the formation of the association was to address poor performance of learners in Grade 12. In the Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) the subjects' associations are the key role players in the establishment of the PLCs and they can strengthen the PLCs with ideas, content and expertise (DBE & DHET, 2015, p.21). The ISPFTED seems to suggest that the Commerce Teachers' Association is not a PLC but it is one of the role players that should support PLCs (DBE & DHET, 2011).

The Mathematics Group is part of the DBE cluster which is assisted by the NGO in order to improve the teaching and learning of Mathematics in under-resourced areas. The cluster consisted of approximately 25 teachers. However, only 14 teachers were active in the Mathematics Group workshops. The Mathematics Group was formed in line with the administrative purpose of the DBE. One of the South African studies on teachers' clusters reports that teacher' clusters "are characterized by administrative regulation of teacher collaborations, where district officials of DBE provide instructions and set agendas and goals of teacher collaboration" (Jita & Mokhele, 2012, p. 3). The NGO became involved with the Mathematics Group in order to help Mathematics teachers to master Mathematics content knowledge and to make them competent in the teaching of Mathematics in rural schools faced with a shortage of resources.

Leadership in the formation and functioning of TLCs is very essential. The literature highlights that: "through the exercise of leadership and professional judgement, teachers can play an important role in constructing a context that supports innovations" (Butler, Schnellert & McNeil, 2015, p. 4). Distributed leadership was evident both in the Commerce Teachers' Association and the Mathematics Group. In the Commerce Teachers' Association, leadership was distributed to the executive members, comprised of five teachers and subject advisors as ex- officio members. Leadership in the Mathematics Group comprised of the NGO facilitator, the subject advisor, the cluster coordinator and four lead teachers. The group of authors maintain that: "Teachers' liberation from agency concerns seems to depend on the considerable efforts of formal and informal leaders to distribute leadership across the system" (Butler, Schnellert & MacNeil, 2014, p. 22). Teachers' liberation in this context means autonomy in making decisions about what should be learnt Teachers' liberation was evident from the Mathematics Group when the NGO facilitator changed her programme in order to accommodate the teachers' needs to work on the March 2013 Mathematics controlled tests

question papers. There is also evidence that there are workshops that are facilitated by the Mathematics teachers. This situation is in line with the literature which suggests that in a TLC there should be opportunities for members to play new roles such as curriculum leadership, create and share stories of individual and community success (Chow, 2015, p. 303). Furthermore, the findings in Chapter Eight suggest that the NGO facilitator exercises power over Mathematics teachers. This was evident from the horizontal division of labour that prevailed during the enactment of objects during the NGO workshops and also in the autonomy of the Mathematics teachers in deciding what should be learnt.

Leadership in TLCs is important because 'teachers' autonomy during the workshop depends on who is leading or coordinating the workshop' (Butler, Schnellert & MacNeil, 2014, p. 22). The workshops of the Commerce Teachers' Association were facilitated by the external experts such as subject advisors, grade 12 external examination moderators, and examiners. In relation to the facilitators of PLCs the ISPFTED states that in the initial stages, PLCs require substantial external input through a well-trained facilitator such as a subject advisor, to assist teachers to take control of the their own development within a manageable timeframe (DBE & DHET, 2011, p.14). This seems to imply that after the initial stage of the PLC, teachers should take charge of their own professional development. Brodie and Borko (2016) suggest that the ISPFTED statement: "teachers should take control of their own development" means that teachers come together in PLCs as relatively autonomous agents who are able to drive their own learning in communities (Brodie & Borko, 2016, p.11). The findings do not show that Commerce teachers were fully liberated to assume a leading role such as facilitating the workshops and taking charge of their own learning. This was evident from the workshops and meetings organized by the Commerce Teachers' Association, for example the Economics workshop and the election meeting which were coordinated by the subject advisors instead of the chairperson of the association. Furthermore, the facilitators were identified by the subject advisors.

Drawing from Chow's (2015) landscapes of types of leadership in TLCs, the findings points out that leadership in the Mathematics Group functions consistently with the shared leadership. For example the subject advisor and the NGO facilitator exercise power over teachers through autonomous decision-making. The literature clarifies that autonomy does not mean acting freely in isolation, but rather feeling recognised as a valuable part of the whole, which was evident during the Mathematics workshops. In line with the shared leadership style, the study suggests that learning was achieved through leadership

development (Chow, 2015). This is evident from another NGO programme known as the Laptop project programme. This project is facilitated by the lead teachers that are first trained to teach Mathematics using the technology by the NGO facilitator and the lead teachers then train other Mathematics teachers. According to Chow (2015), the shared leadership in TLCs creates growth and empowerment.

Leadership in the Commerce Teachers' Association is distributed amongst the executive committee. However, leadership is not shared in terms of the decision-making process. This was evident from the planning meeting held by executive members, which appeared to facilitate what was already planned by the subject advisors. The centralised decision-making was evident during the executive meeting when the Economics subject advisor announced that the facilitators of the revision workshops had already been identified by subject advisors. This situation appeared as a paternalistic (a top-down) leadership characterised by a "high level of concern for accountability" (Chow, 2015, p. 299) regarding the grade 12 learners' performance. This situation of leadership in the Commerce Teachers' Association seems to be in line with the literature that leadership in PLCs/ TLCs can be a barrier to autonomy in decision-making (Butler, Schnellert & McNeil, 2015, p .4).

Both the Commerce Teachers' Association and the Mathematics Group were formed by the DBE. However, this situation is in contrast with international studies (William, 2007; Hargreaves et al., 2013) that suggest that TLCs are initiated and led by teachers themselves; this may be the reason for the lack of attendance when it comes to the NGO Mathematics Group workshops. The lack of workshop attendance is evident from the two workshops observed; where only 14 teachers attended the mathematics workshop as opposed to the plus minus 25 teachers who are all part of the DBE cluster. Therefore, the formation of both Commerce Teachers' Association and Mathematics Group t is not in line with the formation and initiation of an 'ideal' TLC.

