MANAGING THE PROFESSIONAL DEVELOPMENT OF PRIMARY SCHOOL TEACHERS BY MEANS OF ACTION RESEARCH

by

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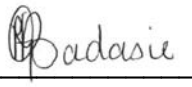
DECLARATION

I declare that MANAGING THE PROFESSIONAL DEVELOPMENT OF PRIMARY SCHOOL TEACHERS BY MEANS OF ACTION RESEARCH is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.



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SUMMARY

In the climate of poor student achievement and a lack of skilled teachers in natural science and mathematics, the main research question of this study was: *How can the professional development of primary school teachers be managed by means of action research?* The aim of the study was to develop, implement and evaluate a site-based collaboration programme to promote the professional development of the teachers in these subjects within a home-based or semi home-based teaching context. The theory of situated learning within a community of practice (CoP) was used as conceptual framework.

Purposeful and convenient sampling was implemented to select participants. Five grade 4 teachers, five grade 5 teachers, four grade 6 teachers and eight members of the school management team participated in the three year study. During the planning phase a needs analysis was done. During the action phase, lead teachers were responsible for the planning in one or two subjects. The teachers met once every six school days (about 30 meetings per year), for up to two hours to discuss content and methodological issues, plan assessment strategies, analyse and reflect on results and decide on intervention strategies. The grade 4, 5 and 6 groups completed six, four and two action research cycles respectively, and the school management team six action research cycles of about six months each.

To evaluate the professional development that resulted, data collection was by means of observation, field notes, typed minutes, four focus groups, 12 individual interviews, teachers' files, a questionnaire and students' books and achievements. The results indicate that the professional development of primary school teachers could be managed and constantly improved by means of action research. When school managers organise teachers into communities of practice and implement action research cycles, the teachers learn in a context-sensitive way. This learning is characterised by two social stages involving participation in the subject and grade CoP, and an independent stage of personal involvement when teachers internalise

knowledge and practices of other teachers. The professional development of the teachers was in the areas of content knowledge, pedagogic content knowledge, assessment literacy and professional attitudes. Student achievement improved.

KEY WORDS

- Professional development
- Primary School
- Action research
- Community of practice
- Situated learning
- Socio-constructivist learning
- Mathematics
- Natural Science

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LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency syndrome
ANA	Annual National Assessment
CGI	Cognitively Guided Instruction
CoP	Community of Practice
DoE	Department of Education
ELRC	Educator Labour Relations Council
E = MCA2	E – Efficacy, M – Motivation, C – Capacity, A – Assistance, A – Accountability
GDE	Gauteng Department of Education
HIV	Human Immunodeficiency Virus
HoD	Head of Department
HSOM	High Schools on the Move
ICT	Information and Communication Technology
IMA	Integrated Mathematics Assessment
IQMS	Integrated Quality Management System
OBE	Outcomes-Based Education
PCK	Pedagogic Content Knowledge
PLC	Professional Learning Community
QUASAR	Qualitative Understanding: Amplifying Student Achievement and Reasoning
SGB	School Governing Body
STAAR	Supporting the Transition from Arithmetic to Algebraic Reasoning
TASS	Teaching All Secondary Students
TCAR	Teacher Collaboration Assessment Rubric
TCIF	Teacher Collaboration Improvement Framework
TBI	Teaching to Big Ideas
TIR	Teacher’s Intellectual Resources

UNIVEMALASHI	An acronym used for a stakeholder partnership project between the Limpopo University, the schools in the Malumele district and the Shingwezi College of Education in the Limpopo province.

CHAPTER ONE

OVERVIEW AND RATIONALE

1.1 INTRODUCTION AND BACKGROUND

The teaching profession in South Africa is facing many challenges, one of which is the problem of teacher supply and demand. On the one hand we have a high attrition rate (Matomela 2010:1). Some of the reasons cited for teachers “leaving in droves” include low salaries, continuous curriculum changes, poor student discipline, overcrowded classrooms, corruption, lack of resources and lack of parental involvement (Matomela 2010:1-2; Nesane 2008:3). Some teachers are lost to the profession due to the mortality rate associated with HIV/AIDS (Afrol News 2010:1; Bennell 2005:1-4). Teachers give many years of service but have to retire at some stage and are lost to the profession in this way. Lastly, no country and no profession are untouched by the forces of globalisation. South Africa, like many developing countries, is faced with the migration of homebred professionals to developed countries (Manik 2009:1).

In addition to the above, the number of newly qualified teachers entering the teaching profession from colleges and universities supply less than a quarter of the teachers who are required in South Africa (Ramasehla 2009:5). This problem is captured in the following statistic taken from an article in the Business Report quoting Azar Jammine, the then chief economist at Econometrix: "Just to stay where we are, we need 21 000 new teachers each year but only 5 000 come on stream” (in Hazelhurst 2007:1).

With high attrition rates and low recruitment levels, South Africa does not have a sustainable system of teacher supply and demand. Special concern revolves around the great shortage of qualified teachers in the subjects of mathematics and science (Adler 2002:9; Clewell & Villegas 2001:vi; Kriek & Grayson 2009:1; Oliver, McConney

& Maor 2009:6; Stevens undated:8). However, students' school enrolment continues each year and is unlikely to be kept on hold before the teacher supply issue has been solved.

The problem of a shortage of teachers in South Africa is exacerbated by the problem of lack of quality learning outcomes as evident in the poor grade 12 pass rates in secondary schools and the Annual National Assessment (ANA) results in primary schools. In 2009 the grade 12 pass rate dropped 2% since 2008 and saw two out of every five students who wrote failed (Reyneke, Meyer & Nel 2010:2; Venter 2010:1). The Literacy / English results in Gauteng revealed the following: (i) Over half of the grade three students were achieving a literacy result below 50 percent. (ii) In grade 6, 60 percent of the students were not reaching the minimum curriculum standard in language (Gauteng Department of Education [GDE] 2010:6).

Among the many factors attributed to low pass rates are poorly or unqualified teachers (Venter 2010:1) and teachers with limited content knowledge, ineffective teaching approaches and unprofessional attitudes (Kriek & Grayson 2009:1). In a press release by Motshekga (2010), Minister of Basic Education, the following problems were highlighted: Teachers lacked the required subject knowledge, they were not teaching what they were trained to teach; and they were found lacking in their commitment to teach for six-and-a-half hours every day.

Poor school results (as mentioned above), has led to a scrutiny of the curriculum, the teachers, the school leaders and the education system as a whole and has ushered in a greater era of accountability (Adler 2002:5). According to Bush and Glover (2009:11-12), despite the global trend towards devolved, or school-based management, schools are increasingly subjected to local or national guidance and are expected to be accountable for low results. Schools with grade 12 scores below 60%, for example, are described as 'under-performing' and are required to produce a school improvement plan (Bush and co-authors in Bush & Glover 2009:12). These

schools get more support and intervention from the district in an effort to improve their results.

The support described above would be considered by Fullan (2000:6) as an *outside-in* approach to school reform which is considered important but unlikely to achieve or sustain the desired results. The ideal, according to Fullan (2000:7), is to have *internal* school development (inside change). This takes place while connecting to the outside world that includes parents, the community, and technology, while being challenged and supported by an external infrastructure namely, the district office, the Department of Education (DoE) and the School Governing Body (SGB).

An important aspect of inside development is that teachers and school leaders need to critically reflect on the important role they play in student learning (Fullan 2000:2). A school may not be able to influence the prior experience or socio-economic status of students, but the school could decide who its teachers would be; such decisions would have long-term consequences for the students' academic success (Johnson 2009:1). The view that quality schools are dependent on the quality of the teachers is shared by many researchers with the specific emphasis that teacher quality directly impacts student achievement (Bubb & Earley 2007:1; Feiman-Nemser 2001:1013; Johnson 2009:1; Kaiser, Rosenfield & Gravois 2009:444; Ramasehla 2009:5; Wong 2004:41; Zakaria & Daud 2009:226).

Christie (2005:5) asserts that in order for teachers to maximize student learning, they need to have the necessary knowledge and skills in terms of both subject content and pedagogical repertoires. Teachers need to take professional responsibility for student learning and be active students if they are to stimulate the learning of others (Christie 2005:5; Mestry, Hendricks & Bischoff 2009:488).

In addition to facilitating learning, teachers must also become "more assessment literate" (Fullan 2000:2). Assessment literacy is characterised by two factors: (i) the ability of teachers, individually and as a group, to interpret achievement data on

student performance; and (ii) the equally important ability to develop action plans to alter instruction and other factors in order to improve student learning.

Several researchers argue for the collaborative interaction of teachers and the development of professional learning communities (PLCs) as a means to build on teachers' knowledge and skills and thus positively impact on student learning (Anderson 2007:10; Bolam, McMahon, Stoll, Thomas, Wallace, Greenwood, Hawkey, Ingram, Atkinson & Smith 2005:157; Christie 2005:6; DuFour 2004:9-10; Eraut 2004:267; Ferguson 2006:4; Fullan 2000:2; Gajda & Koliba 2008:133; Johnson 2009:5; Pappano 2007:1-4). This will involve a 'reculturing' more than a restructuring of education (Bubb & Earley 2007:18; Fullan 2000:3). Reculturing, as a start, would mean going against conventional classroom practice where teachers work in isolation to teachers working with each other across the divides of space and time, observing each other's lessons, sharing teaching strategies, trying out new ways of teaching and getting feedback on their work (Anderson 2007:2, Bezzina in Bubb & Earley 2007:19, Christie 2005:6; Furguson 2006:4; Horne & Hotchkiss 2007:1; Johnson 2009:3; Wagner 2001:382; Wong 2004:52). Teachers would have to move from a situation of limited attention to assessment and pedagogy, to a situation in which they and others routinely and collaboratively focus on these matters and make associated improvements (Fullan 2000:3). This will require many professional conversations among teachers that will enable them to build a shared understanding and common language around learning and student achievement (Christie 2005:6). Reculturing would thus require a deep shift in teacher relations where teachers are asked to lay bare their assumptions, strengths and weaknesses before their colleagues (Servage 2008:71). Teachers would be asked to peel away facades, admit vulnerabilities, share precious insights, ask tough questions, compromise and give colleagues real help – not just worksheets (Pappano 2007:1).

The above has implications for school managers and leaders. Christie (2005:6) makes the point that teacher collaboration and learning in order to support student learning must be *led* using a strategic combination of pressure and support and a

strong focus on professionalism. Supporting teacher learning means creating opportunities for collaborative interaction and creating a safe and productive environment for challenging professional conversations (Borko 2004:7; Christie 2005:6; Pappano 2007:1). School leaders must maintain high expectations of teachers and find ways of spreading good practice from isolated pockets of individual classrooms across the school (Christie 2005:6).

However, providing opportunities for teachers to learn does not guarantee that learning will take place, or that teacher professionalism will grow (Christie 2005:6). Support for teacher learning needs to be accompanied by pressure in terms of holding teachers accountable to an appropriate degree for student learning outcomes (Christie 2005:6, DuFour 2004:6; Fullan 2000:8). It is therefore imperative that school leaders employ models of supervision that monitor and evaluate the performance of teacher collaboration and find ways to improve the quality of teacher collaboration (Gajda & Koliba 2008:133).

The above mentioned ideas introduce a discussion of a leader's ability to create a PLC and to lead their schools as learning organisations. In the face of complex competing demands on the time and energy of the principal, it becomes all the more important to disperse leadership of learning so that it becomes the responsibility of as many people in and around the school as possible (Hayes, Mills, Christie & Lingard in Christie 2005:7). This form of distributed leadership would result in the formation of various communities of practice in the school, organised and led with specific academic improvement goals in mind. A community of practice (CoP) is a group of people bound together by shared expertise and a passion for a joint enterprise (Wenger & Snyder 2000:139). Communities of practice form the basic building blocks of a school's larger professional learning community (Gajda & Koliba 2008:137).113

With the above as background, the problem that motivated this study will now be explained.

1.2 PROBLEM STATEMENT

In the climate of poor grade 12 results, poor ANA results, high turnover of teachers and poorly skilled teachers who enter the profession as indicated in section 1.1, I am inspired by the inside approach to school reform (Fullan 2000:3) characterised by teachers working collaboratively in a CoP. The inspiration comes from the possibility of school improvement contained in these ideas.

As a matter of certainty, continuing with the same kinds of practices at school will not yield different let alone improved results. A shift in thinking and practice is urgently required. The shift envisaged is from a focus of *teaching* to *learning*, not just to what *students* learn (DuFour 2004:7), but also to what *teachers* learn in their efforts to improve students' learning (Fullan 2007:35). Another shift envisaged is from *individual* teacher learning to *collaborative* learning (Christie 2005:6; Darling-Hammond & Richardson 2009:47; Johnson 2009:5; Pappano 2007:2), not merely by restructuring (creating new teams) but by reculturing as described in section 1.1.

Built into the above system of learning must be responsibility and accountability. In this respect the formula provided by Fullan (2000:8) to describe school change is enlightening: E = MCA2: where E refers to the rate of efficacy of the system, M refers to the motivation for reform (will, purpose, commitment), C refers to the capacity for reform (skills, know-how, available resources), and A2 refers to assistance times accountability. Fullan (2000:8) posits that this change formula is activated when the three approaches to reform (inside, inside-out and outside-in) work together. Thus greater energy for reform is generated in a system of integrated pressure and support in which capacity and accountability are both increased.

Starting from and proceeding with the assertion that there is no substitute for internal development (Fullan 2000:3), I sought to explore ways to 'reculture' my school to embrace a collaborative planning and learning culture in PLCs. However, an effective system of teacher collaboration within a PLC does not emerge spontaneously or by

invitation nor is there a prescribed pathway for schools to follow (DuFour & Eaker in Gajda & Koliba 2008:134; Fullan 2000:3). Fullan (2000:3) therefore suggests that each school build its own model and develop local ownership through its own process. In this regard Gajda and Koliba's (2008:136) Teacher Collaboration Improvement Framework (TCIF) gives clear direction. Grounded in the principles of action research, their framework can be used as a blueprint for the supervision, assessment and improvement of the quality of teacher collaboration within a PLC.

In line with the above, the main research question of this thesis is: *How can the professional development of primary school teachers be managed by means of action research?*

1.4 AIM OF THE RESEARCH

In undertaking this research I aimed to draw up a programme for collaborative teacher interaction within PLCs that would improve teachers' content knowledge, pedagogic content knowledge and assessment literacy to meet both the teachers' needs and the school's needs. To this end, I wished to explore the growth and development of teachers who work in various communities of practice.

The move to home-based teaching in grades 4 and 5 and semi home-based teaching in grade 6 provides a perfect opportunity for the above mentioned exploration. The school uses the term *home-based* to describe the situation where a single teacher remains with one class for most of the time, teaching all the required subjects to the same class. This concept is also referred to as self-contained classrooms (Horne & Hotchkiss 2007:5). In a semi home-based scenario two teachers are assigned to one class.

To reach my aim, I carried out the following:

(i) undertook a needs analysis, which included a feasibility study in terms of cost-benefit;

(ii) developed a collaboration programme that addressed these needs;
(iii) implemented the programme and
(iv) evaluated the programme to make recommendations for further improvement.

I established this for the following categories and groups of participants:

- A group of Grade 4 teachers
- A group of Grade 5 teachers
- A group of Grade 6 teachers

With each group I focused on the conversations, interactions, decisions and results around two main subjects, mathematics and natural science.