9.2.2. How does teacher learning happen in the two selected teacher learning communities?

This study used cultural- historical activity theory (CHAT) elements and principles to understand how learning occurred in the two cases. The literature on learning communities and cultural- historical activity theory (CHAT) state that "learning occurs when knowledge is externalized and objectified from the individual and groups within an activity system and this

knowledge is then internalized by different members of the activity system" (Imants, 2002, p. 729). This means that the knowledge is first absorbed (internalisation) then externalisation takes place when applying what was learnt.

The findings show that teacher learning in the Commerce Teachers' Association and the Mathematics Group differs. The Commerce teachers were learning a body of knowledge on how to revise with learners from the external facilitators' knowledge and expertise. The workshops organized by Commerce Teachers' Association engaged teachers in conceptual issues; learning for meaning such as the subject content. This was evident from the two Business Studies teachers who reported that the external facilitator was teaching them a new topic from the new curriculum. In terms of learning perspectives, "the formal workshop approach to teacher learning is generally underpinned by a cognitive perspective of learning" (Bertram, 2011, p. 13) which also focuses on individual learning. In this case, the Commerce teachers were then expected to transfer the revision skills and revision questions to their Grade 12 classrooms. From a CHAT perspective, the Commerce teachers learnt by internalising the knowledge from the facilitators which was then expected to be externalised in the classroom situation.

The Mathematics Group case suggests the 14 teachers that were attending NGO workshops learnt by acquiring different types of Mathematics knowledge and skills both as individuals and collectively. Individual learning was evident in one of the NGO workshops where the teachers took part in learning tasks that were aligned to Mathematics content as Grade 10, 11, and 12 learners. These tasks seemed to integrate different types of Mathematics knowledge such as common content knowledge, specialised content knowledge, knowledge of content/students/teaching and knowledge of content and curriculum (horizon). Collective learning was evident when the teachers engaged in group tasks showing how each teacher teaches Mathematics differentiation. In a CHAT context, this means that teachers as subjects were resources for others and at the same time drawing from others as resources. The findings also suggest that the Mathematics Group learnt by observing each other teaching. In relation to teachers observing each other, different types of teacher knowledge are learnt in different spaces. For example, Bertram (2011) highlighted that practical knowledge is often learnt informally from observing colleagues or by asking colleagues about their teaching methods. Therefore, in the Mathematics Group both collaborative and individual learning was promoted, which is in line with CHAT's emphasis on interdependence and relational dimensions.

According to Stoll and Louis (2007), reflective inquiry means that teachers have a thorough conversation about their teaching and learning. The observation findings do not show that Economics teachers were reflecting on their practice during the workshop while the two NGO workshops suggest that the Maths Group were reflecting to a large extent, discussing their current teaching practices and how they experience teaching certain topics such as Mathematics differentiation. From a CHAT perspective this suggests they were learning with and from each other. The literature has highlighted that reflection is one of the core characteristics of PLCs which make them differ from traditional models of professional development. In line with reflective professional inquiry, which includes "dialogue of serious education issues" (Stoll & Louis, 2007, p. 2), Mathematics teachers from a CHAT perspective of relational dimensions, shared their ideas, experiences and challenges in order to support each other. The findings on how teacher learning occurred in the Mathematics Group are consistent with the characteristics of PLCs.

From a CHAT perspective, the findings show that learning in both the Mathematics Group and the Commerce Teachers' Association was in response to the contradictions. For example, in the Mathematics Group the NGO programmes target Mathematics teachers in under-resourced schools in order to improve their competence and confidence in teaching Mathematics. The learning in the Commerce Teachers' Association was directed towards improvement of Grade 12 examination results. In a CHAT context, a subjects/community contradiction occurred within the broad activity system involving learners because of failing in the Grade 12 examination.

Comparing the Commerce Teachers' Association with the Mathematics Group, the findings suggest that learning in the Commerce Teachers' Association is not regular because the workshops seemed to happen once a year and in 2014 there were no content workshops organized by the Commerce Teachers' Association. This failure to organize and run content workshops by the executive committee is a contradiction according to the constitution of the association. Learning in the Mathematics Group is continuous and sustained by the involvement of the NGO facilitator in terms of the funding, resources and workshops.

The findings of this study do not provide evidence of a written vision, hence the shared values and vision of the Commerce Teachers' Association and the Mathematics Group is summarized from the aims and the learning focuses of each case. The aims and focus of learning in the workshops organized by the Commerce Teachers' Association emphasise how

to revise with the learners. This seems to suggest that the shared vision of the Commerce Teachers' Association is the improvement of learners' performance in the Grade 12 results. The learning focus of the Mathematics Group puts more emphasis on the specialised content knowledge of Mathematics and the aim of the Mathematics Group is to improve the teaching and learning of Mathematics by developing teachers' subject knowledge.

It seems that the Commerce teachers learnt by interacting with the facilitator in the workshops. The findings did not show that the teachers were also interacting with each other during the workshops. This is a contradiction from the CHAT perspective which emphasizes learning in collaboration, negotiation and re-negotiation. In the Mathematics Group, the study findings reveal that the mathematics teachers learnt in different ways. They learnt by interacting with the facilitator, and doing the tasks demonstrated by the facilitator, and in addition, they observed each other teaching and they also facilitated the workshops themselves. As shown in Chapter Three, expansive learning is manifested primarily as change in the object of the collective activity. According to Engeström and Sannino (2010) expansive learning requires articulation and practical engagement with inner contradictions of the learners' (in this case its teachers who are learners) activity system. In relation to this study, the contradictions did not lead to expansive learning and there was minimal or no transformative agency

9.2.3. What kind of teacher knowledge is learnt in these two teacher learning communities?

The findings point out that common content knowledge, specialised content knowledge; knowledge of content/student/teaching and knowledge of content and curriculum horizon were learnt. There was more emphasis on the specialised content knowledge.