1.4 PARADIGMATIC PERSPECTIVE

There is now a greater acknowledgement of teacher's having a voice (DeMulder & Rigsby 2003:267; Fiszer 2004:7; Freeman 2002:10; Kayler 2004:268; Meyer 2002:37; Phillips 2003:257; Robinson 2001:103; Salleh 2007:1; Zepeda 2012:4), teachers having an ability to find solutions to their own problems and developing what is called 'context-sensitive' pedagogic knowledge (Bax in Freeman 2002:10; Kumaravadivelu 2001:539), and craft or practitioner knowledge (Hiebert, Gallimore & Stiegler 2002:4). This acknowledgement of the idea of teachers' theory or teachers' know-how has influenced the emphasis on reflective teaching and action research, the aims of which are to change and improve practice not just to produce more knowledge (Elliot in Kumaravadivelu 2001:540). Working towards improving their practice positions teachers as change agents (DeMulder & Rigsby 2003:278; Kumaravadivelu 2001:55; Price 2001:67) and makes their learning transformational (Brookfield 2005:250; DeMulder & Rigsby 2003:282-286). Central to this is the idea of teacher learning that is underpinned by values espoused by critical theory such as empowerment, emancipation and democratic participation (Salleh 2007:2).

Professional development should empower teachers by building their capacities such as knowledge, skills and authority to act successfully within an existing system and structures of power - working within the system, on their own behalf (Inglis in Salleh 2007:2). Professional development should emancipate teachers insofar as it enables them to critically analyse, resist and challenge structures of power. To this end teachers should separate themselves from constraining modes of thinking or acting that limit perception and action toward realising alternative possibilities (Brookfield 2005:48; Inglis in Salleh 2007:2; Kumaravadivelu 2001:549). Professional development should be characterised by democratic participation because individuals are essentially social beings who not only belong to several layers of communities within society, but also relate and work interdependently with each other (Salleh 2007:2).

With teachers having a right to speak for and about teaching (Elbaz in Freeman 2002:10), and there being so many diverse yet legitimate voices, the interaction of different types of knowledge or of things known from different points of view, could result in an inevitable power struggle of ‘who is right?’ (Freeman 2002:11). Living in association with others only works if we adjust our actions to take account of the presence of others (Brookfield 2005:64). Ultimately there should be a move towards power-sharing among researchers, teachers and teacher-educators (Freeman 2002:11).

Critical theory breaks down the barriers between subject and object, of researcher and focus of research (Brookfield 2005:26). The theory’s utility depends partly on people recognising that it expresses accurately the yearnings they have for a better, more authentic way to live. Critical theory underpins action research which was used in this study. This research method is briefly explained in the next section.

1.5 RESEARCH METHODS AND DESIGN

Action research, done by practitioners using their own site as the focus of their study, has been suggested as a means of fostering meaningful professional development of teachers (Goodnough 2008:433). It is a type of inquiry that aims at discovering, developing or monitoring changes in classroom practice through interrogating one's own and others' practices and assumptions. The emphasis here is on reflecting critically and conceptualising alternate perspectives on a problem, which, according to Schon (in Atay 2008), lie at the very heart of professional development.

I undertook an action research project at my school. Following action research steps of planning, acting, data collecting and reflecting (Hughes & Seymore-Rolls 2000:1), I described the benefits of grade collaboration interacting with subject collaboration. I also described what and how teachers learn through working together collaboratively in a CoP. More detail is provided in chapter four.

1.5.1 Sampling

In each grade, the teachers involved in the action research project were the class teachers of the grade. One of the latter was also the grade leader. The Head of Department (HOD), deputy principal and principal were also involved. Each teacher agreed to be a teacher in the relevant grade and to be part of the move to home-based teaching. Each teacher chose which subjects he/she planned for the other teachers.

In line with the above, a non-probability sampling procedure was used. Both purposeful and convenient sampling were used (McMillan & Schumacher 2010:138). The sampling was regarded as purposeful as the school teachers and school leaders involved in collaboration teams were regarded as information rich participants. The sampling was regarded as convenient as it involved teachers and school leaders who were accessible and willing to participate (Castillo 2009:1). These are both important

in action research as in this kind of research, the major attribute is the extent to which a group or individual is affected by or has an effect on the problem or issue of interest (Stringer 2007:43).

1.5.2 Planning phase

In this first phase the collaboration groups and members of the school management team brainstormed all the possible needs and problems that could arise from moving to home-based teaching and decided how to proceed with this innovation. Minutes were kept of this brainstorming session and the proceedings were recorded on a tape recorder. Decisions were made with regard to meeting times, meeting dates and work roles. Teachers were informed of avenues in which they could access additional support and guidance outside of grade collaborative teams. This too was tape recorded, transcribed and analysed and kept as reference for future planning meetings and to keep us on track during the action phase.

1.5.3 Action phase

In the action phase teachers met once a cycle (once every six school days) for up to two hours to plan content knowledge, discuss methodological issues, plan assessment strategies, analyse results and plan and implement required intervention strategies to enhance student learning. Each teacher was responsible for the total planning (content, methodology, lesson resources and assessment) for one or two subjects. More detail about this phase is given in chapter four.

1.5.4 Data collection

Field notes, typed minutes, personal observations and reflections of collaborative encounters formed part of the data collected. I conducted focus groups as well as individual interviews. Tape recordings of end–of-term reflection sessions were done and recordings were transcribed verbatim. I also observed lessons, studied students'

books and teachers' planning and assessment files and administered a questionnaire. The academic results in each subject in the grade were studied and discussed at meetings. Minutes were kept of these meetings. Other data collection involved a study of teachers' reflections on lessons and assessments as noted in their planning books or files.

1.5.5 Reflection

At the end of each action research cycle (six months), I conducted a focus group to evaluate our strategies. Different tools were used to evaluate the quality of the collaboration including an analysis of our strengths, weaknesses, opportunities and threats (a SWOT analysis), the stop-start-continue tool, the Teacher Collaboration Improvement Framework (TCIF) and the Teacher Collaboration Assessment Rubric (TCAR) (Gajda & Koliba 2008:136,144).

The aim of the above mentioned evaluative sessions was to answer (in different ways) the following three questions: What was positive? What was negative? What could be done to improve collaborative team work in the future in order to improve teacher learning and thus student learning?

The information obtained was used to feed into planning for the following term. In addition to these focus groups, I also conducted individual semi-structured interviews with teachers. Each of these interviews explored specific questions on teacher learning and evaluated the quality of the collaboration.

1.5.6 Analysis

All tape recorded sessions were transcribed and analysed for themes and patterns. These tape recordings together with field notes, classroom observation data, book control data, reflection notes in a field journal and minutes of assessment meetings

provided the data that described what and how teachers learned as a result of their involvement in collaborating teams which formed a CoP.

1.5.7 Ethical considerations

Nolen and Van der Putten (2007:401-402) note that the ethical issues unique to action research have not received consideration in proportion to the growing interest in this methodology. They explain three unifying ethical principles to consider in this type as well as all human subject research: (i) Respect for persons (which includes informed consent, confidentiality of participants and autonomy of participants), (ii) beneficence and (iii) justice. I noted these ethical measures and committed to ensuring that these principles guided the study from the beginning. Informed consent was obtained from the SGB and each participant (See appendix A and appendix B).

Ethical clearance was obtained by the relevant committee in the College of Education at the University of South Africa (see appendix D). This was done after permission to conduct the research had been obtained from the DoE in Gauteng (see appendix C).

1.5.8 Validity in action research

According to McMillan and Schumacher (2010:451-452), validity in action research is ensured by means of the same techniques that are generally used for both quantitative and qualitative research. In addition, five criteria determine the credibility of action research. These criteria are: democratic validity, outcome validity, process validity, catalytic validity, and dialogic validity. A brief description of the types of validity follows.

Democratic validity is concerned with “the extent to which research is done in collaboration with all parties who have a stake in the problem under investigation” (Anderson & Herr in Newton & Burgess 2008:8).

Outcome validity refers to the extent to which outcomes of the research are successful. Put another way, outcome validity refers to the extent to which the outcomes of the research match the intended purposes of the research (Anderson & Herr in Newton & Burgess 2008:8).

Process validity focuses on “the much debated problem of what counts as ‘evidence’ to sustain assertions” (Anderson & Herr in Newton & Burgess 2008:8). This validity is concerned with the efficacy of the research approach in addressing the research problem.

Catalytic validity refers to the ability of the research process to transform the participants, deepen the understanding of the participants, and motivate participants to further social action (Anderson & Herr in Newton & Burgess 2008:8).

Dialogic validity is akin to the peer review process in academic research. In practitioner research, however, it is suggested “that practitioner researchers participate in critical and reflective dialogue with other practitioner researchers” (Anderson & Herr in Newton & Burgess 2008:8).

The validity of the project will be explained in detail in Chapter four.

1.6 DEFINITION OF CONCEPTS

1.6.1 Teachers

A teacher is defined and described in many different ways including the following: A person with the educated competencies and abiding commitment to engage successfully in the professional practice of teaching (DoE 2005:6), a person who teaches students a particular course of study or a practical skill (WordiQ.com) and a professional with rich content-specific and general knowledge who shapes instruction by the way they respond to students and materials (Mosvold 2010:1).

In South Africa, a teacher must fulfill the following roles: They must be (i) learning mediators, (ii) interpreters and designers of learning programmes and materials, (iii) leaders, administrators and managers, (iv) scholars, researchers and lifelong students, (v) subject/phase specialists, (vi) assessors and they must also (vii) fulfill a community, citizenship and pastoral role (Republic of South Africa 2000).

1.6.2 Management and leadership

The literature providing definitions of ‘management’ and ‘leadership’ is vast and overlaps in their views. Researchers have attempted to provide distinctions between these two terms: ‘management’ and ‘leadership’ (Bush 2007: 392; Christie 2005:2; Heystek 2007:493-496). However, the two concepts and practices are seen as inseparable and it is clear that to be effective in their roles, principals should integrate the functions of leadership and management and possess skills in both (Christie 2005:3; Heystek 2007:493). Drawing from some of these researchers, I provide the following distinctions.

Management is an organisational concept. It relates to structures and processes by which organisations meet their goals and central purposes, and it is more likely to be tied to formal positions than to persons (Christie 2005:3). Robbins (in Heystek 2007:496) defines management as a process of planning, organising, leading and controlling to ensure effectiveness in an organisation. Principals are seen to be increasingly focused on these managerial tasks within the framework of control arising from rules, regulations and policies (Ofsted in Heystek 2007:493). Good management is regarded as absolutely essential for the functioning of schools.

Leadership is seen as the exercise of influence and of working with people and getting things done through people (Christie 2005:3; Heystek 2007: 493). Leadership is not confined to a position and can be exercised on many levels in a school (Christie 2005:3). The emphasis in leadership is on relationships with people and on communication, motivation and the leader’s emotional intelligence. A leader is more open to risk-taking while being less restricted by prescribed policies (Heystek

2007:493). The concept leadership is seen to be an ‘advancement’ over that of management (Earley & Weindling in Heystek 2007:493).

In this study, a distinction between these two terms is made because I see the role of a manager as one that can help organise the school calendar, timetable, resources, policies and procedures to make collaborative work possible. However, it is the influential role of the principal as leader, in working closely with the people (the teachers and mentors), that could possibly initiate the reculturing desired for building an effective learning community.

1.6.3 Professional development

Teachers are considered to be builders of the future; therefore, it is important for them to remain competent in their fields (Morgan 2006:1). This competence is achieved and enhanced through ongoing professional development, which broadly refers to the development of people in their professional roles (Villegas-Reimers 2003:11).

Professional development encompasses many different types of learning opportunities including professional studies (diplomas and degrees), workshops, courses, seminars, conferences and all learning opportunities situated in practice such as coaching, mentoring, lesson study, collaborative planning, curriculum development, reflective supervision and action research (Guskey 2002:46). The professional development of teachers is seen as a lifelong process which begins with the initial preparation that teachers receive and continues until retirement (Bubb & Early 2007:3; Howe 2006:290; Coolahan in O’Donoghue & Harford 2010:91; Schlager & Fusco 2003:205; Villegas-Reimers 2003:8). Learning how to teach, and working to become an excellent teacher, is a long term process that requires not only the development of very practical and complex skills under the guidance and supervision of experts, but also the acquisition of specific knowledge and the promotion of certain ethical values and attitudes (Villegas-Reimers 2003:8).

1.6.4 Collaborative learning

According to DuFour (2003:1), collaboration is best defined in narrow terms. It can be seen as a systematic process in which teachers work together to analyse and impact professional practice in order to improve their individual and collective results. A focus on this definition prevents leaders, determined to improve student achievement, from accepting other interactions that mask as collaboration such as congeniality, coordination, delegating responsibilities, or what DuFour (2003:2) calls "collaboration lite." Social get-togethers to build group camaraderie, meetings to decide on routine school operations and committees that organise school events would all be considered as collaboration-lite. Thus, in this research, ‘collaboration’ refers to teachers working in teams and engaging in an on-going cycle of questions that promote deep team learning. This process, in turn, leads to higher levels of student achievement.

1.6.5 Action research

According to Ferrance (2000:1), action research is a process in which participants examine their own educational practices systematically and carefully using the techniques of research. Anyone with a vested interest in the teaching and learning process may undertake action research for the purpose of gathering data about how their particular schools operate, how they teach and how their students learn (Mills in Nolen & Van der Putten 2007:401). There are four moments in action research, namely planning, acting, data collecting and reflecting, which exist interdependently and follow each other in a spiral (Hughes & Seymore-Rolls 2000:1). More than one of these cycles are completed because reflection leads to the planning of an improved second cycle.

1.7 DIVISION OF CHAPTERS

My thesis comprises of the following chapters:

CHAPTER 1: OVERVIEW AND RATIONALE

Chapter one contains an overview and rationale of the study as stated above. An introduction and background to the problem has been given. The problem as well as the aims of my research have been stated and a brief overview of the research methods has been given. All important concepts used in the study have also been defined.

CHAPTER 2: LITERATURE REVIEW

Chapter two explains the conceptual framework of the study. It comprises theories on professional development and situated learning theory (e.g. Wenger's theory of learning in a CoP).

CHAPTER 3: LITERATURE REVIEW

Chapter three focuses on empirical results of research done worldwide and in South Africa on teacher collaboration for the professional development of teachers.

CHAPTER 4: RESEARCH DESIGN

Chapter four describes the research design and methodology along with specific measures to ensure research ethics and the validity of the results of the action research project.

CHAPTER 5: FINDINGS AND DISCUSSIONS

Chapter five contains the findings and interpretation of the results of my research. I attempt to identify patterns and themes in the responses from teachers. The findings are interpreted and discussed in the light of the conceptual framework.

CHAPTER 6 CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

Chapter six provides conclusions and recommendations as informed by the research I had undertaken. Recommendations for the professional development of teachers and for future research are made and limitations of the project pointed out.

1.8 SUMMARY

In this chapter, the justification for the research has been presented. Thus, the following has been highlighted: the problem statement (research question), aims of the research, research design and method, and a definition of concepts.

In chapter two, the conceptual framework of the research is made clear.

CHAPTER TWO

TEACHER LEARNING AND PROFESSIONAL DEVELOPMENT

2.1 INTRODUCTION

In chapter one, a background to the study has been given. The research problem and the aims of the research have also been formulated.

In chapter two, a literature review on teacher learning and professional development is undertaken. I start with a brief overview of the concept of teacher learning and development as a continuum. I then proceed to look at theories of teaching and learning through two lenses: acquisition and participation. Finally, I present a traditional pathway of teacher growth and development as well as what is considered as a 'new' path of teacher learning and development.

2.2 TEACHER LEARNING AND DEVELOPMENT AS A CONTINUUM

The teacher shortages and problems of teacher quality experienced in South Africa and across many parts of the world (Clewell & Villegas 2001:2, Ingersoll 2001:500; UNESCO 2006:1) coupled with the problem of poor student outcomes (Reyneke et al 2010:1; Venter 2010:1) has led to a scrutiny of teacher education and development in general and in teacher preparation in particular (Cross & Rigdon 2002:25; Feiman-Nemser 2001:1019; Kruss 2008:1; O'Donoghue & Harford 2010:91;Villegas-Reimers 2003:52) .

Principal amongst these problems is the failure to equip teachers as career-long students in an environment where there should be a strong linkage between initial teacher education, induction and continuing professional development (Coolahan in

O'Donoghue & Harford 2010:9, Schlager & Fusco 2003:205).The ability to learn throughout a career and deepen ones knowledge and skills should be one of the hallmarks of being considered a professional (Bubb & Early 2007:3; Garet, Porter, Desimone, Birman, & Yoon 2001:916). The ideal is that teachers should participate in intensive learning activities that build on their pre-service preparation and induction. This should lead to lifelong learning (Bubb & Early 2007:3-4; Howe 2006: 290), the development of expertise in teaching and the fulfillment of the fundamental impulse in teacher learning which is to find or establish meaning in their work (Freeman 2002:7,11).

Feiman-Nemser (2001:1014) speaks of a "professional learning continuum" in which each phase in a continuum of teacher learning should have a unique agenda shaped by the requirements of good teaching and *where* teachers are in professional development. On the one hand this should be seen as an institutional obligation and an entitlement to teachers (Jones in Bubb & Early 2007:9; Guskey 2002:45; Hargreaves & Fullan 2000:51). On the other hand, all teachers should assume responsibility and accountability for professional learning and development throughout their careers (Bubb & Early 2007:6; Christie 2005:5; DelliCarpini 2008:223; Freeman 2002:8; Hargreaves & Fullan 2000:5; Candy in Kwakman 2003:152). Both personal as well as institutional obligation to professional learning will feature in this study.

Bubb and Early (2007:6) warn: "There are two groups of students within schools – young people and adults – and we neglect either at our peril. If teachers and other staff are not seen as continuous students by the school itself, how can adults engage youngsters in any meaningful pursuit of learning?" The point of departure in this study therefore is a look at adult (teacher) learning and development. This is done through two main lenses: (a) learning as acquisition of knowledge and skills and (b) learning as participation. These are largely considered as rival metaphors of learning (Hodkinson & Hodkinson 2003:3). The former is often referred to as the traditional or conventional model of learning (Kwakman 2003:150; Lave & Wenger 1991:47). It has

also been referred to as the standard paradigm of learning (Beckett & Hager in Hodkinson & Hodkinson 2003:3).Through each of these lenses I trace a path of teacher learning from pre-service to in-service learning and development.

2.3 THEORIES AND MODELS OF LEARNING

2.3.1 Cognitive learning theory

Cognitive theorists treat knowing as the manipulation of symbols inside the mind of an individual (Putnam & Borko 2000:4). They draw on the root metaphor of *acquisition* to conceptualise learning (Sfard in Mason 2007:2). Entities such as knowledge, concepts, conceptions, ideas, notions and contents are seen as constructs that can be obtained (acquired) and become one's own. Individuals receive the entities from their environment (Rogoff in Kazemi & Franke 2004:205). When such knowledge or any other entity is acquired, it can be applied, shared with others, or transferred to another situation (Mason 2007:2).

Learning is thus centered in the mind, based on propositional knowledge and is largely approached from the perspective of the individual person (Hodkinson, Biesta & James 2008:30; Putnam & Borko 2000:4; Wenger 1998:3). Cognitive theorists see individual learning as occupying a particular context rather than being part of it (Hodkinson et al 2008:32). There is thus an assumed boundary between the world and the individual and this leads to a tendency in the literature to either focus on the learning situation and its participatory practices *or* to see individual learning as occupying a context, rather than as being part of it.

Many researchers use the term transmission model for the passing on of knowledge to an individual (Beck & Kosnick 2001:945; Rogoff in Kazemi & Franke 2004:205; Kumaravadivelu 2001:537; Tatto in Ono & Ferreira 2010:61; Pani 2004:355). In this traditional or conventional way of thinking (Kwakman 2003:150; Lave & Wenger 1991:47), learning is viewed as a process by which a student internalises knowledge,

whether discovered, transmitted from others, or experienced in interaction with others (Lave & Wenger 1991:47). A concern to situated theorists is that a focus on internalisation in this way leaves the nature of the student, of the world, and of their relations unexplored. Furthermore, the focus on internalisation in this way is seen to establish a sharp dichotomy between inside and outside and suggests that knowledge is largely cerebral. In contrast with acquisition, transmission and cognitive internalisation, situated learning is seen as increasing participation in a CoP and concerns the whole person acting in the world (Lave & Wenger 1991:49; Wenger 1998), and where internalisation takes on a different meaning. (These ideas on situated learning are discussed in section 2.3.3.)

2.3.2 Socio-constructivist learning theory

A socio-constructivist perspective is a coordination of social and cognitive perspectives on knowing and coming to know (Coob & Yackel in Tzur, Simon, Heinz & Kinzel 2001:227, 228). From a social perspective, learning is a process of enculturation to the communities in which one participates for example, the primary school teaching community.

Research suggests that teachers learn best when working in a dialogue and action community (Schlager & Fusco 2003:210). A grade 4, 5 and 6 team each represents such a community. The experiences, skills and strength of each member of the community are harnessed to assist in the development of all. In addition the community is able to provide support and encouragement as members grapple and experiment with new ideas and approaches (Chalmers & Keown 2006:148).

From a constructivist perspective, teacher learning in the field of professional development is a sense-making process where teachers build new knowledge and understanding from the base of their existing knowledge and perceptions (Chalmers & Keown 2006:148; Simon, Tzur, Heinz, Kinzel & Smith 2000:583-584; Brooks & Brooks in Slepkov 2008:96). It involves (for the student) an interplay between existing

knowledge, ideas and beliefs and new approaches advocated by professional developers (Chalmers & Keown 2006:148).

Constructivist knowledge creation leads to a revelation of what is known and what is not known (Slepkov 2008:99). This brings to light the role of scaffolding of new learning and suggests that opportunities for learning would be more likely to lead to change when it fits into already existing schema on the part of the teacher as a student (Brooks & Brooks in Slepkov 2008:87).

The constructed nature of knowledge and beliefs must be seen along with the importance of personal thoughts and reflection about them. This element involves teachers in a process of developing new ideas, skills and approaches and interpreting their meaning and significance personally. Teachers also think through the issues and decide which aspects they believe to be important, and can be adopted in their classroom teaching (Chalmers & Keown 2006:148).

The constructed nature of knowledge must also be seen along with the situated nature of cognition. This element recognises that professional development of teachers needs to be closely tied to the real situations and contexts of individual schools, teachers and classrooms. Grade 4 teachers, for example, need to be able to apply, experiment, and reflect on new ideas and approaches relevant to teaching the students in that *specific grade*. These experiences in turn, can be brought back to the teaching community for further discussion and reflection (Chalmers & Keown 2006:148). A more detailed discussion of situated learning follows.

2.3.3 Situated learning theory

Much of the situated learning theorising originated in attempts to understand why school students in America and Europe struggled to understand mathematics and science (Lave in Hodkinson et al 2008:30). In this respect, the cognitive versus situated debate shares issues of thought, knowledge and understanding, i.e. of

cognition. Much situated thinking (often termed activity theory), draws upon Vygotsky (in Hodkinson et al 2008:30, 31) who was primarily concerned with integrating the mind and its social and cultural setting. Both the situated and cognitive views are primarily concerned with thought, and the processes that influence thought. Both theories are centrally concerned with cognition. However, situated theorists challenge the assumption of the existence of a cognitive core independent of context and intention (Brown, Collins & Duguid 1989:32; Lave & Wenger 1991:53).

To situated theorists, knowledge is not an entity in the head of an individual, which can be acquired, enriched, or changed, but rather an *activity* that cannot be considered separately from the context in which it takes place. Students therefore, do not accumulate knowledge from the outside, but rather participate in activities that are distributed among the individuals, tools and artifacts of the relevant community (Mason 2007:2; Putnam & Borko 2000:5).This knowledge is appropriated – made one's own (Wertsch in Ball 2000:248). In this study teachers participate in planning activities where each member shares knowledge tools and artifacts necessary to teach mathematics and natural sciences in a specific grade.

Cognitive development from a socio-cultural perspective can be seen as a progressive movement from an external socially mediated activity to internal mediation controlled by the individual or what Vygotsky calls internalisation (in Johnson & Golombek 2003:731). In this case, internalisation involves a process in which a person's activity is initially mediated by other people or cultural artifacts but later comes to be controlled by the individuals as they appropriate resources to regulate their own activities. Learning and development is thus not just the straightforward acceptance of information from the outside in. It is a process through which teachers appropriate alternate ways of thinking about their practice (Ball 2000: 248; Johnson & Golombek 2003:732).

Situated learning theorists draw upon the metaphor of *participation* to conceptualise learning (Hodkinson et al 2008:30; Sfard in Mason 2007:2). Learning is approached

from the location where it takes place in the sense that what is learned is specific to, and grounded in, the situation in which it is learned. According to Mason (2007:2), learning a subject domain is viewed as a process of becoming a member of a particular community. Grade 4, 5 and 6 teachers learn because they are part of a grade CoP to which they contribute as well. Thus participation means “taking part” as well as “being part of” a member of a CoP (Mason 2007:2). This is a central tenet of the situated learning perspective.

Lave and Wenger (1991:29) conceptualise learning as coming to know *how* to participate in the discourse and practices of a particular community. From this perspective, learning is as much a matter of enculturation into a community’s way of thinking and dispositions as it is a result of explicit instruction in specific concepts, skills and procedures (Resnick in Putnam & Borko 2000:5). Lave and Wenger (1991:29, 53) call this process of participation of novices, *legitimate peripheral participation*. Each of the collaborating groups in this study has novice teachers participating with more experienced teachers. These novice teachers participate in each grade CoP and as they master the knowledge and skills of their trade, they move towards more central and full participation. In this way of thinking, learning is not merely a condition of membership, but it is an evolving form of membership.

As members interact in their communities they often share tacit knowledge as they socialise (Lave & Wenger 1991:95; Wenger 1998:47). Interactions with colleagues in one’s environment are thus major determinants of both what is learned and how learning takes place (Putnam & Borko 2000:5) This view of knowledge and learning holds that what we take as knowledge and how we think and express ideas are the products of the interactions of groups of people over time. Knowledge entails lived practices, not just accumulated information. The knowledge of each individual teacher in this study is constructed through the knowledge of the CoP within which the teacher participates (Johnson 2006:237).

It is important to note that this learning is not a unidirectional phenomenon. It is not only the individual, but the community too that changes through the ideas and new ways of thinking which its new members bring to the discourse (Putnam & Borko 2000:5) As Hodkinson et al (2008:37) puts it : “Individuals influence and are part of learning cultures just as learning cultures influence and are part of individuals”. Learning is also seen to be distributed. Rather than considering cognition solely as a property of individuals, situated learning theorists posit that it is distributed over the individual, other persons, and various artifacts such as physical and symbolic tools (Solomon in Putnam & Borko 2000:5). Such distribution of cognition across people and tools make it possible for teams to accomplish tasks beyond the capabilities of individual members (Hutchins in Putnam & Borko 2000:5). This is the main goal pursued in this study.

It follows then that if, from a cognitive point of view, knowing means acquiring or possessing; from a socio-cultural perspective it means participating, communicating and also belonging (Mason 2007:2). Learning involves the whole person - the mental, the emotional, the physical and the practical - and these are interrelated, not separate (Hodkinson et al 2008:30; Lave & Wenger 1991:53). This embodied view implies that the whole person participates in the activities of a CoP. Conceiving of learning in terms of participation focuses attention on ways in which it is an evolving, continually renewed set of relations (Lave & Wenger1991:50).

Learning is also about identity formation (Lave & Wenger 1991: 53; Wenger 1998:143) or as Hodkinson et al (2008:40) prefer, of *becoming*. Learning implies becoming a different person. Hence, learning involves the construction of identities.

A CoP concept uses many of the ideas from the dialogue community approach in education. These communities are important in facilitating the construction of new knowledge and understanding, and in examining personal and collective values, attitudes and beliefs. Communities also enable the social and distributed aspects of cognition to come into play (Chalmers & Keown 2006:149).

2.4 TRACING A PATH OF TEACHER LEARNING AND DEVELOPMENT THROUGH TWO LENSES

In tracing a path of teacher learning and development from pre-service to in-service, I allude to practices that follow the acquisition and transmission model and the possible impact it has on teacher learning and development. I then look at teacher learning and development according to a new model and evaluate the impact on teacher learning.

2.4.1 Tracing a traditional path of teacher learning and development

Learning or professional development activities that follow the cognitive approach are often referred to as a traditional model. In the traditional view of schooling, teaching is telling and learning is listening or absorbing (Feiman-Nemser 2001:1015). Teachers transmit knowledge to students and by doing this they fail to teach for understanding (Kwakman 2003:150).

In contrast to the above, teaching for *understanding* requires teachers to see complex subject matter from the perspectives of diverse students (Fiszer 2004:5). Teachers also have to learn to teach students in a way that enables students to actively construct their own knowledge (McLaughlin in Kwakman 2003:149). Teachers should facilitate learning so that students learn how to learn and become lifelong students. Teachers should also strive to foster higher-order thinking skills (Darling-Hammond & Richardson 2009:46; Kwakman 2003:149).

Promoting the above requires that teachers adopt a new pedagogical approach (Putnam & Borko 2000:12). However, many teachers themselves learned predominantly via the traditional, transmission method of learning and are inclined to teach the same way they were taught (Johnson 2006:248; Kruse 2011:116). Such traditional teacher learning activities are seen throughout the learning continuum from pre-service to in-service learning activities.

2.4.1.1 Pre-service teacher learning and development

In the traditional model of teacher preparation a student or pre-service teacher leaves the university or college and goes to a school for teaching practice for four to ten weeks every year (Mawoyo & Robinson 2005:109).The period of time given to teaching practice is most important; a short time period can be seen as a lost opportunity for learning that can occur nowhere else (Walkington 2005:59). Lectures, tutorials and workshops at university cannot simulate the spontaneity of the classroom or the nuances of the workplace.

In the above-mentioned model, learning theory at an educational institution often precedes application in a classroom situation. These processes are seen to happen in sequence with the mind acquiring the knowledge first and the knowledge being transferred in later situations where its application is required.

Such a traditional model of pre-service teacher education is influenced by particular discourses in cognitive psychology which have tended to dichotomise learning (know what) and doing (know how) as distinct processes (Brown et al 1989:32; Mawoyo & Robinson 2005:110). This view divorces cognition from its social and cultural contexts and has come under attack from theorists of situated cognition (Brown et al 1989; Lave & Wenger 1991; Wenger 1989).

Furthermore, according to Freeman (2002:4), the traditional way of learning to teach a subject involves mastering the specific content one has to teach first and then separately mastering methodologies, for conveying that content to the students. These methodologies are also bolstered by theories of learning, in particular that of cognitive psychology. Separate courses, taught by individual faculty in different departments, rarely build on or connect to one another nor do they add up as a coherent preparation for teaching (Feiman-Nemser 2001:1019).

Many researchers are concerned with the role of prior beliefs and knowledge of teachers in initial teacher learning (Feiman & Nemser 2001:1017; Freeman 2002:2; Kumaravadivelu 2001: 552; Kwakman 2003:150; Massengill, Mahlios & Barry 2005:225; Melnick & Meister 2008:40; Meyer 2004:971). According to Ball (in Feiman-Nemser 2001:1017), many prospective teachers have visions of a teacher standing in front of a class and imparting knowledge. They think of teaching as passing on knowledge and learning as absorbing and memorising knowledge. They also perceive teaching to be a highly individualistic affair (Beck & Kosnick 2001:927).

Prospective teachers need to embrace a different vision of a teacher – that of a facilitator of knowledge construction. To do this, they need to examine critically their taken-for-granted, often deeply entrenched beliefs so that these beliefs can be developed or amended (Feiman-Nemser 2001:1017).Teacher candidates must also form visions of what is possible and desirable in teaching to inspire and guide their professional learning and practice. This is in-keeping with Kumaravadivelu's (2001:543) concept of a pedagogy of possibility which serves to empower participants and is concerned with individual identity as well as social transformation. The aforesaid could be achieved if the teacher candidates are able to work collaboratively with others and have their views broadened, challenged and interrogated in a culture where such practice is routine (Walkington 2005:59). However, traditional beliefs endure when no special effort is made to offset those conceptions within their practicum placements and later in their schools after graduation (Beck & Kosnick 2001:945; Feiman-Nemser 2001:1017; Walkington 2005:63).