In line with Brodie and Sanni, (2014) who argue that different knowledge is learnt in different contexts, this study reveals that both the Commerce Teachers' Association and the Mathematics Group learnt different types of teacher knowledge. In terms of teacher knowledge that should be learnt in PLCs, the ISPFTED envisages that PLCs will assist teachers to integrate their own knowledge with the latest researched-based knowledge about content and practice (DBE & DHET, 2011, p. 14). Ball, Thames and Phelps' (2008) domains of teacher knowledge and Hurrel's (2013 supporting questions, were used as an analytical

tool to describe in depth the kinds Mathematics knowledge that was learnt in the Mathematics Group. The teachers learnt different types of Mathematics knowledge as shown in Table 30 below.

Type of Mathematics Knowledge Ball, Thames and Phelps (2008)	Examples
Common Content Knowledge	Teachers must not cancel but teach learners to divide, to cancel is a common error (the facilitator shows teachers how to divide).
Specialised Content Knowledge	How to introduce cyclic geometry (Grade 12)? Modified way to prove the Pythagoras Theorem. Demonstration of using the model the Midpoint Theorem (Grade 10) and Ratios (Grade 11) Demonstration of Proportional Intercept Theorem (Grade 12). Demonstration of Similarities (Grade 12)
Knowledge of Content/ Student Teaching	How to use software, laptop and projector to teach Mathematics. How to use strategies for Midpoint Theorem Learners find it difficult to find a constraint when there is a number. Lesson observation 2013 March Controlled Papers.
Knowledge of Content and Curriculum (Horizon)	Programme of Assessment from the Mathematics Curriculum. Connections across topics from Grade 10 to 12 Connection between Midpoint Theorem, Similarities And Proportional Intercept.

Table 29: Types of Knowledge learnt in the Mathematics Group

Not all of these teacher knowledge domains were learnt in the DBE workshops. The DBE moderation workshop focused on the content and curriculum horizon while the NGO facilitator focused on specialised content knowledge, and other types of Mathematics knowledge such common content knowledge, knowledge of content/student/teaching were tied to specialised content knowledge. For example, demonstrations of proportion, ratios and similarities made a link between Grade 10, 11 and 12 work. This situation shows how the curriculum knowledge was tied to specialised content knowledge.

Grossman's (1990) domains of teacher knowledge were used as a conceptual framework to describe the kind of teacher knowledge that was learnt in the Commerce Teachers' Association. Table 31 below summarises the kinds of knowledge that was learnt in Commerce Teachers' Association.

Types of Teacher Knowledge Grossman (1990)	Examples of learning tasks and topics
Subject Matter Knowledge	Content-Based Economics topics: Perfect market, Monopoly, Oligopoly and Monopolistic competition. Business Study topic: Porters Substantive structure Structure of the examination papers according to the DBE examination guidelines.
Pedagogical Content Knowledge	Knowledge of students' understanding In Business Studies, they learn why it is difficult for learners to understand the topic Porters. They learn how to teach this topic in relation to the learners' environment. Curricular knowledge (curriculum materials) They learn how to choose suitable books for certain topics
General Pedagogical Knowledge	Curriculum and instruction They learn how to use CAPS Learners' and learning Skills to revise with Grade 12 learners Examination expectations Essay writing skills Structure of the question papers Leadership Curriculum Vitae enrichment
Contextual Knowledge	Rural district context, learners have a language barrier, secretary reported that she learnt how to overcome the issue of language barrier when teaching.

Table 30: Types of teacher knowledge that was learnt in the Commerce Teachers' Association

Table 31 shows that all four types of teacher knowledge were learnt in the Commerce Teachers' Association. The emphasis was mostly on general pedagogical knowledge where teachers were taught how to revise with learners.

Considering these two cases, one may conclude that the Commerce Teachers' Association does not make much contribution to the development of content knowledge and pedagogical knowledge as stipulated in the aims of the association. The PCK that is learnt in the Commerce Teachers' Association seems to focus on curriculum knowledge and general pedagogical knowledge. This suggests that learning in the Commerce Teachers' Association is intended to meet the demands of the DBE; that is to improve Grade 12 results. This is also evident as the workshops focussed on Grade 12 teachers. In contrast, learning in the Mathematics Group seems to focus in different types of Mathematics knowledge with more emphasis on SCK. The NGO workshops that were observed focussed on the Mathematics content for Grade 10 to 12.

9.2.4. What is the nature of collaborative relationships in the teacher learning communities?

The findings of this study show that collaboration is understood in different ways by teachers and researchers. The findings suggest that the Mathematics Group collaborated during the workshops and outside of the workshops while the Commerce Teachers' Association seems to collaborate out of the workshops only because the observation findings did not show that they were collaborating during the Economics workshop. Unfortunately, the Accounting and Business Studies workshops were not observed.

Table 32 below summarises the nature of collaborative relations in the Mathematics Group and the Commerce Teachers' Association.