2.4.1.2 Induction of newly qualified teachers: the beginning phase of in-service professional development

Unlike novice professionals in other professional fields, newly qualified teachers are expected to take on a full range of responsibilities as their veteran colleagues and are often disadvantaged by being allocated the least desirable classes (Angelle 2006:318; Carter & Francis 2001:250; David 2000:135; Howe 2006:289, Johnson & Birkeland 2003:21; McCormack, Gore & Thomas 2006:108).They are expected to perform and to be effective but many have to cope with the realities of school on their own and this causes feelings of isolation (Carter & Francis 2001:250; Johnson & Birkeland 2003:21; Kauffman, Johnson, Kardos, Liu & Peske 2002:273; Wong 2004:46).

The novice teacher has to cope with two jobs: teaching and learning how to teach and struggle with the basics: *what* to teach and *how* to teach it (Feiman-Nemser 2001:1026; Kauffman et al 2002:273; Street 2004:9). According to Johnson, Monk and Hodges (2000:186), novice teachers with poorly developed mental models of classroom practice, simply blunder on and learn the hard way. They frequently have to develop their teaching skills through trial and error and they continue to depend on these strategies whether or not they represent best practice (David 2000:134; Feiman-Nemser 2001:1027; Hargreaves & Fullan 2000:50; Howe 2006:287; Grossman in Schulz 2005:162; Steyn 2004:82). This haphazard development often takes years, by which time many struggling teachers experience attrition pressures and some have left the classroom (David 2000:134; Freiberg in Steyn 2004:82). Consequently, they often experience feelings of disillusionment and failure during their first years of teaching.

Some schools offer orientation days and induction programmes to the newly qualified teacher (Hargreaves & Fullan 2000:51, Meyer 2002:27; Wong 2002b:52). A programme may be in place where short-term support is provided to ease new teachers' entry into teaching and to help them cope. The latter induction practices are

characterised by offering materials, advice and hand-holding to the novice (Feiman-Nemser 2001:1031). This support is seen as necessary to reduce stress and address immediate problems but not to promote teacher development and improve the quality of teaching and learning.

Schools often allocate a mentor to provide support to a novice teacher (Feiman-Nemser 2001:1031; Meyer 2002:27; Wong 2002b:56). Mentors are chosen because of their teaching excellence and they draw on a menu of predetermined activities for novice teachers. Although the novice-mentor arrangement offers promise, it can be compromised by a variety of factors. One problem is that the mentoring pairing process results in a 'blind date' where the teachers do not know each other and neither partner has input into the pairing (Saphier, Freedman & Ascheim in Wong 2004:45). Finding compatible mentors is challenging and the consequences from a mismatch could be disastrous (Greenlee & DeDeugd 2002:70). Other problems include the following: many mentors find it difficult to articulate their knowledge craft (McIntyre & Hagger in Street 2004:16); they think they may only assist when asked for help (Greenlee & Dedeugd 2002:71); and they may be under the impression that the culture of individualism in a school associates mentoring with weakness from which novice teachers are more likely to extricate themselves than derive any professional benefit (Little in Hargreaves & Fullan 2000:51). Wong (2002b:56; 2004:44) therefore asserts that orientation days and mentorship can be considered only as components of induction, but must be viewed as incomplete by themselves.

It is very important, at the beginning stage of a teacher's career that all that is possible in teaching is illuminated so that the novice teachers are not forever limited and constrained by their prior beliefs. In this regard, the newly qualified teachers could benefit from school-based collaboration around curriculum development and having mentors personally selected with whom joint problem-solving and inquiry is possible and where the novices can be involved in ongoing engagement in a learning community (Feiman-Nemser 2001:1032; DePaul in Greenlee & de Deugd 2002:70; Kauffman et al 2002:295; Meyer 2002:27; Street 2004:8).

2.4.1.3 In-service teacher learning and development

For many years, in what is now known as the traditional model of teacher development (Garet et al 2001:920), the only form of ‘professional development’ available to teachers was ‘staff development’ or ‘in-service training’ usually consisting of workshops or short-term courses that would offer teachers new information on a particular aspect of their work (Chalmers & Keown 2006:143; Garet et al 2001:920; Glazer & Hannafin 2006:179; Kwakman 2003:150; Villegas-Reimers 2003:13).
Such short-term workshops or courses are presented in line with cognitive approaches of acquisition and transmission where learning is listening or absorption, and teaching is telling (Feiman-Nemser 2001:1015; Tatto in Ono & Ferreira 2010:2). Students are seen as passive people who ‘sit and get’ information transmitted by outside experts (Chalmers & Keown 2006:147; Feiman-Nemser 2001:1038, 1041; Fiszer 2004:xi; Gould 2008:5). These development sessions are typically top-down, dialogue–free and based on a deficit model of teacher learning where teachers are helped to acquire knowledge and especially skills that they are perceived to lack (Chalmers & Keown 2006:147; Fiszer 2004:1; Hodkinson & Hodkinson 2003:14).

A critical oversight of the above way of thinking is that teachers are not considered as sources of knowledge in their own right (Chalmers & Keown 2006:147). A workshop may enhance an individual teacher’s repertoire (Hodkinson & Hodkinson 2003:19), however, it falls short of influencing a professional community thereby limiting collective understanding and impact (McCotter in Glazer & Hannafin 2006:180). Workshops are usually organised away from the school as in the traditional view the workplace (school) is not considered as appropriate to reaching teacher learning goals (Kwakman 2003:151). Finally, a workshop fails to provide ongoing support and continual feedback to attain long-term systematic improvements (Darling-Hammond & Richardson 2009:47; Fullan 2007:35; Mouza in Glazer & Hannafin 2006:179).

2.4.2 Tracing a ‘new’ path of teacher learning and development

Professional development models that allow for self-directed, collaborative, inquiry-based learning that are directly relevant to teachers’ classroom lives are increasingly replacing traditional top-down models (Johnson 2006:243).These are referred to as reform or alternate type of development activities (Garet et al 2001:920; Johnson 2006:243).

This new model of teachers’ learning is conceived as a socially negotiated activity. Teachers learn through experiences in various social contexts, and they are both receptors and creators of the knowledge base they apply in numerous decisions in the classroom (Geyer 2008:627). Such a ‘new model’ is being advocated in all stages of a professional development continuum. Wenger’s (1998) situated theory of learning and its notion of a CoP is useful for exploring the learning processes of teachers working together in school-based subject and grade communities of practice.

2.4.2.1 Wenger’s theory of learning in communities of practice

A CoP is a group of people bound together by shared expertise and a passion for a joint enterprise (Wenger & Snyder 2000:139). A CoP represents the smallest unit of analysis in which one can include the negotiation of meaning as a mechanism of learning. The CoP model is appropriate as it is grounded in a perspective of learning as a socially and contextually bound process (Wenger 1998:4). It allows for thinking that moves away from traditional professional development opportunities situated outside of a school to teacher learning through participation in practice (Wenger 1998:3, 7). This is the shift envisaged in this study.

Placing the focus on *participation* has broad implications for what it takes to support and understand learning (Wenger 1998:7-8). For individuals, it means that learning is an issue of engaging in and contributing to the practices of their communities. For

communities, it means that learning is an issue of refining their practice and ensuring a new generation of members. For organisations it means that learning is an issue of sustaining the interconnected communities of practice through which an organisation knows what it knows and thus becomes effective and valuable as an organisation.

Wesley and Buysse (2001:118) note that in education the emphasis has shifted from *describing* communities of practice, to *creating* them with the aim to improve practice. This is done in particular with regard to professional development. In keeping with Wenger's model, each group is made up of diverse teachers in terms of age, race, gender, qualifications and expertise (Wenger 1998:75, 76). Mutual engagement involves complementary contributions in that each member plans and shares work in subjects. While this may result in contrived engagement (Hargreaves in Sergiovanni 2004:51), the plan is that a combination of pressure and support (Christie 2005:6; Langer, Colton & Goff 2003:158), or as Fullan (2000:8) puts it, accountability and assistance, would enhance the participants' functioning.

This model is chosen for this thesis with the acknowledgement that there are formal and informal communities of practice. In Wenger's (1998:6-7) works, communities of practice are informal naturally occurring, spontaneously evolving groups. However, in this study teacher groups were created intentionally and consultatively at the school site to collaborate on all the issues relevant to teaching mathematics and natural sciences in a home-based or semi-home based scenario.

However, not all communities of practice advance learning. Communities of practice cannot be romanticised because while they are born of learning, the practitioners can also learn *not* to learn and therefore it cannot be assumed that learning will take place (Wenger1998:132; Wenger 2000:230). As DuFour (2003:2) notes, teacher-to-teacher collaborations may not focus on raising student achievement. The collaborations may be more superficial, concerned with student discipline, planning events or teacher socialising. This is why although teachers remain in communities of practice because of their need to co-operate with each other, the right kind of collaborative culture

needs to be nurtured in order to raise student achievement (Sergiovanni 2004:51). This thesis considered all the ways participating teachers changed their ideas, commitment and competence to raise student achievement over a three-year period, noting that reculturation takes a much longer time than does restructuring.

According to Wenger and Snyder (2000:140, 40), managers cannot mandate a CoP. Instead managers bring the right people together, provide an infrastructure in which communities can thrive, and measure the communities' value in non-traditional ways. The above mentioned authors point out that while the tasks of cultivation are not easy; the harvests they yield make them all worth the effort. The role of school leaders will be an important feature of this study.

Schools are a constellation of different communities of practice (Gajda & Koliba 2008:140; Wenger 1998:127): CoP theorising allows a focus on a smaller group where the centre of teachers' learning can be placed in teachers' identity and dispositions and relations to each other (Hodkinson & Hodkinson undated:1). Each CoP is engaged in a cycle of inquiry around a shared purpose (Gajda & Koliba 2008:140). In this research, the grade 4, 5 and 6 communities of practice were configured around a teacher's capacity to effectively teach different subjects in a home-based or semi home-based environment. However, teachers within these groups were part of other subject-specific communities of practice. Thus, grade level teams intersected with subject teams. In particular the interaction with the mathematics and science subject teams was highlighted.

Communities of practice add value to an organisation in several important ways. They solve problems quickly, they transfer best practices, they develop professional skills and they help institutions recruit and retain talent (Wenger & Snyder 2000:140). Communities of practice emphasise an increased interactive dialogue among professionals about professional knowledge and practice (Wesley & Buysse 2001:118). Ongoing reflection and inquiry are core practices in each model, as is the

notion that by improving what and how they learn, participants create positive outcomes that extend beyond their own learning.

Traditional training tends to pull professionals away from their practice, focusing on information about a practice rather than on how to put that knowledge into practice. Only by engaging in work and by talking about the work from inside the practice can one learn to be a competent practitioner (Brown & Duguid in Schlager & Fusco 2003:203). Practice is an effective teacher and the CoP an ideal learning environment.

2.4.2.2 A new CoP model of pre-service learning and development

Traditionally in pre-service learning, the focus was on the development of individual knowledge more than on the formation of discourse communities for prospective teachers (Putnam & Borko 2000:9, 10). However, the view of knowledge as socially constructed makes it clear that an important part of learning to teach is becoming enculturated into the teaching community. In this study the pre-service teachers who were part of the grade 4 and 5 communities of practice were given time to think, talk and act as teachers. They were afforded opportunities to reflect on their work and opportunities to make judgements. According to Walkington (2005:60-61), these kind of activities challenge personal philosophies and existing practices.

In keeping with the above mentioned view, it has become imperative for teacher education to have a stronger and more diverse practical component and be predominantly school-based (Boylan 2004:3; Conkling 2007:44; Feiman-Nemser 2001:1020; Le Roux & Moller 2002:184; Melnick & Meister 2008:53; Walkington 2005:55). Examples of such models in practice are the studentship model of teacher education in South Africa (Mawoyo & Robinson 2005:109; Potgieter 2003:167) and professional development schools in America and England (Conkling: 200744, Kruse 2011:115, Melnick & Meister 2008:53; Pellett & Pellett 2009:31; Scharmann 2007:235). The practical component is meant to provide for the authentic context

within which student teachers are exposed to experience the complexities and richness of the reality of being a teacher (Republic of South Africa 2000:12).

It is also essential for teacher candidates to be part of a learning community where inquiry, critique and reflection are the norms (Frick, Carl & Beets 2010:422; Putnam & Borko 2000:10; Schulz 2005:148). In some scenarios, prospective teachers begin with minimal responsibilities and then move towards broader responsibilities and greater investment in the school CoP as they develop a sense of belonging in the community (Conkling 2007:48; Howe 2006:292). The idea is not for prospective teachers to assume a 'borrowed voice', however enlightened it may be, but to be sufficiently autonomous to make mistakes, to take ownership of their own learning and to develop their own identity as teachers (Frick et al 2010:432, Kumaravadivelu 2001:552).

2.4.2.3 A new CoP model of induction of newly qualified teachers: the beginning phase of in-service professional development

While some knowledge can be acquired through pre-service university practice, much of what teachers need to know can only be learned on-the-job through practice. In Lave and Wenger's (1991) terms, newly qualified teachers are legitimate peripheral participants and will work best in a collaborative culture, promoting a gradual acculturation into the profession of teaching. Each CoP comprises of at least one novice teacher.

In line with the above, the most successful teacher induction programmes are structured within learning communities (Wong 2004:50). These afford the experts and neophytes in the subject and grade communities of practice many opportunities to learn together in a collaborative, supportive environment promoting reflection and learning (Gilbert 2005:36; Howe 2006:288; Wong 2004:50).

When new and veteran teachers interact in learning communities, they treat each other with respect and are valued for their respective contributions (Gilbert 2005:36; Wong 2004:50). There is an acknowledgement that giving information, advice or answers are not substitutes for helping the mentee to discover his/her own answers and to strategically build up a personal map of the learning landscape of the organisation (Alfred & Garvey 2000:268). Above all the mentor should help the mentee come to see their learning in true situated fashion, as resulting from learning at work and from being at work. Lantolf (2000:17) asserts that in cases where experts and novices do come together, novices do not merely copy experts' capabilities; rather they transform what the experts offer to them as they appropriate it. Such interactions offer both emotional and instructional support, potentially developing the skills of new teachers and veteran teachers alike (Beutel &Spooner-Lane 2009:351; David 2000:134; Gilbert 2005:36).

An alternate to the traditional top-down mentor-protégé relationship is a dispersed form of mentorship where the mentor could be not one but a variety of different individuals who can help the protégé (Caruso in Alfred & Garvey 2000:270). In this case one can talk about a 'mentoring organisation' which is characterised by, among other things, a focus on collaboration, team development and a complex web of practices and relationships that is supportive and developmental, both of the individual and of the organisation. It is also important for mentoring to be viewed as a natural process and part of the normal behavior at work rather than a 'new initiative'.

2.4.2.4 A new model of in-service learning and development

In the new model of teacher learning, also called the professional development perspective, teachers themselves are key actors in directing and arranging their own learning processes. This perspective favours professional communities as a significant source for learning in addition to the everyday learning that takes place at the workplace (Kwakman 2003:151; Putnam & Borko 2000:6). Each CoP comprises of at least one experienced teacher.

For experienced teachers to be successful in constructing new roles they need opportunities to participate in grade and or subject professional communities. Many experienced teachers, as in the case of this study, are part of grade teams but also have leadership roles as subject heads. The leadership roles exercised within a CoP afford opportunities for the sharing of practice as well as the discussion of new teacher materials and strategies. Furthermore, the risk-taking and struggles entailed in transforming practice are supported (McLaughlin & Talbert in Putnam & Borko 2000:8).