Aspects	Commerce Teachers' Association	Mathematics Group
Kinds of collaborative tasks during workshops	Working with other teachers to solve problems related to subject content. Sharing ideas about how to teach particular topics Sharing resources with other teachers. Working with other teachers to go through past exam papers. Moderate each other's CASS.	Working with other teachers to solve problems related to subject content. Sharing ideas about how to teach particular topics Sharing resources with other teachers. Working with other teachers to go through past exam papers. Moderate each other's CASS.
Extent of collaboration	6.9% meet once a week 5.2% do not meet 34.4% do not meet very often but meet in the workshops.	45% meet once a week 20% meet once a month. 25% of 19 teachers do not meet very often but meet in the workshops
Types of support outside of the workshops	Share teaching resources. Share tests and examination papers Work together to plan different ways in which to teach particular topics Work together to design tests and examination. Moderate each other's learners' tests and assignments	Share teaching resources Share tests and examination papers Work together to plan different ways in which to teach particular topics Work together to design tests and examination Moderate each other's learners' tests and assignments Observe each other teaching Use Team teaching Teach each other how to teach Teach Mathematics with a laptop

Table 31: Comparative summary of the nature of collaborative relationships in the Commerce Teachers' Association and the Mathematics Group

The data in Table 32 comes from the survey that was undertaken after realising that the interviews and observation provided minimal data on the nature of collaborative relationships outside of the workshops. Table 32 shows that collaborative tasks during the workshops are the same in both cases. This is in tandem with CHAT, where learning through engagement in collaborative activity is central to the perspective. However, there was no evidence from the

Economics workshop that suggests that teachers were exchanging their ideas and resources such as question papers. Only the facilitator was interacting with teachers by using questions and he came with resources comprised of questions from the past question papers and power point notes. From a CHAT perspective, the past exam papers and power point, including the facilitator's knowledge and experiences were the mediational means that promoted learning. The findings in Table 32 suggest that teachers support each other outside of the workshops. The final difference between them is lesson observation and team teaching that only takes place in the Mathematics Group. According to Hargreaves et al. (2013), this situation seems to relate to professional reflective practice. The 14 Mathematics teachers reflected on their own practice and how to improve it. Considering that the Mathematics Group was initiated by the DBE, and so one could expect more contrived collegiality and mandated collaboration, the learning situation in the Mathematics Group seems to be in contrast with the international literature. Servage, (2009) says that in mandated collaboration teachers are expected to further science of teaching.

Another key issue from the findings are the resources. In CHAT, resources are known as the mediating artefacts used by subjects (teachers) to enact the objects. A shortage of support in terms of funding was reported as the major challenge or contradiction in the Commerce Teachers' Association. The association depends on the membership fees from each teacher which are used to cover the expenses of the external facilitators. However, one may not say the shortage of collaborative learning is due to the shortage of funding because collaboration can be informal. This seems to be a key difference that makes the Mathematics teachers collaborate more. The additional resources such as Mathematics rooms in their schools, furnished with resources and laptops for the Mathematics teachers, enabled them to collaborate more and perhaps it is rather that the resources supported collaboration. In relation to collaboration in a TLC, Chow (2015) argues that in order to enable in a collaborative learning and knowledge sharing community there should be adequate infrastructure for team learning.

The Mathematics Group has an adequate infrastructure such as laptops and projectors which are the material/physical mediational tools that are used to learn how to teach Mathematics with technology. Opfer and Pedder (2011) note that the types of materials that teachers use while learning, the coherence of learning tasks to their daily work, and the pedagogical processes that teachers engage in while learning, all contribute to the effectiveness of learning. Within the CHAT framework learning in collaborative activity is mediated by

material resources. Furthermore, the venue that is used for the workshops within the circuit has necessary resources convenient for team learning. For example, there are two communicating white boards, one was used by the facilitator and the second one was used by the teachers when shared how to solve a Mathematics problem. Furthermore, the Maths teachers have Mathematics rooms in their schools with Mathematics facilities provided by the NGO institution and teachers get money for the transport.

Literature on professional development suggests that "teachers need time to develop, absorb, discuss and practice knowledge, which implies that activities that effectively result in professional learning need to be sustained and intensive than brief and sporadic" (Opfer & Pedder, 2011, p. 384). However, the workshops of the Commerce Teachers Association were not regular. The workshop and meetings of the Commerce Teachers' Association were held in a "ritualistic fashion" (Hargreaves et al., 2013, p. 31). This means that workshops seem to be in line with the training model (traditional model of professional development) where teachers come to a central venue and the expert facilitates what needs to change. In this case, it was teaching teachers how to revise with Grade 12 learners in order to improve Grade 12 performance in the final examination. This situation is also in contrast with the literature on learning communities that states that "successful networks are flexible responsive to the needs of their participants and continually learning and reinventing in themselves" (Lieberman, 2000, p. 223).

On the other hand, the Mathematics Group has regular workshops facilitated by the NGO facilitator. These workshops take place twice per term within the circuit. In addition, there are workshops that take place during the holidays, out of the circuit in the NGO institution. The findings on the historical background and formation of the Mathematics Group have highlighted that the DBE cooperated with the NGO facilitator, the teachers and the principals of the schools to schedule the workshops. These findings are consistent with the literature on collaborative design that says "all stakeholders (teachers and administrators) and professional learning facilitators should take note of the reality that collaborative learning practices take time, therefore time should be allocated in order to allow teachers to share their ideas and provide opportunities for negotiating between different perspectives and meaning" (Voogt et al., 2015, p. 262). In addition, CHAT also emphasises interaction, negotiation and renegotiation in the process of collective learning in activity. Therefore, time is a crucial mediational means that affects the functioning of a TLC. In the South African context the issue of time for professional learning activities is further highlighted by Brodie and Borko

(2016) when they say that time is necessary for on-going systematic professional learning. Therefore, if PLCs are to take hold in South Africa there should be ways to provide time for professional learning.

While the international studies suggest that PLCs that are initiated by teachers are more effective than those PLCs that are initiated by the administrators (William 2007), this study suggests that the Mathematics Group, a DBE- initiated group seems to have created a collaborative culture. The findings concur with Jita and Mokhele (2014) that clusters can promote lasting collaboration, helping teachers to share and champion a more decentralised curriculum, or instruction. In this study, I therefore argue that the issue of who initiated the TLC is not a determining factor of its functional effectiveness. What is more critical is the leadership, as well as autonomous decision-making regarding what should be learnt, how it should be learnt and the size of the group. Regarding effective teacher learning, Hertzberg and Roe (2016) note that:

> Teachers learn best when they are involved in the activities: (a) that focus on instructions and students' learning in the setting in which they teach, (b) are sustained, continuous, rather than episodic. (c) provide opportunities for teachers to collaborate with colleagues inside and outside the school, (d) reflect teachers' influences about what and how to learn, and help teachers develop theoretical understanding of the skills and knowledge they need to learn (Hertzberg & Roe, 2016, p. 573).

This quote relates to learning that is out of the school context. This quote supports the DBE and DHET (2011) whose focus is on the PLCs that are within the school context. The above-mentioned learning conditions were mostly found in the Mathematics Group rather than in the Commerce Teachers' Association. However, the question that remains unanswered about the Mathematics Group is "will the Mathematics Group be sustained in terms of these learning conditions when the NGO's support ceases?

The next section presents the implications of this study and possible future research options.

9.3. Concluding summary and Implications of this study and future research

Besides the findings of this research, I would like to end by highlighting my own learning experience in these two cases and recommendations thereof. When I started this study, I believed that the Commerce Teachers' Association was a teacher learning community that

was initiated by teachers. After reviewing the local and international literature on TLCs and PLCs, I found that not all cluster or groups of teachers can be regarded as TLCs or PLCs and that these groups do not necessarily support engaged teacher learning.

When looking at the Commerce Teachers' Association and the Mathematics Group as two systems, the CHAT enabled me to understand the interplay of a variety of systems and cultures. The subjects that I focused on were Commerce and Mathematics teachers who were directly involved, and engaged in the activities (workshops). The aim of the workshop was to enact the object, for example teachers learning to revise content with learners or learning the Mathematics content. The psychological tools were primarily knowledge, expertise, and language. The physical tools were the resources such as hand-outs, smart boards, power point presentations and the Laptop project. The workshops were shaped by rules: some were subject based such as the Pythagoras Strategy for the Mathematics Group and the election rule for the Commerce Teachers' Association.

The workshops and meeting activities involved different people working in different capacities. The labour was both vertical (e.g. subject advisors in Commerce determined the dates and facilitators of the workshop. Mathematics subject advisor co-ordinated the moderation) and horizontal division of labour was shown when the subjects and the community member (NGO facilitator, Mathematics subject advisor) act on an equal level to the Mathematics teachers). The findings revealed that often associations that are formed and led by the DBE may not last once the authority withdraws.

Although CHAT was a useful and appropriate theoretical lens with its language of description in terms of analysing and understanding the interactions between various elements within the activity system, it did not have the language to describe the kinds of knowledge that were learnt in the two TLCs. Hence, the theory of teacher knowledge was used to complement CHAT. As shown earlier in this chapter CHAT was very useful to explain who is doing what in the workshops. This was made possible by the seven elements of CHAT.

Consistent with Yin (2009), this study has used the case study approach which has allowed in-depth, multifaceted exploration of two cases within their real –life context. This study enabled me to gain insight into how Commerce teachers in a district and Mathematics teachers from a circuit learn when they are together both in a workshop, and outside of the workshop. However, the findings of this study cannot be generalized because of the small

number of the participants. However, there can be theoretical insight due to the in-depth nature of the data analysis.

This study investigated how teacher learning occurs in two TLCs. According to Butler, Schnellert and McNeil (2015), professional development should promote meaningful change in the classroom level. The limitation of this study is that it did not investigate whether teachers' instructional practices changed after learning collaboratively during the workshops, and outside of the workshops. It is important to understand how knowledge was transferred to the classroom situation. Therefore, the outcome of the activity systems was incomplete because teachers were not traced back to their classrooms to observe how knowledge was transferred to the classroom situation. Future research might use the fourth generation of CHAT which focussed on identity, to find out how teachers change and how they utilise different types of knowledge after learning in a TLC. Furthermore the expansive learning cycle might be used as lens to understand if teachers developed certain models such as lesson plans after learning in the workshops.

The empirical findings and the literature review of this study suggest that PLCs have not yet been formed as envisaged by the ISPFTED, but some subject clusters outside of the schools, and groups within the schools, are operating like PLCs. The functioning of the Mathematics Group concurs with the findings of studies undertaken by Jita and Mokhele (2014) in the South African context, that clusters could constitute a special learning community committed to discussing and planning. Such TLCs that are outside of the school context are still rare in South Africa. The DBE and DHET still have a task to advocate TLCs because little is known about them. Teachers in general seem to be unfamiliar with TLCs/PLCs as a model of professional development.

The findings of the study suggest that the Mathematics Group reflected many of the characteristics of a TLC, while the Commerce Teachers' Association did not. This is probably due to the smaller number of teachers, and more regular meetings. Maistry (2005) contends that sustaining TLCs over time is a challenge. Perhaps follow up studies could look at factors that can facilitate formation, effectiveness, popularity of TLCs formed and run by teachers with the support of the DBE and also, whether or not the Mathematics Group can be sustainable when the NGO pulls out its support.

Certain concepts such as community, activity and collaboration had limitations in this study. The findings reveal that there is gap between the understanding of concepts used by researchers and teachers. Future research might explore these gaps.