The notion of distributed cognition suggests that when diverse groups of teachers with different types of knowledge and expertise come together in discourse communities, community members can draw upon and incorporate each other's' expertise to create rich conversations and new insights into teaching and learning. The main challenge of this study is the acknowledgement that the existing cultures and discourse communities in many schools do not value or support critical and reflective examination of teaching practice advocated by Putnam and Borko (2000:8-9).

Successful communities of teachers engage in what is called 'reform types' or alternate forms of professional development activities. Examples of reform activities engaged in are coaching, mentoring, study groups, teacher networks, common planning, lesson study, peer review of lessons, and joint evaluation of student work. The main reform activity engaged in by the subject and grade communities of practice is planning for classroom implementation. This activity takes place for the most part within the school day during regularly scheduled planning time (Garet et al 2001:921; Johnson 2006:243).

Designed to create more equitable social roles (Johnson 2006:243), reform activities are more likely than traditional forms to focus on student learning and make connections with classroom teaching (Ball in Garet et al 2001: 921). These approaches offer obvious strengths when viewed from a situated perspective. The

learning of teaching is intertwined with their ongoing practice, making it likely that what they learn will indeed influence and support their teaching practice in meaningful ways (Putnam & Borko 2000:7).

Education departments need to change a professional development model from isolated in-service workshops/seminars in which teachers passively receive prescribed information from outside experts, to one in which teachers are active. The teachers need to actively develop their own expertise and a deeper understanding of teaching and learning through focused, collaborative, relevant work that is supported to ensure sustainability (Palombo 2003:28). This study seeks to undertake this change.

2.5 SUMMARY

In chapter two I presented a conceptual framework for teacher education and development. To this end I explained situated learning theory. I traced a path of teacher learning and professional development pointing out opportunities for and problems with teacher learning starting with initial teacher education and moving on to teacher induction and then in-service professional development. From initial teacher education right to in-service education there are great opportunities for effective teacher learning and development if teachers work collaboratively in communities of practice. As they learn, they move from legitimate peripheral participation to more central participation in their CoP.

In chapter three I will review empirical results of research done worldwide and in South Africa on teacher collaboration for the professional development of teachers.

CHAPTER THREE

RESEARCH ON THE PROFESSIONAL DEVELOPMENT OF TEACHERS

3.1 INTRODUCTION

In chapter two, a conceptual framework on teacher learning and development was presented. The focus was on situated learning.

In this chapter, a literature review of research on the professional development of teachers is undertaken. First, I look at the goals of professional development and what the problems and challenges are in terms of this area. This is followed by a critical discussion of what effective professional development entails, and activities that have been shown to represent 'best practice' in professional development. I provide results of empirical investigations of teachers working collaboratively in communities of practice, in particular of mathematics and science teachers. Finally, I dedicate a section to the professional development of teachers in South Africa.

3.2 GOALS OF PROFESSIONAL DEVELOPMENT

The chief objective of professional development should be to foster changes in teachers' knowledge, beliefs and attitudes because these components of teacher cognition show a strong correlation to teachers' classroom practices (Richardson in Fishman, Marx, Best & Tal 2003:645). According to Schlager and Fusco (2003: 205), professional development to reach the aforementioned goal should be a collaborative effort. Through collaboration teachers implement and share practices, knowledge and values that address the needs of all students. Through engagement within a CoP teachers learn how to put knowledge into practice. Ultimately, the professional development of teachers must produce superior teaching in classrooms which in turn

should improve student learning (DuFour 2004:12; Fishman et al 2003:655; Guskey 2003:750, Hewson 2007:1182; Supovitz & Turner 2000:965).

3.3 PROBLEMS AND CHALLENGES OF PROFESSIONAL DEVELOPMENT

When embarking on a professional development project with the aim of improving teacher competence and student learning, it is important to have solid background knowledge of what has been successful and unsuccessful in other contexts. In particular it is essential for this study that research on site-based collaborative activities that have been shown to successfully impact classroom practice be identified and described.

The problems and challenges identified in professional development in national and international studies are relevant and revealing for the context of this study. Although some of the gains that are often associated with collaborative engagement in communities of practice are also beginning to emerge, in this section the problems and challenges of professional development are discussed.

There is a considerable body of literature on professional development in terms of teacher learning and teacher change (Garet et al 2001:917). Despite the size of the body of literature, however, there are still many problems with the design of professional development programmes (Schlager & Fusco 2003:205). Studies of professional development have consistently found programmes that are disconnected from practice, fragmented and misaligned (Fiszer 2004:2; Kayler 2004:265; Schlager & Fusco 2003:205). Many programmes lack key pedagogical, content and structural characteristics of effective professional development (Garet et al 2001:934; Desimone, Porter, Garet, Yoon & Birman 2002:83). Few professional development providers have the resources to address all stages of career development. Moreover, they seldom have the capacity to provide support on an on-going basis (Fiszer 2004:7; Schlager & Fusco 2003:205). Local values and norms of practice within

schools have proved formidable barriers to effective professional development (Putnam & Borko 2000:8-9; Schlager & Fusco 2003:205).

Teachers find it very difficult to reflect on their own practice (Schlager & Fusco 2003:205). The existing cultures and discourse communities in many schools do not value or support critical and reflective examination of teaching practice (Putnam & Borko 2000:8-9).

Teachers are also reluctant to engage in inquiry or dialogue that critiques the practice of their peers. This could be attributed to many factors including the fact that the teachers' classroom practices are closely tied to their identities as people (Schlager & Fusco 2003:205, 206), that teachers lack certain professional dispositions, that teaching has largely developed a culture of privacy (Fullan 2007:36; Pounder in Gajda & Koliba 2008:149; Schlager & Fusco 2003:206) and that it is very difficult to build trusting and respectful relationships across school departments and career development levels.

Researchers also continue to know relatively little about what teachers actually learn from professional development (Garet et al 2001:917; Guskey 2003:749; Penuel, Fishman, Yamaguchi & Gallagher 2007:953; Wilson & Berne in Fishman et al 2003:643); by what mechanism that learning takes place (Wilson & Berne in Schlager & Fusco 2003:206); let alone what students actually learn as a result of changed teaching practices (Garet et al 2001:917; Johnson 2006:244; Supovitz in Fishman et al 2003:643; Penuel et al 2007:953).

According to Penuel et al (2007:921), it is important to improve the quality of evidence about the effectiveness of teacher professional development. To do this it is necessary to build an empirical knowledge base that links different forms of professional development to both teacher and student learning outcomes (Fishman et al 2003:643). However, creating a chain of evidence that links student learning to teacher learning, professional development, and policy is remarkably challenging.

Therefore, so far, most studies have elected to look at components of the chain (Hewson 2007:1199; Penuel et al 2007:953). One basic component of the chain is to answer the question of what the features are of effective professional development. This issue is discussed in the next section.

3.4 EFFECTIVE PROFESSIONAL DEVELOPMENT

Identifying the features of high quality professional development is critical for any leader wanting to see results from their professional development efforts. As a starting point, the features provide a kind of checklist which could be used as a basis for comparing what is happening at their school to what has been identified by esteemed researchers as best practice.

According to Wong (2003a:3), the American Institute for Research identified six factors that make professional development effective and improve instruction in mathematics and science. These are:

- *Form of activity*: Teachers learn more in teacher networks and study groups than with mentors or in traditional classes and workshops.
- *Duration*: Sustained, intensive programmes are better than shorter ones.
- *Collective participation*: Activities designed for teachers in the same school, grade or subject are better than programmes that target groups of teachers who do not work together.
- *Content*: Programmes that focus on what to teach and how to teach are key to effective professional development.
- *Active learning*: Teachers need to observe and be observed to plan for classroom implementation, to review student work and to be involved in cohort groups where they are actively writing, presenting, and leading.
- *Coherence*: Teachers need to perceive professional development as a coherent part of other activities at their schools such as meeting state standards or adoption of new textbooks. It should be seen as integrated into the daily life of the school.

Professional development in the context of this study will involve most of the above features. There will be on-site grade level collaboration engagement intersecting with subject collaboration on an on-going basis. The groups strive to improve the quality of interactions and ensure that it is characterised by discussions around subject matter and how to teach it.

It is enlightening to note that some studies conducted over the past decade suggest that professional development experiences that share all or most of the above features can have a substantial positive influence on teachers' classroom practice and student achievement (Garet et al 2001:917). Empirical confirmation on what is considered 'best practice' in professional development was indicated by many different authors (Desimone et al 2002:102; Garet et al 2001:935; Palombo 2003:28; Penuel et al 2007:952; Saxe, Gearheart & Nasir 2001:59; Supovitz & Turner 2000:976).

Researchers found that high quality professional development characterised by reform activities in which participants are immersed in inquiry, questioning and experimentation were strongly linked with increasing teacher use of inquiry-based practice and investigative classroom culture (Corcoran, McVay & Riordan in Darling-Hammond & Richardson 2009:48; Supovitz & Turner 2000:973).

The content of professional development can make the difference between enhancing teachers' competence and simply providing a forum for teachers to talk (Darling-Hammond & Richardson 2009:46). The most useful professional development emphasises active teaching, assessment, observation, and reflection rather than abstract discussions. Such approaches engage teachers in the pursuit of genuine questions, problems and curiosities, over time, in a way that leaves a mark on their perspectives, policy and practices (Little in Crockett 2002:609).

The aspect of engaging in reform type activities is linked very closely to the number of hours that teachers participate. Sustained and intensive professional development is

more likely to have an impact than shorter professional development (Darling-Hammond & Richardson 2009:48; Garet et al 2001:935; Kosko & Wilkins 2009:7; Lumpe, Czerniak & Beltyukova 2011:1; Supovitz & Turner 2000:976). Teachers who had 80 or more hours of professional development in inquiry-based science displayed significant gains in their science teaching self-efficacy (Lumpe et al 2011:1) and were significantly more likely to use this type of science instruction than teachers who had experienced fewer hours of professional development.

In the challenging arena of teaching students with learning disabilities a longer duration of professional development increased teachers' efficacy in terms of adapting their instruction to assist their students (Kosko & Wilkins 2009:7).The longer training programme is regarded as essential in the light of how difficult it is for teachers to change classroom practices and classroom culture (Supovitz & Turner 2000:976). If teachers change their practices, students benefit. Students that had a greater exposure to the reform-based instruction showed an increase in achievement (Darling-Hammond & Richardson 2009:48; Lumpe et al 2011:2).

Researchers found that professional development that focuses on academic subject matter (content) gives teachers opportunities for hands-on active learning (Borko 2004:5; Garet et al 2001:935; Saxe et al 2001:61). Such hands-on work focuses on teachers' knowledge of the content and how to teach it. Experiences that engage teachers as students in activities such as solving mathematical problems and conducting scientific experiments are particularly effective (Borko 2004:5; Crockett 2002:622; Saxe et al 2001:61). The conceptual change science teaching project, the Summer Math for Teachers (Borko 2004:5) and the Integrated Mathematics Assessment approach (Saxe et al 2001:59) provide examples. Teachers attended summer workshops where they were exposed to intensive learning opportunities in which active subject learning was a central component, followed by on-going support during the school year. With this support they could discuss their practice or solve problems. The teachers who participated in these projects developed a deeper understanding of the mathematical and/or scientific content they explored.

From the above and other studies it is clear that professional development that focuses on content matter enhances the knowledge and skills on the part of the teacher and produced a sense of efficacy (Crockett 2002:622; Garet et al 2001:935, Palombo 2003:24; Supovitz & Turner 2000:976). The impact on students was found to be an increase in conceptual understanding (Saxe et al 2001:70), an increase in the variety of the problems solved and in the strategies used to solve them (Franke and co-authors in Borko 2004:6), and better achievement (Palombo 2003:24; Resnick 2005:2; Saxe et al 2001:72). This was especially true when that content was aligned with local curricula and policies (Garet et al 2001:936; Penuel et al 2007:952).

Research results also provide support for the importance of collective participation and collaboration of teachers (Crockett 2002:621; Fiszer 2004:32; Garet et al 2001:936; Palombo 2003:28; Street 2004:22). Supporting the notion that collaboration is an effective strategy for teacher learning is a large body of theory and research focused on the importance of teachers' professional communities. Thus, research on collaborative engagements in communities of practice is the next focus.

3.5 TEACHERS' COLLABORATIVE PROFESSIONAL DEVELOPMENT IN COMMUNITIES OF PRACTICE

Researchers and reform advocates consistently cite collaborative participation in communities of practice as an integral factor in achieving effective, sustainable professional development (Schlager & Fusco 2003:206). Smylie and co-authors (in Schlager and Fusco 2003:206), point to the catalytic role played by a CoP in teachers' professional development. A CoP can serve an enabling function establishing and spreading professional norms of practice, encouraging collaboration among community members, and instilling dispositions needed for effective professional development.

In a national survey of American teachers, Riel and Becker (in Schlager & Fusco 2003:206) found significant differences in the classroom practices of professionally

engaged teachers and those who engaged in ‘private’ practice isolated in their classrooms. Teachers who played important roles in an educational community were more likely to use constructive and collaborative instructional strategies in their classrooms while teachers who were less involved in collaborative activities with other colleagues were more likely to use direct instruction and individualised learning tasks. This finding was confirmed in two other studies where teachers reported on how they modelled their teacher collaborative pedagogy with their students (Borko 2004:8; Samaras, DeMulder, Kayler, Newton, Rigsby, Weller & Wilcox 2005:160).

In the next section the focus is on the activities that teachers engage collaboratively in within a CoP.

3.5.1 Sharing and building of knowledge

The most common type of activity in which people engage in collaboratively in a CoP is knowledge sharing (Chalmers & Keown 2006:152; Hew and Hara 2007:588; King 2002:247; Owen 2005:6; Palombo 2003:28; Street 2004:11; Wenger & Snyder 2000:140). Results from Hew and Hara’s (2007:588) study show that practical knowledge, namely personal opinions and suggestions, was most frequently shared. Knowledge sharing centered on examples that emerged directly from the context of the teacher and benefited teachers by engaging them in what they do.

The sharing of knowledge in a community allows prospective teachers and novice teachers access to the craft knowledge of experienced teachers. From a Vygotskian vantage point this enables student teachers to accomplish more with a mentor than they would have done on their own (Street 2004:16).

The sharing of knowledge builds the knowledge base of the community itself (Alfred & Garvey 2000:263; Handscomb 2007:81; Schlager & Fusco 2003:210). Knowledge and capacity generated in communities arise when community members engage in activities with each other tapping the tacit and often highly subjective insights,

intuitions and hunches of individuals and making these available for testing and use by the organisation as a whole (Alfred & Garvey 2000:263; Howe 2006:287; Palombo 2003:28).

Knowledge is also generated through the collaborative creation of new artifacts (e.g. rubrics, lessons), new tools (e.g. video cases, modelling and simulation tools) and the knowledge of how to use the tools (Palombo 2003:28; Schlager & Fusco 2003:210). Where such knowledge exists in a database, it allows teachers to build on one another's work rather than constantly reinventing good practice (McLaughlin 2002:108; Palombo 2003:28).

Handscomb (2007:81) draws a distinction among interesting and innovative practice, good practice and best practice. He explains it as follows: Teachers, who have developed a set of practices in their classroom that works well with their group of students, might be characterised as being at the one end of the practice continuum which is at the interesting and innovative end. As this is shared with other school colleagues, who adapt and apply it in their different settings, it gets tested against a range of teacher professionalism and might be termed 'good practice' which is at the middle of the practice continuum. Eventually it might be developed into school-wide approaches shared in other school settings, benchmarked and validated by supporting evidence and proven over time – and thus merit the accolade 'best practice'.

Handscomb (2007:83) notes further that even when there is such clarity on the nature of best practice, the process of actually sharing expertise among practitioners is in itself problematic. He therefore draws on Hargreaves (in Handscomb 2007:83-84) who gave considerable thought to the problem of how to 'bottle' and share teacher practitioner knowledge:

> *If one teacher tells another teacher about a practice he finds effective, the second teacher has merely acquired information, not personal knowledge. Transfer occurs only when the knowledge of the first becomes information for the second, who then*

> *works on that information in such a way that it becomes part of his or her context of meaning and purposes and pre-existing knowledge and then is applied in action ... Transfer is the conversion of information about one persons' practice and another's' know-how.*

While some researchers have serious doubts about whether such transfer is possible, other researchers insist on the transforming power of collaborative networks as long as such networks are committed to quality, rigour and a focus on outcomes. The critical benefit here that is relevant to this study is that a school works towards tapping its own expertise rather than importing it (Fiszer 2004:12; Handscomb 2007:79).

Hew and Hara (2007:574) addressed the crucial question that makes a teacher CoP possible in the first place: Why would practising teachers share knowledge to help others? Their question is relevant to this study as the grade 4, 5 and 6 communities of practice were expected to help each other and share knowledge; if no contributions had been made, the community would not have survived. Motivators for sharing knowledge were mainly community involvement motives – motives that aim to increase the welfare of the group. The most common combination of community motivators was collectivism and reciprocity (Hew & Hara 2007:576).

Collectivism and reciprocity appear to be closely linked to each other (Hew & Hara 2007:590, 592). Collectivism is easily built in social ties among members through face-to-face socialisations. In this study the grade communities of practice met for approximately 30 sessions a year. These face-to-face socialisations not only led to more chance encounters during which knowledge could be shared, but also increased familiarity. Increased familiarity results in shared understanding and community feelings, both of which increase the likelihood of knowledge sharing.

Reciprocity has been referred to as a shrewd investment. When teachers voluntarily share knowledge to help others, it is likely that this will motivate other teachers to

reciprocate by sharing their knowledge in return (Hew & Hara 2007: 592). Complimentary contributions to each grade CoP is a norm. A member shares information in one or two subjects but equally gets information from the other CoP members as well.

A related issue to knowledge sharing is the perceived seekers' behaviour (Hew & Hara 2007:589). Knowledge sharers form beliefs about whether a seeker is interested to learn, using seeker cues such as enthusiasm and interest in learning. These beliefs in turn shape the knowledge-sharers' decisions about whether or not to share knowledge. It can be expected that the challenge of teaching so many different (sometimes unknown) subjects, especially in grades 4 and 5, should generate teachers' interest in learning what their colleagues offer.

Knowledge is more easily shared in a safe, confidential and respectful environment (Hew & Hara 2007:589; Meyer 2002:37). This is best understood from a person's self-image perspective. According to Wasko and Fraj (in Hew & Hara 2007:589), knowledge is a very important component of an individual's self-efficacy and personal self-image. A respectful environment helps reduce the possibility that an individual's personal self-image is being threatened because attacks on an individual's ideas, which are typically viewed as attacks on the individual itself and destroys knowledge-sharing, are minimised. In this regard research results point to the importance of the moderator or facilitator of the knowledge sharing groups who should create a respectful environment (Chalmers & Keown 2006:153; Hew & Hara 2007:589).

It is important for facilitators of professional development programmes to listen to all points of view, offer praise, and call for calm in times of conflict. Facilitators must monitor the contributions of members ensuring that all members have a voice irrespective of their level of enthusiasm, their years of experience and their differences in institutional power (Chalmers & Keown 2006:153; Hew & Hara 2007:589; Kazemi & Franke 2004:217; Tobin & Roth 2005:319).

Facilitators also play an essential role in guiding discussions and thinking in a direction that increases the growth and development of teachers. For example, facilitators must support teachers in learning how to effectively use common planning time in mathematics and science. One way to do this is to have a facilitator who can ask questions, probe the teachers' thinking and lead them from just listing the tasks that need to be done to teachers talking about the tasks and actually doing the tasks (Murray, White & Brunaud-Vega 2009:5).

As in any knowledge-building effort, this study had to consider all the factors that impact knowledge sharing. Hew and Hara (2007:590) found knowledge sharing to be most commonly hindered by a lack of time and a lack of knowledge. The quality of the knowledge shared could also be a limiting factor.

According to Gajda and Koliba (2008:145) members in highly functioning communities of practice will be engaged in collective dialogue about student engagement and achievement, the effects of practice on student performance, and how to provide an appropriate level of challenge and support to every student. Members in lower functioning teacher teams may find themselves consistently talking about such topics as grouping, curriculum pacing and alignment, test-taking strategies, scheduling and dividing tasks, allocation of materials, discipline and coordinating learning activities. This indicates that the dialogue of each grade and subject CoP must be well-managed (Gajda & Koliba 2008:148).

Knowledge sharing is closely linked to issues of creating a supportive environment within a CoP as well as to problem solving within a CoP. Research on these two aspects is explored next.

3.5.2 Support in a CoP

When teachers collaborate and engage with each other in an ongoing way, they are often involved in oral conversational routines such as focus groups (Gajda & Koliba 2008:147), check-ins and charettes (Meyer 2002:34), co-generative dialoguing (Tobin & Roth 2005:315), written dialogue journals (Street 2004:14), or online dialogue (Chalmers & Keown 2006:152, Hew & Hara 2007:588; Palombo 2003:24). These conversations engender a strong sense of on-going emotional and instructional support and allow teachers to transcend the sense of isolation that is often associated with lower morale, burnout and attrition (DelliCarpini 2008:225; Fiszer 2004:16; Gilbert 2005;39; Greenlee & de Deugd 2002:72; Kayler 2004:271; Kinsey 2006:152; Oliver et al 2009:10; Phillips 2003:258; Samaras et al 2005:152; Tobin & Roth 2005:32).

Teachers in a CoP therefore often report on having emotional support. Emotional support arises from the opportunity to talk to other teachers, to listen to them and respect their opinions, to ask for help, to vent problems and frustrations and to encourage each other (Kayler 2004:270; Samaras et al 2005:159). These teachers appreciate being able to share ideas without feeling like they have to be an expert. They also welcome the opportunity to learn alongside each other and from other people's mistakes (Owen 2005:7; Zepeda 2012:3).The feeling that everyone is in the same boat and that each member of a CoP is regarded as valuable and on equal footing with everybody else serves as motivators for teachers to persevere in their endeavours (Fiszer 2004:11; Jita & Ndlalane 2009:63; Krainer 2003:100; Loughran 2002:149; Oliver et al 2009:8; Samaras et al 2005:161). Samaras et al (2005:161) found that their team collaboration resulted in a new energy, direction and voice in their student-centered teaching.

Teachers in a CoP also report on receiving instructional support. Instructional support is fostered when teachers are afforded opportunities to give and receive feedback on instructional practices, lesson plans, assessments (Phillips 2003:258; Samaras et al

2005:155), to learn new strategies and to solve problems with people who understand and could provide meaningful and relevant help (Kayler 2004:270, Samaras et al 2005:155). Instructional support arises less from just being heard, but more from critical dialogue, where teachers are challenged and held accountable (Palombo 2003:25; Samaras et al 2005:159-160). In this regard critical friends play a role in providing constructive feedback on how to improve teaching practice. The area of providing instructional support is a critical area for school leaders/managers in this study who are challenged by the need to support teachers as well as to gain their accountability. If critical friends are able to provide constructive feedback for teachers' growth, it could reduce the need for authoritative management as well as enhance group accountability.

Instructional support is more readily fostered when colleagues in the same field work together and novice teachers are mentored by experienced teachers (Oliver et al (2009:10). Having a mentor or more knowledgeable colleague in the same field is essential for deep knowledge to be shared and developed. Common planning time with teacher colleagues and networking with teachers all add up to considerable instructional support (Ingersoll & Smith 2003:34; Owen 2005:10).

It is important that support moves beyond cosiness (Handscomb 2007:84), "making nice" (Pappano 2007:1), hand-holding (Feiman-Nemser 2001:1031) or just talking, reflecting, sharing and identifying problems (Saxe et al 2001:71). Creating time and space for teachers to work together and the simple acts of sharing ideas and swopping strategies may be great supportive strategies but are not sufficient to improve practice and increase student learning (Gajda & Koliba 2008:145; Rusch 2005:86). Saxe et al (2001:72) found more benefits when issues are not merely discussed but are the focus of sustained discussion and exploration. The kind of support envisaged here is support for on-going professional development ensuring that learning is connected with practice and that when obstacles are encountered teachers will work collaboratively in a problem-solving spirit (Fiszer 2004:8,11-12; Handscomb 2007:84; McLaughlin 2002:108).

3.5.3 Problem-solving and joint-work in a CoP

Crocket (2002:611) refers to problem-solving episodes as “Deweyan dilemmas”. According to Dewey (in Crockett 2002:611), reflective thinking can only take place when there is a problem to solve. Problem solving occurs in communities of inquiry where members engage in shared work or joint work around a particular pedagogical matter (Little in Darling-Hammond & Richardson 2009:49). The dialogue in this context goes beyond knowledge sharing and supportive words of encouragement and extends to areas which may polarise teachers and bring about questions, confusion, disagreements and conflict but also, on a more positive note, discovery, as teachers engage in a collaborative search and construction of meaning (Crockett 2002:622; Gomez & Rico 2005:2, Kazemi & Franke 2004:231).

Research has been conducted on collaborative engagement around setting common lessons, scoring guides, scoring and analysing student work and analysing data (Crockett 2002:617; DuFour 2004:10-11; Kazemi & Franke 2004:231; King 2002:247; Palombo 2003:25). Lesson plans, scoring guides and student work are artifacts which provide a means through which participants in a CoP negotiate meaning (Wenger 1998).

The studies conducted revealed that jointly focusing on students’ work poses challenges, polarises teachers and leads to different levels of success in team members (Crockett 2002:617, Kazemi & Franke 2004:231). When some level of cognitive dissonance is created in individuals and teams, opportunities for learning are generated (Langer et al 2003:27,159; Loughran 2007:1045). The discussions and arguments, for example on how to score a mathematics activity, challenged each other’s assumptions and were the seeds of an emerging consensus about what counts as mathematical understanding in the context of a specific problem. It is precisely this process that moves teachers to a better understanding of the content and of children’s mathematical thinking (Crockett 2002:622).

Analysing student work and data together gives teachers an opportunity to develop a common understanding of what high quality work is, of what common misconceptions students have, and which instructional strategies work (Darling-Hammond & Richardson 2009:50; DuFour 2004:11, Langer et al 2003:19). The challenging discussions support the development of a shared language and allow teachers to build a common ground (Kazemi & Franke 2004:230-231). The different levels of success among team members allow them to confront their strengths and weaknesses and build on them in order to raise student achievement and this shapes the focus and trajectory of the group.

When individuals participate in shared endeavours, not only does individual development occur, but the process develops the practices of the community (Kazemi & Franke 2004:230). The power of joint work is evident in the success of schools that improve their results rather than make excuses for them (DuFour 2004:14; Palombo 2003:25). In such successful schools, explanations for student performance move from those based on beliefs about students' attitudes, backgrounds or capacities to the 'fit' between what their students need to learn and achieve and what is provided to them (McLaughlin 2002:108).

3.5.4 Problems within a CoP

High quality collaborative work within a CoP must be purposefully cultivated and then tools must be used to evaluate its effectiveness (Gajda & Koliba 2008:134). Research indicates that problems emerge because of isolationism and the mindset and practices of individualism that remain deeply ingrained in the culture of schooling. The result is that teachers feel uncomfortable and threatened by collaboration (Ashdown 2002:124; Gajda & Koliba 2008:149).

A related problem to the above arises when areas of work is seen as 'un-discussable' (Rusch 2005:94, 90) and where administrators themselves submerge talk about the

things that are potentially most controversial and potentially most important. This shuts down the learning system.

Furthermore, assumptions and beliefs are found to be extremely resistant to change. According to Zeichner and Gore (in Massengill et al 2005:214), an individual becomes a participating member in the CoP of teachers through a process that is influenced by pre-training experiences as a student, formal pre-service education and in-service years of teaching. Many experienced teachers express and display deeply entrenched beliefs and assumptions of how students should learn, about what the curriculum should contain and about how teaching should be approached. They are also critical of novel teaching approaches (Beutel & Spooner-Lane 2009:358).

Poor planning and division of labour was found to be a symptom of both proximal and remote group work. Many of these problems relate to interdependence in distributed groups. Reliance on members can also lead to the collapse of group work when one side fails to deliver on time (Dunlap, Neale & Carroll 2000:13). This situation reflects the need to build flexibility and autonomy in the activities of remote collaborations so that one side can continue and progress despite failures of remote members.

Teachers working within different zones of proximal development can be a source of conflict (Samaras et al 2005:153). Not all teachers participate with the same eagerness and learn in the same way in collaborative groups (Jita & Ndlalane 2009:66). This therefore dispels the notion that groups are monolithic and offer identical benefits to participating teachers.

Moreover, the development of teacher communities is difficult and time consuming work (Grossman et al in Borko 2004:7). It takes time to develop a vibrant social community where reasons for change and underlying philosophies and concepts can be explored and debated. Individual teachers within the community need personal time to work through the issues involved in new ideas and approaches (Chalmers & Keown 2006:149).

A huge responsibility rests on school management to ensure that collaborative groups spend their time wisely (Gajda & Koliba 2008:143). Critical to this challenge is the systematic exploration into the kinds of participation that team work engenders, their impact on teacher learning, and the kinds of learning environments teachers in turn create to foster student learning (Johnson 2006:244).

Beer and Einstsat (in Rusch 2005:91) conducted extensive research on interventions designed to promote increased organisational learning. These behaviours include learning how to receive feedback without the loss of self-esteem, learning how to collaborate without feeling out of control, and learning how to own up to weaknesses without feeling incompetent. These interventions could only achieve success in an open and respectful environment.

3.5.5 A pathway to action: guidelines for school leadership

Gajda and Koliba (2008:135) report on two collaborative projects, namely High Schools on the Move (HSOM) and Teaching All Secondary Students (TASS). Both projects were set up with the same goals in mind which is to realise significant gains in student achievement through the development of teacher collaboration in professional learning communities. According to Gajda and Koliba (2008:135), it is important for school leaders to follow six action steps in ensuring there is high quality collaboration. These six steps are depicted in Figure 3.1.