The findings from the Mathematics Group show that the subject clusters can operate as TLCs where teachers can share their personal professional practices other then meeting moderation and curriculum reforms, and the matric intervention programmes facilitated by the DBE. It is likely that the Mathematics groups reflected more characteristics of a TLC due to the small size of the group. It is recommended that the Commerce Teachers' Association could break into smaller groups on their own and that teachers decide on what they want to learn. It appeared that it was difficult for teachers to propose divergent ideas in the workshops when their authorities (subject advisors) are in the dominant position. It also appeared as if some teachers did not see the need to contribute during the workshops because the subject advisors were seen as the 'experts'. It is for these reasons that I suggest that Commerce teachers could break into small groups initiated by teachers. Ideally, teachers should take ownership of their groups. It must be noted that TLCs can be formal or informal, and can be initiated by teachers themselves without an involvement of the education administrators.

The DBE should provide supportive conditions which cater for the resources and time to meet and talk. This study has shown that physical proximity of schools to one another is a barrier for regular meetings and workshops for teachers. The schools are far from one another so even informal meetings of teachers can be a challenge. The online learning communities can be an ideal solution in a rural district. The online learning communities can solve time issue because teachers can use their cell phone to interact with one another even after hours.

9.4. Conclusion

This research study investigated how teacher learning happens in two TLCs. The study findings suggest that neither the Commerce Teachers' Association nor the Mathematics Group were initiated by the teachers themselves, but were initiated by the DBE. The findings have shown that the Mathematics Group, with support from all stakeholders, was able to sustain and   promote teacher learning in the workshops and outside of the workshops. On the other hand, Commerce teachers were able to learn in the workshops although the Commerce Teachers' Association lacked support in terms of resources that could sustain teacher learning both in the workshops and outside of the workshops. Although the findings of this study cannot be generalized, the findings suggest that teacher learning in TLCs that are in

developing rural contexts might be possible when the DBE, NGOs, teachers and schools play a meaningful role, as shown in the above section 9.2.4, (a) to (d) to achieve teaching and learning. In other words, all the stakeholders should support the TLCs.

This study has used two different teacher knowledge conceptual frameworks (Ball, Thames & Phelps, 2008; Grossman, 1990). Grossman (1990) was used to describe the teacher knowledge learnt in the Commerce Teachers' Association. The findings have shown that in this case, subject matter knowledge was learnt, PCK, general pedagogical knowledge, and contextual knowledge but there was more emphasis on curriculum knowledge and general pedagogical knowledge. However, Grossman (1991) could not be used to describe the knowledge that was learnt in the Mathematics Group because of the nature of the data collected from observations, interviews, surveys and documents analysis, which was more Mathematical in nature. The findings show that common content knowledge specialised content knowledge; knowledge of content/student/teaching and knowledge of content and curriculum horizon were learnt. There was more emphasis on the specialised content knowledge.

The findings suggest that the Mathematics Group collaborated during the workshops and outside of the workshops while showing that the Commerce Teachers' Association seemed to collaborate out of the workshops only. This was because the observation findings did not show that they were collaborating during the Economics workshop. However the Accounting and Business Studies workshops were not observed and it is possible that there may have been collaboration found there.

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Appendices

Appendix A: Ethical Clearance Letter

UNIVERSITY OF ™
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI
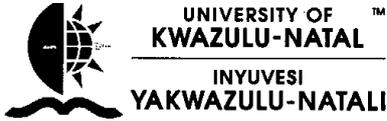
14 February 2013

Mrs Bongiwe Zulu 207526298
School of Education
Pietermaritzburg Campus

Protocol reference number: HSS/0075/013D
Project title: A case study of teacher learning in three teacher learning communities in KwaZulu-Natal.

Dear Mrs Zulu

Expedited Approval

I wish to inform you that your application has been granted Full Approval through an expedited review process.

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

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

Yours faithfully

Professor Steven Collings (Chair)
/px

cc Supervisor Dr Carol Bertram
cc Academic leader Dr MN Davids and Dr R Mudaly
cc School Administrator Ms Bongekile Bhengu

Professor S Collings (Chair)
Humanities & Social Sc Research Ethics Committee
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 3587/8350 **Facsimile:** +27 (0)31 260 4609 **Email:** ximbap@ukzn.ac.za / snymanm@ukzn.ac.za

ounding Campuses: ■ Edgewood ■ Howard College ▪ Medical School ■ Pietermaritzburg ■ Westville

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Appendix B: Interview Schedule

INTERVIEW SCHEDULE

Title: TEACHER LEARNING: A CASE STUDY OF TWO TEACHER LEARNING COMMUNITIES IN KWAZULU-NATAL

Thank you so much for being available for an interview. You have signed a consent form, so you are aware that this project is part of my studies at UKZN. Everything that you say will be kept confidential. The interview should take 60 minutes

A BIOGRAPHIC QUESTIONS

1. How old are you?

2. How long have you been teaching?

3. What subject(s) and grades are you teaching and how long have you been teaching this/ these subject(s)?

4. Were you trained to teach these subjects?

B FORMATION AND MEMBERSHIP OF TEACHER LEARNING COMMUNITY

5. Do you belong to any teacher learning community? If yes tell me its name and when it was formed?

6. Who initiated the formation of this teacher learning community and why was it formed?

7. Who are the members of this teacher learning community? How were these members invited to join the group?

8. What is your portfolio in your teacher learning community?

9. When do you meet?

10. What sustain the functioning of this teacher learning community in terms of resources and funding?

C TEACHER LEARNING AND KNOWLEDGE CONSTRUCTION

11. What do you understand by the term teacher learning?

12. Is there a learning that takes place in this learning community? If yes how does it happen? What are you learning? What are the activities that teachers do if there are any? Who facilitate this learning?

13. How useful or not useful is the learning that takes place in your teacher learning to your teaching practice? (Why?)

14. Who pre-determined what should be learnt in your teacher learning community?

15. Describe other learning experience that you have experience in your teacher learning community. Who pre-determined it? Who facilitated it? What were activities? What was the focus? What were the resources that were used and who provided them?

D NATURE OF COLLABORATIVE RELATIONSHIP IN THE TEACHER LEARNING COMMUNITY

16. How do you describe the relationship between teachers in this teacher learning community?

17. Who is leading the teacher learning community how was she/he chosen?

18. How do you feel about yourself regarding learning in your learning community? Does it improve the sense of being a professional? (Explain)

19. What does it mean for you to say that your teacher learning community is a professional learning community?

Thank you

Appendix C: Questionnaires for Mathematics Group and Commerce Teachers' Association

Collaboration and networking activities in the Mathematics Group.

Please tick next to the closest answer:

Questions		Tick here
1. What gender are you?	Female	
	Male	
2. In which age range are you?	20-30 years	
	31-40 years	
	41-50 years	
	Above 50 years	
3. Which grade are you currently teaching?	Grade 10	
	Grade 11	
	Grade 12	
4. Did you study this subject in your teaching diploma or undergraduate degree?	Yes	
	No	
5. How long have you been teaching?	1-5 years	
	6-10 years	
	11-20 years	
	20-30 years	
	More than 30 years	
5. What are your professional teaching qualifications?	Professional Diploma e.g. SSTD	
	B.A or BSc + PGCE	
	B. Paed or BEd	
	BEd Hons	
	Other (please specify)	
6. How long have you been a member of Mathematics Cluster?	Not a member	
	1 year	
	2 years	
	3 years	
	4 years	
	5 years	
	6 years	

7. If you are a member, why did you join?	To develop my content knowledge in my subject	
	To meet with, and be supported by other Mathematics teachers	
	To get useful resources to help me in my teaching	
	Other (please specify)	

8. How many workshops initiated by the NGO have you attended since you joined the cluster? _____

9. In the table below, please provide details of those workshops.

Subject	Date and facilitator of the workshop	What was the objective or purpose of the workshop?	What did you learn?

10. What kind of collaborative activities took place during the workshops?	Working with other teachers to solve problems related to the subject content	
	Sharing ideas with other teachers about how to teach particular topics	
	Sharing teaching resources with other teachers	
	Working with other teachers to go through past exam papers and tests, and memoranda	
	Other (please specify)	

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11. To what extent do you collaborate with Mathematics colleagues outside of the workshops?	At least once a week	
	About once a month	
	Not very much, we only meet at workshops	
12. How do Mathematics colleagues support one another outside of the workshops?	We share teaching resources like textbooks, worksheets and activities.	
	We share tests and exam papers	
	We work together to plan different ways in which to teach particular topics	
	We work together to design tests and exams	
	We observe one another teaching in order to develop our practice	
	We moderate each other's' learners' tests and assignments	
	Other (please specify)	
13. Do you think Mathematics workshops are run by the NGO facilitators DBE or by Maths teachers?	Subject advisors in the DBE	
	NGO facilitator	
	Both DBE and NGO	
	Maths teachers, NGO and the DBE	
14. What is the most valuable learning opportunity that Maths Cluster offers you as a Maths teacher?		
15. What other learning opportunities do NGO Mathematics project offers to you?		

Thank you for your time.

Research Project: Teacher Learning: A case study of two teacher learning communities in KwaZulu-Natal

Collaboration and networking activities in Commerce Teachers' Association

Please tick next to the closest answer:

Questions		Tick here
1. What gender are you?	Female	
	Male	
2. In which age range are you?	20-30 years	
	31-40 years	
	41-50 years	
	Above 50 years	
3. Which subject are you currently teaching?	Accounting	
	Business Studies	
	Economics	
4. Did you study this subject in your teaching diploma or undergraduate degree?	Yes	
	No	
5. How long have you been teaching?	1-5 years	
	6-10 years	
	11-20 years	
	20-30 years	
	More than 30 years	
6. What are your professional teaching qualifications?	Professional Diploma e.g SSTD	
	B.A or B.Comm + PGCE	
	B. Paed or BEd	
	BEd Hons	
	Other (please specify)	
7. How long have you been a member of Commerce Teachers' Association?	Not a member	
	1 year	
	2 years	
	3 years	
	4 years	
	5 years	

	7 years	
8. If you are a member, why did you join?	To develop my content knowledge in my subject	
	To meet with, and be supported by other Commerce teachers	
	To get useful resources to help me in my teaching	
	Other (please specify)	

9. How many workshops initiated by the Commerce Teachers' Association have you attended since you joined the association? _____

10. In the table below, please provide details of those workshops.

Subject	Date and facilitator of the workshop	What was the objective or purpose of the workshop?	What did you learn?

11. What kind of collaborative activities took place during the workshops?	Working with other teachers to solve problems related to the subject content	
	Sharing ideas with other teachers about how to teach particular topics	
	Sharing teaching resources with other teachers	
	Working with other teachers to go through past exam papers and tests, and memoranda	
	Other (please specify)	
12. To what extent do you collaborate with commerce colleagues outside of the	At least once a week	
	About once a month	

workshops?	Not very much, we only meet at workshops	
13. How do commerce colleagues support one another outside of the workshops?	We share teaching resources like textbooks, worksheets and activities.	
	We share tests and exam papers	
	We work together to plan different ways in which to teach particular topics	
	We work together to design tests and exams	
	We observe one another teaching in order to develop our practice	
	We moderate each other's' learners' tests and assignments	
	Other (please specify)	
14. Do you think Commerce Teachers' Association is run by the DBE or by Commerce teachers?	Subject advisors in the DBE	
	NGO facilitator	
	Both teachers and the DBE	
15. What is the most valuable learning opportunity that Commerce Teachers' Association offers you as a Commerce teacher?		
16. What other learning opportunities would you like Commerce Teachers' Association to offer you?		