Figure 3.1 Teacher Collaboration Improvement Framework (TCIF) (Gajda & Koliba 2008:136)

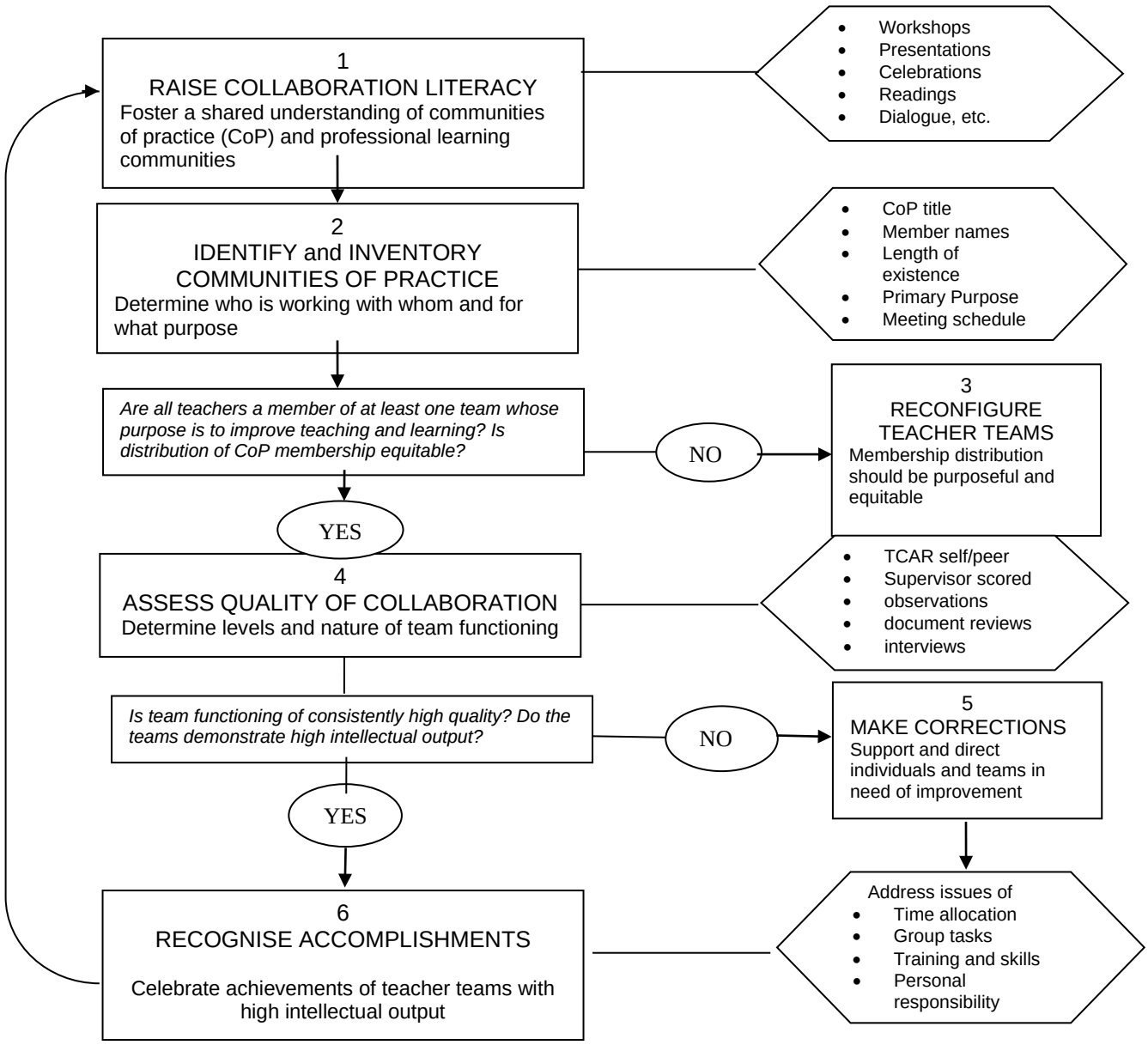

Figure 3.1 can be explained as follows:

(i) Firstly, ensure that every teacher is a member of a CoP focused on student achievement and guarantee that all communities of practice have strong linkages to each other (DuFour 2004:11; DuFour, Eaker & DuFour 2005:18; Reeves 2006:34).

(ii) The principal must make sure that all teachers are a member of at least one CoP that deals with the pedagogically important issues directly related to the core technology of schooling: teaching and learning (DuFour et al 2005:18).

(iii) If the school does not comply with the above, reconfigure the teams so that membership distribution is purposeful and equitable.

(iv) Members of each CoP should be engaged in a cycle of inquiry that should exhibit characteristics of high quality dialogue, decision making, action and evaluation (Gajda & Koliba 2008:143).

(v) School leaders are advised to use the TCAR (see 1.5.5) which the teachers involved in HSOM and TASS were jointly involved in compiling, refining and piloting. The TCAR must be used to evaluate the quality of collaboration and then teams must make corrections to their modes of interactions and the quality of the dialogue that frames their interactions (Gajda & Koliba 2008:144).

(vi) The final step is to recognise accomplishments (Gajda & Koliba 2008:148; Langer et al 2003:165). If groups are engaged in high quality cycles of inquiry, they will realise important outcomes. It is the responsibility then for school leaders to ensure that the accomplishments and collaborative processes of groups with high intellectual output are recognised.

It is only when members of a CoP collectively engage in high quality dialogue, decision-making, action and evaluation around a shared purpose that schools increase their capacity to achieve unprecedented improvements in student learning (Gajda & Koliba 2008:149). This necessitates groups of teachers setting goals for instruction, the public sharing of practices, the observation and examination of collaborative behaviour, feedback on team performance and accountability and responsibility to others.

Because teacher isolationism and the mindset and practices of individualism remain deeply ingrained in the culture of schooling, collaboration could feel uncomfortable and threatening to teachers. In their research, Gajda and Koliba (2008:149-150) have

found a need for principals to negotiate varying degrees of cultural resistance to collaboration. School leaders need to skillfully handle individual reluctance to the open examination of teacher teaming and inspect what they expect. School leaders are increasingly employing techniques for tracking and evaluating the quality of teacher collaboration through such means as requiring and reviewing team agendas, collecting minutes, and observing teacher teams in action (Pappano 2007:2). These methods are said to be greatly enhanced through the use of an assessment rubric such as the TCAR (Gajda & Koliba 2008:147). By using the rubric school principals are able to evaluate and make adjustments to teacher collaboration.

The TCAR is presented as Table 3.1. An explanation of each item on the TCAR follows the table.

Table 3.1 The Teacher Collaboration Assessment Rubric (TCAR)

		Dialogue		Decision-Making		Action		Evaluation
▲	6 5	Agenda for team dialogue is pre-planned, prioritized and documented. All team members regularly meet face-to-face. Team dialogue is focussed on the structured examination and analysis of instructional practice and student performance. Professional tension exists and disagreements are resolved 'now' or as close to now as possible. Team members value and reaffirm their shared purpose-to improve instructional practice and cultivate student learning. Members participate equally in group dialogue. There are no 'hibernators' or 'dominators'	6 5	Team regularly makes decisions about what individual and collective pedagogical practices they will initiate, maintain, develop and/or discontinue. All decisions are informed by team dialogue. The process for making any decision is transparent and adhered to. Team leadership/facilitators are purposefully selected and visible. Decisions are directly related to the improvement of instructional practice and the cultivation of student learning.	6 5	Each team member regularly initiates, maintains, develops and/or discontinues an instructional practice as a result of team decision-making. Team member actions are co-ordinated and interdependent, pedagogically complex/challenging, and directly related to the improvement of instructional practice and the cultivation of student learning. Equitable distribution of workload among team members	6 5	The team regularly collects and analyses qualitative and quantitative information about member teaching practices and student learning, including data collected through peer observation of classroom instruction. The team uses student performance data to evaluate the merit of individual and collective pedagogical practices. Evaluation data and findings are shared publicly and form the basis for team dialogue and decision-making.
	4 3	Agenda for team dialogue exists. Most group members regularly meet face-to-face. The process for team dialogue tends to be somewhat informal or unstructured. Discussion is usually related to instructional practices and student performance. Professional tension exists, but disagreements are rare and/or conflict may go unresolved. Most team members share a common purpose-to improve instructional practice and to cultivate student learning. For the most part members participate equally in the dialogue. Some members occasionally 'hibernate' or 'dominate'	4 3	The team makes decisions about what pedagogical practices they will initiate, maintain, develop and/or discontinue. Most decisions are informed by group dialogue and the process for making decisions is usually transparent and adhered to. Team leadership/facilitators exist but may not be purposefully selected or visible. Decisions are generally related to instructional practice and student learning.	4 3	Some team members will initiate, maintain, develop and/or discontinue practice as a result of team decision-making. Team member actions are somewhat co-ordinated interdependent and complex. Team actions are directly related to the improvement of instructional practice and the cultivation of student learning. Fairly equitable distribution of workload among team members.	4 3	The team does not regularly collect and/or analyse qualitative and quantitative information about member teaching practices and student learning. The team may rely more on 'hearsay', 'anecdotes' or 'recollections' to evaluate the merit of their practices. Evaluation information is usually shared publicly and forms the basis for dialogue and decision-making.
	2 1	Full attendance at team meetings is rare or the group meets face-to-face sporadically. Agenda for group dialogue is minimally, if ever, planned. The process for dialogue is typically improvisational. Tension is said not to exist, disagreements go unresolved, and/or team members may air disagreements about others after the meetings. Some or most team members do not value and/or hold disparate conceptions as to the purpose of the team. Unequal participation in dialogue. Members tend to 'hibernate' or 'dominate'	2 1	The team does not typically make decisions about pedagogical practices. Processes for making decisions are not purposeful, transparent or do not exist. Decisions are minimally informed by group dialogue. Group leadership/facilitators are not purposefully chosen or are not visible. Most decisions are unrelated to the improvement of instructional practice and the cultivation of student learning.	2 1	Team members take minimal action as a result of group decision-making. Member actions tend to be individualistic in nature, or involve very little challenge and/or complexity. Team actions are tangentially related to the improvement of instructional practice and the cultivation of student learning. Inequitable distribution of workload among team members.	2 1	Team members do not share evaluative data about the merits of their instructional practices with one another. The team does not systematically collect or analyse information about instructional practice and student learning. The team relies exclusively on 'hearsay', 'anecdotes' or 'recollections' to form the basis of their dialogue and decision-making.

Table 3.1 can be explained as follows:

- *Dialogue*: The dialogue aspect scores teams on the attendance at meetings, the frequency of meetings, whether or not there is an agenda and if minutes

are taken. The item considers the aspect of tension and conflict and how, if at all, it is resolved. Teams consider whether they have any ‘hibernators’ or ‘dominators’. The most important aspect of dialogue is to what extent dialogue is focused on student learning.

- *Decision-making*: This item can be used to evaluate the decisions taken by the teams. The essential matter here is to what extent and how often teams make decisions about what individual and collective pedagogical practices they will initiate, maintain, develop and/or discontinue. To achieve a high score, all decisions taken must be informed by team dialogue, must be transparent and adhered to. Team leaders/facilitators should be purposefully selected and visible and it is imperative that the decisions are directly related to the improvement of instructional practice and the cultivation of student learning.
- *Action*: This item evaluates the actions taken by the group. Of importance is the workload distribution in the group. A high score requirement is that each team member regularly initiates, maintains, develops and/or discontinues an instructional practice as a result of team decision-making. Furthermore, team member actions must be seen to be coordinated and interdependent, pedagogically challenging, and directly related to the improvement of instructional practice and the cultivation of student learning
- *Evaluation*: This item considers the use of data to inform decisions. To achieve a high score, the team must collect and analyse qualitative and quantitative information about member teaching practices and student learning. Qualitative data could be data gathered by teachers on their own classroom practices as well as data collected through peer observation of classroom instruction. Quantitative data is student performance data. The data gathered is used to evaluate the merit of individual and collective pedagogical practices. The data must be shared publicly and must form the basis for team dialogue and decision-making.

The TCAR can be used to gauge the quality of dialogue, decision-making, action and evaluation in order to help them improve (Gajda & Koliba 2008:146). Each of these items can be ranked from one (lowest score) to six (highest score).

The rubric operationalises collaboration and has been successfully used by principals in their efforts to put theory into practice for their teachers and administrators. The recommendation is that school principals observe teacher meetings and review archival data (meeting agendas, minutes and products) to evaluate and score the quality of team functioning using the TCAR. Teachers are also able to use the TCAR to assess the quality of their own team's functioning. Team member ratings can be aggregated and the resulting averages can provide an overall snapshot of quality.

Rubrics can and should be collected over time and documented in hard copy or electronically. Comparison between team assessment and school management assessment could be compared for consistency among scores (Gajda & Koliba 2008:146, 147). The essential idea is that teacher collaboration be corrected and improved.

The focus of the next section is on professional development of mathematics and science teachers in particular.

3.6 MATHEMATICS AND SCIENCE TEACHERS' PROFESSIONAL DEVELOPMENT

There are insufficient mathematics and science teachers worldwide (Clewell & Villegas 2001:vi; Oliver et al 2009:6; Stevens undated:8; Tobin & Roth 2005:313). Consequently there are many teachers in this school and in others that teach mathematics and science but are not qualified to do so (Jita & Ndlalane 2009:58; Oliver et al 2009:6). Although there are policy initiatives to recruit more teachers, there is no guarantee that those recruited will stay in their jobs.

According to Kriek and Grayson (2009:1) the state of mathematics and science education in South Africa is a cause for concern. The situation can be attributed in part to many mathematics and science teachers' limited content knowledge, ineffective teaching approaches and unprofessional attitudes.

Mathematics and science teachers often leave the profession because of job dissatisfaction (Ingersoll 2000:8; Oliver et al 2009:6; Tobin & Roth 2005:314). It has been found that job dissatisfaction could be improved by support offered in induction and mentoring programs. In this scenario mathematics and science teachers may find it easier to cope with problems such as poor discipline, large classes and the huge subject demands placed on them.

3.6.1 The demands on mathematics and science teachers

For mathematics and science teachers to be successful in their classrooms they need to be proficient in the content and methodology of their subjects (Anthony & Walshaw 2009:158; Drake, Spillane & Hufferd-Ackles 2001:1; Jita & Ndlalane 2009:59; Zakaria & Daud 2009:229). Proficient teachers offer many opportunities for their students to learn. Opportunities for students to learn are facilitated when teachers make connections with their subjects to everyday contexts, facilitate discursive interchanges, organise structured and purposeful tasks, use varied materials and representations and teach to promote conceptual change (Modisenyane, Rollnick & Huddle 2004:142; Tzur et al 2001:230; Walshaw 2012:425).

Each one of the teacher demands will be briefly discussed in the next section.

3.6.1.1 Teachers' content knowledge

Teachers' knowledge of mathematics and science has become an issue of concern (Appleton 2007:497; Hill, Schilling & Ball 2004:11; Jita & Ndlalane 2009:61). Concerns about whether or not teachers possess the necessary knowledge and skills for teaching mathematics have led to the development and use of teacher licensing examinations in many states in America (Hill et al 2004:12). The knowledge and skills assessed range from teachers' abilities to solve middle-school-level mathematics problems, their abilities to construct mathematical questions and tasks for students and their abilities to understand and apply mathematics content to teaching. Despite

the development of many standards and assessments there is a lack of agreement over what teachers need to know.

Furthermore, instructional programmes in mathematics are recently beginning to include substantial units on algebra and geometry in primary schools. (Hammer & Schifter 2001:470). Research results point to teachers' limited content knowledge and consequently their low confidence and self-efficacy in related topics (Appleton 2007:497; Drake et al 2001:14; Jita and Ndlalane 2009:61).

Research further indicates that while some teachers do make an effort to enhance their subject content knowledge, other teachers teach a topic just because they have to. These teachers tend to adopt one or more avoidance strategies such as teaching as little of the subject as possible, keeping to topics where confidence is greater, relying solely on a textbook, avoiding all but the simplest practical work or avoiding the topic altogether (Appleton 2007:497; Drake et al 2001:14).

The problems with a lack of content knowledge mentioned above have been attributed to a mismatch between the developmental level of the teacher and the developmental level assumed by the curriculum (Drake et el 2001:14). These problems could be and should be remedied by effective professional development for Saxe et al (2001:61) assert that teachers' knowledge of subjects like mathematics should be deeper than the content of the curriculum they are teaching.

3.6.1.2 Teachers' pedagogical content knowledge

Pedagogical content knowledge is a term introduced by Shulman (in Hill et al 2004:12-13). The term is used to refer to the special nature of the subject-matter knowledge required for teaching. Conceived as complimentary to general pedagogical knowledge and general knowledge of subject matter, the concept of pedagogical content knowledge includes familiarity with: topics students find interesting or difficult, the representations most useful for teaching an idea, and

students' typical errors and misconceptions. This term underscores the importance of understanding subject matter in teaching but also suggests that personal knowledge of the subject was insufficient for teaching that subject. Pedagogical content knowledge is a form of knowledge that combines subject matter (content) knowledge with an understanding of instruction, producing a highly specialised type of knowledge unique to teachers (Shulman in Phillips 2003:243).

McLaughlin (2002:95) states that teachers require more than content knowledge to construct the sorts of educational environments reformers hope for and contemporary students need. They need to know how to engage the students in content knowledge, how to allocate time and attention, and how to articulate standards appropriate for practice. They need to know where to place instructional priority, how students are responding to their classroom choices, and how to make adjustments when student achievement disappoints.