Thank you for your time.

Appendix D: Informed Consent Documents for Interviews and Questionnaires

INFORMED CONSENT DOCUMENT

PhD research project: TEACHER LEARNING: A CASE STUDY OF TWO TEACHER LEARNING COMMUNITIES IN KWAZULU-NATAL.

The aim of this study is to explore teachers learning in professional learning communities. In this study I aim to contribute to the development of knowledge about how teachers learn collaboratively in learning communities such as subject associations. The research project form part of my studies. The research project is supervised by Dr Carol Bertram a Senior lecturer at the School of Education and Dr Tabitha Mukeredzi in the University of KwaZulu-Natal.

You have been identified to participate in this interview session as a member of the learning community. I would like to conduct interview with you. The interview should last approximately 45- 60 minutes. I will record your views in writing and tape record the interviews. The data will be anonymous; it will be not possible for it to be linked to your name or your learning community. You will not be disadvantaged if you choose not to participate or if you choose to leave or withdrew from the study. For any other information regarding this study feel free to contact my supervisor Dr Carol Bertram at UKZN; Tel 0332605349.

Thank You

Bongiwe Zulu _____   Date_____

Consent form for Questionnaires (Mathematics Group)

I am a PhD student at the University of KwaZulu Natal. I am researching teacher learning activities in teachers' subjects associations and clusters. Kindly respond to the following questions about collaboration and networking in Mathematics Cluster with Mathematics Non-Governmental Organisation (NGO) in your circuit. Your participation in this research is voluntary and your answers will be confidential. You responses will help us to understand the role that NGO plays in teacher professional development.

Please sign the Consent Form below if you are willing to participate in the study by answering the Survey questions overleaf.

 Thanking you in anticipation.

Bongiwe Zulu

_____

Consent Form

I --, fully understand the conditions of participating in this study and agree to be a participant. I understand that the data will be confidential.

Signed: -------------------------------- Date: ----------------------------

Consent form for Questionnaires (Commerce Teachers' Association)

I am a PhD student at the University of KwaZulu Natal. I am researching teacher learning activities in teachers' subjects associations and clusters. Kindly respond to the following questions about collaboration and networking in Commerce Teachers' Association. Your participation in this research is voluntary and your answers will be confidential. You responses will help us to understand the role that Commerce Teachers' Association plays in teacher professional development.

Please sign the Consent Form below if you are willing to participate in the study by answering the Survey questions overleaf.

 Thanking you in anticipation.

Bongiwe Zulu

_____

Consent Form

I --, fully understand the conditions of participating in this study and agree to be a participant. I understand that the data will be confidential.

Signed: -------------------------------- Date: ----------------------------

Appendix E: Request for Permission from the Department of Basic Education

P.O. Box 516
Camperdown
3720
22 October 2012

The Head of Department: Doctor
KwaZulu-Natal Department of Education
Private Bag x 9137
Pietermaritzburg
3200

Dear Sir

<u>Request for conducting Research in Zethembe District</u>

Proposed Topic: Teacher Learning: A case study of two teacher learning communities in KwaZulu-Natal.

My name is Bongiwe Zulu a teacher at the above mentioned school. Currently I am pursuing doctoral studies in Education at the University of KwaZulu-Natal. I kindly request permission to conduct research on teacher learning in teacher learning communities in Zethembe District in 2013. I am trying to get a deeper understanding of how teacher learning happens in teacher learning communities that are in the rural context. The study requires me to observe meetings of three teacher learning communities and interview three teachers from each teacher learning community after the observation session.

All the information obtained will be kept confidential from other people and locked up at a facility storage unit in the University of KwaZulu-Natal where it will be destroyed after five years. I will make up pseudonyms for confidentiality reasons. Participation of teachers in this study is voluntary and they may withdraw without any disadvantage to them. The research project is supervised by Dr Carol Bertram and Dr Tabitha Mukeredzi at UKZN.

For any other information about the proposed study feel free to contact my supervisors:
Dr Carol Bertram and Dr Tabitha Mukeredzi
School of Education
Senior Lecturer
University of KwaZulu-Natal
Pietermaritzburg Campus
Private Bag X01
Scottsville 3209
Tel: 033 260 5349

Thanking you in advance.
Yours sincerely,
Bongiwe Zulu (Mrs)

Appendix F: Permission from the Department of Basic Education

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Sibusiso Alwar	Tel: 033 341 8610	Ref.:2/4/8/346

Mrs B Zulu
PO Box 416
HAMMARSDALE
3700

Dear Mrs Zulu

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **A CASE STUDY OF THREE TEACHER LEARNING COMMUNITIES IN KWAZULU-NATAL,** in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 01 April to 30 November 2013.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Mr. Alwar at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report / dissertation / thesis must be submitted to the research office of the Department. Please address it to The Director-Resources Planning, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education as per attached list.

Nkosinathi S.P. Sishi, PhD
Head of Department: Education

2013|04|25
Date

KWAZULU-NATAL DEPARTMENT OF EDUCATION

POSTAL: Private Bag X 9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa

PHYSICAL: 247 Burger Street, Anton Lembede House, Pietermaritzburg, 3201. Tel. 033 3921053 Fax. 033 3922616

EMAIL ADDRESS: Slindile.hadebe@kzndoe.gov.za; CALL CENTRE: 0860 596 363;

WEBSITE: WWW.kzneducation.gov.za

...dedicated to service and performance
beyond the call of duty

Appendix G: Turnitin Certificate

Bongi Zulu PHD thesis Jan 2017

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