Current mathematics and science education reform efforts challenge teachers to reduce their role of showing and telling (Asoko 2002:162; Simon et al 2000:579). Instead teachers are encouraged to promote teaching as listening and learning. Teachers are asked to foster increased learning experiences that promote problem-solving, reasoning communication and forming meaningful connections among mathematical and science ideas (Asoko 2002:162; Tzur et al 2001:227). According to Asoko (2002:162), this can be very difficult for teachers who do not have a strong background in a subject like science, for example. Going beyond the labelling of events and phenomena as examples of scientific ideas, towards using those ideas for thinking, demands intellectual and creative effort on the part of both the teacher and the student.

Referring to mathematics, Simon et al (2000:599) suggest that teachers be committed to the learning of the subject with understanding; that they should adopt the view of mathematics as interconnected and develop an appreciation of students' first-hand experiences.

3.6.1.3 Connecting the subject to real-world experiences

There must be connections of mathematics and science to everyday contexts (Adler 2002:4; Asoko 2002:153; Simon et al 2000:599; Walshaw 2012:425). The use of contexts has been shown to motivate student engagement, illustrate potential applications, provide a medium for mathematical thinking and reasoning, and anchor student understanding (Anthony & Walshaw 2009: 156; Walshaw 2012:425). However, Drake et al (2001:4, 6) found that teachers had difficulty integrating mathematics learning with learning in other subjects and with real-world experiences. Teachers themselves report that they learned mathematics exclusively at school describing mathematics as a course to be taken as opposed to something learned from experience.

Contexts such as working in a shop are seen as opportunities for *using* mathematics that has already been learnt rather than as a context for learning new mathematics (Drake et al 2001:6). Walshaw (2012:426) points to story problems as an ideal way for students to make connections between the subject and their daily lives. However, it is important for teachers to develop the necessary skills in the creation and use of story problems in class.

3.6.1.4 Attending to students' reasoning and understanding

Opportunities for students to learn involve purposeful classroom interchanges and feedback to students (Walshaw 2012:425). A classroom environment in which the teacher orchestrates thoughtful discussions around meanings and understandings makes a contribution to the enhancement of student learning. Teachers must be aware of how students think mathematically and scientifically as well as how they engage in classrooms (Anthony & Walshaw 2009:150; Asoko 2002:160; Drake et al 2001:1; Hammer & Schifter 2001:464,456; Kazemi & Franke 2004:223;).

It has become important for teachers to hone their abilities to hear students' mathematics and science ideas (Asoko 2002:155; Hammer & Schifter 2001:464).They also need to develop the skills to elicit and challenge ideas in a way that does not demotivate students. Teachers need to consider what factors would make students receptive to a new idea and when exactly alternative ways of thinking are introduced into a classroom. These aspects are linked to the demand on teachers to teach for conceptual understanding.

Unfortunately, in many cases, teachers have not thought of mathematics as being about ideas, and even if they have, have not entertained the possibility that students have mathematical ideas worth listening to (Drake et al 2001:14; Hammer &Schifter 2001:464). In contrast to this, Kazemi and Franke (2004:223) showed that as soon as teachers start attending to the details of students' strategies to solve problems they recognise just how powerful students' mathematical ideas are.

Referring to the subject science, Asoko (2002:160) points out that there should be recognition as well as respect for students' existing ideas. Teachers must also develop students' scientific reasoning by recognising and supporting the beginning of reasoning in their students (Asoko 2002:154; Hammer & Schifter 2001:456).

3.6.1.5 Attending to the academic tasks

Teachers must attend to the academic tasks with which students engage because these tasks convey what doing mathematics is all about (Anthony &Walshaw 2009: 155; Drake et al 2001:1; Walshaw 2012:425). Tasks should be structured and purposeful, offering a vehicle for students to learn about particular mathematical ideas in ways that allow them to attend to the underlying mathematical structures (Walshaw 2012:425). Effective teachers take care to ensure that tasks help all students to progress in their cumulative understanding in a particular domain and engage in high-level mathematical thinking (Anthony & Walshaw 2009:155; Krainer 2003:93).

Simon et al (2000: 597-598) suggest critical questions for teachers to consider. These are: How do the students understand mathematics? What meaning do they attribute to the mathematical tasks they acquire? How do students construct particular understandings? What cognitive resources might students use and how might they engage in particular mathematics task designed to promote their learning? These questions highlight how much thought and work go into the setting up of activities for students to engage in.

3.6.1.6 The use of varied materials and representations

There should be varied materials and representations in a mathematics and science classroom (Appleton 2007:513; Asoko 2002:156; Walshaw 2012:425, 426). Multiple representations via stories, analogies, pictures, symbols and drawings lighten the cognitive load of the student by giving abstract ideas some form of physical reality and providing conceptual tools for thinking. Opportunities to learn include scaffolding by the teacher through the use of selective tasks and visual representations. In this regard it is important for teachers to enhance their diagram proficiency.

3.6.1.7 Teaching to promote conceptual change

Teaching to promote conceptual change is regarded as important in science and mathematics (Asoko 2002:155; Modisenyane et al 2004:142; Tzur et al 2001:230).To foster students' conceptual understanding, teachers must have rich and flexible knowledge of the subjects they teach (Borko 2004:5). Understanding also requires active, direct instruction by skillful teachers and active participation and cognitive struggle by students (Modisenyane et al 2004:142).

Teachers must be confident enough in their own content knowledge of science to identify which ideas are considered appropriate for their class, the level at which the ideas will be discussed and ways to exploit opportunities to introduce and apply these ideas or concepts (Asoko 2002:161).

Of significance for this study is that Powell (in Modisenyane et al 2004:142) has indicated that a key element in teaching that promotes conceptual change is for teachers to develop the dispositions and capability to examine and improve their teaching through action research. This is accomplished through a reflection-interaction cycle (Tzur et al 2001:230). While interacting with students, teachers continually modify their goals and/or learning opportunities on the basis of on-going reflections on students' evolving activity. When a period of teacher-student interaction in a first lesson is over, the teacher reflects on the students' current conceptions and thereafter plans for the next interactions. This perspective of teaching as reflection-interaction cycles implies that teacher knowledge (conceptions of mathematics, perspectives on mathematical activity and representations), and teaching-learning processes of particular mathematical content, are constantly changing.

The above places huge demands on the teacher's attention in the classroom (Hammer & Schifter 2001:464). In order for a reform vision of teaching mathematics and science to be realised in classroom practice, a considerable amount of teacher change and teacher learning must take place in terms of changes in the content and pedagogy of teaching and learning (Anthony & Walshaw 2009:158; Drake et al 2001:1; Jita & Ndlalane 2009: 59; Zakaria & Daud 2009:229).This is the focus of this study.

3.6.1.8 Teachers' professional development needs

Professional development is more effective when it is based on teachers' needs. Zakaria and Daud (2009:228-229) set out to assess mathematics teachers' professional development needs. They found that the top ten needs are: Integrating information and communication technology (ICT) into the teaching and learning of mathematics; delivering mathematics concepts to students; providing remediation for low achievers; updating knowledge of mathematics-related career opportunities; preparing instructional and learning activities; using test data to diagnose mathematics learning difficulties; selecting appropriate instructional strategies;

learning new methods of teaching mathematics; finding methods of motivating students to learn mathematics and updating knowledge of applications of mathematics.

In Oliver et al's (2009:8) study, which was based on mathematics as well as science teachers, the needs identified were almost a mirror of the above list with changes observed mostly in the rank-order of the items. The study, using Australian teachers, found the top three needs to be teachers needing assistance with: instructional methods (content-related pedagogy); assessment methods that were tailored to mathematics and science; and where to locate resources. Other needs identified were ICT use and integration; content and curriculum needs, and tapping into a mathematics or science communities of practice.

A quick comparison of the two lists above indicates that the CoP idea is not mentioned at all in the first list. This could point to the isolated way in which many teachers work. This situation has been addressed in a study conducted by Mewborn and Hubery (in Steyn 2009:264).The issue of working in a CoP will be addressed in this study.

Mewborn and Huberty (in Steyn 2009:264) successfully implemented a site-based professional development programme for mathematics teachers based on their identified needs. They further identified three main criteria for effective professional development for mathematics teachers. Professional development of mathematics teachers : (i) should be designed for teachers who teach specific grades; (ii) has got to be sustained, contextualised and relevant to teacher's classroom practice, and (iii) should be site-based so that staff developers understand their students, their curriculum, and their school structures. These three criteria are employed in this study.

3.6.2 Difficulties in mathematics and science teachers' professional development

Professional learning and development in teachers have been found to be difficult for many reasons. The first and foremost matter is the teachers' will or motivation to learn. A study conducted by Desimone, Smith and Ueno (in Steyn 2009:267) on mathematics teachers reveals that teachers with content knowledge of their subject have more confidence and motivation to further develop their knowledge and skills, while teachers with less content knowledge often have no interest in professional development, or may feel comfortable with their skills in and knowledge of the subject.

The above could be attributed to the fact that teachers have a fear of confronting the inadequacies in their content knowledge and their pedagogical content knowledge (Jita & Ndlalane 2009:63). Teachers report being apprehensive about sharing ideas with a group because of the fear of getting something wrong and of feeling disappointment and shame when they do get something wrong. Teachers have a lack of trust and are suspicious of other teachers that are better educated and report that they are afraid to approach other teachers because of a concern of exposing themselves as incompetent.

A certain level of personal investment and opening up is essential for teacher learning and development (Dymoker & Harrison in Steyn 2009:267; Jita & Ndlalane 2009:66). It is the responsibility of each staff member to continually experiment, deliberately reflect on what has happened as a result of individual or team effort, and reflect with others in order to learn how to improve. Such an approach will be incorporated into this research.

A further difficulty to confront is that new mathematics content and pedagogy could be radically different from what the mathematics teachers learnt when they were students at school. The acceptance of this 'new' mathematics requires teachers to

reject their previous practices and beliefs as both mathematics students and mathematics teachers (Cohen & Ball in Drake et al 2001:2; Wenger in Kazemi & Franke 2004:205). This results in teachers having to re-form their mathematics identities which can be a very difficult thing to do (Drake et al 2001:2).

3.6.3 Professional development of mathematics and science teachers

In the next section research based on the professional development of mathematics and science teachers is highlighted. Strategies that have assisted teachers in overcoming some of the demands and difficulties mentioned earlier are explained.

3.6.3.1 Developing teachers in terms of their content knowledge and pedagogic content knowledge

Professional development programmes that focus explicitly on subject matter can help teachers enhance their knowledge of a subject as well as increase powerful understandings about the subject (Borko 2004:5, 6). A key reason for deepening teacher's content knowledge of subject matter is to improve classroom teaching.

There are three important aspects that contribute to effective professional development that deepen teachers' content knowledge. One of these features is the kind of task or activity that the teachers are engaged in. A second facet is whether or not teachers are involved in the activity as individual students or collaborative students (Borko 2004:7; Crockett 2002:623). The third consideration is the teachers' identities related to the subject matter that they teach (Drake & Spillane 2001:4).

Experiences that engage teachers as collaborative students in activities such as working on open-ended problems, jointly planning, viewing and critiquing lessons, analysing students' work, solving mathematical problems and conducting scientific experiments are effective in enhancing both teachers' content knowledge and their pedagogic content knowledge (Borko 2004:5, Crockett 2002:622).Teachers find

discussions around open-ended problems not only enjoyable but also useful because it affords them the opportunity to enhance their content knowledge as well as share the problems with their students. This aspect will therefore be considered in this study.

Teaching vignettes and lesson planning sessions were found to enhance teachers' content knowledge on fractions (Crockett 2002:622). Teachers learnt that there were several conceptual meanings for fractions. This also stimulated further discussions on how fractions were represented in textbooks.

When teachers jointly analysed students' work the activity generated the most debate about what constituted mathematical understanding. There were many disagreements among the teachers but it extended teachers' thinking on mathematical understandings (Crockett 2002:623; Kazemi & Franke 2004:230). Examining students' work is regarded as a very fruitful data source especially in terms of insights into students' learning. It creates insights into what students are learning and what areas need improvement (Loucks-Horsley, Stiles, Mundry, Love & Hewson 2010:37).

The above highlights a few activities that teachers can engage in collaboratively in order to deepen their content knowledge. Such learning communities are central to fostering teacher change and student learning (Borko 2004:6). Studies of professional development in teacher communities such as Quantitative Understanding: Amplifying Student Achievement and Reasoning (QUASAR) and Supporting the Transition from Arithmetic to Algebraic Reasoning (STAAR) are further illustrative.

At each QUASAR school, the mathematics teacher worked with resource partners (usually mathematics teachers from a local university), to develop and implement innovative curricula and instructional practices. The project concluded that professional learning communities were central to fostering teacher change and

student learning. For example, at schools where strong learning communities evolved, teachers increased their use of cognitively challenging tasks and students' mathematical explanations. Students in these QUASAR schools grew in their ability to solve problems and communicate mathematically (Stein, Smith & Silver in Borko 2004:7).

In the STAAR professional learning community project a safe environment was created for teachers to explore an unknown mathematical terrain and share their solution strategies (Borko 2004:7). Teachers demonstrated greater knowledge of algebra concepts and skills on an assessment of mathematical knowledge at the end of the project than on a parallel assessment administered prior to the project. In daily written interviews and reflections at the end of the project, several teachers commented that peer collaboration and mathematical conversations played a crucial role in their evolving understanding of algebra concepts (Borko 2004:8). Moreover, they indicated that they planned to foster similar collaborations and conversations in their own classrooms.

Research using an individual teacher as the unit of analysis has shown that meaningful learning is a slow, uncertain process for teachers just as it is for students (Borko 2004:6). It has also been found that teachers that are exposed to identical reform programmes respond differently and that some change more than others through participation in professional development programmes (Adler 2002:9; Borko 2004:6; Spillane & Jennings in Drake et al 2001:3). Furthermore, some elements of teachers' knowledge and practices are more easily changed than others. In their study, Drake et al (2001:14-15) concluded that these could be attributed to differences in teachers' subject (e.g. mathematics) identities.

Drake et al (2001:4) also conducted a study with ten elementary school teachers. All of them implemented a research-based curriculum designed to blend the best of traditional and reform mathematics curricula. Each teacher could be placed in one of three categories based on their mathematics identities. Their identities determined

how they generally responded toward a reform mathematics curriculum. These identities were failing or foreclosed teachers, turning point teachers, and roller-coaster teachers as follows:

- Teachers who had early negative experiences which had not been 'redeemed' by later positive mathematics experiences were called *failing* or *foreclosed* teachers. They generally taught 'strictly by the book'. This strategy constrained their ability to use a curriculum as a site of learning about mathematics and mathematics teaching. New concepts in the syllabus were not viewed as opportunities to learn. They were perceived instead to be too 'abstract' and confusing. Some of these teachers generally avoided teaching the topics to their students (Drake et al 2001:14). These teachers were also unable to 'hear' innovative student responses and often taught activities focusing on the tasks and procedures and not on the content or on the meaning.
- *Turning-point* teachers had recently had a turning point from negative experiences in learning mathematics to experiences where they understood and enjoyed mathematics (Drake et al 2001:8, 13). These teachers initially lacked confidence and understanding in their own mathematics learning and early mathematics teaching experiences. They recalled that when they started teaching mathematics they just taught a topic because it was part of the curriculum and it had to be done. The teachers had experienced a 'turning point' (McAdams in Drake et al 2001:8) as a result of participation in professional development activities. As a result of this turning-point experience, they realised it was possible to succeed at, and more importantly to enjoy, mathematics.

Although the turning-point teachers worked hard on changing their mathematics identities, they viewed their primary turning points as affective. Consequently, their reform efforts focused more on the affective and process-oriented aspects of reform, and less on the mathematical content of the reforms (Drake et al 2001:12-13). Such teachers strived to, for example, get their students to love mathematics and tended to reward effort above all. Thus, they ensured that their students did

not get demotivated but continued to try. The main priority for turning-point-teachers was to help students enjoy mathematics and not fear it, as they had for so long.

- *Roller-coaster* teachers had mixed mathematics learning experiences (Drake et al 2001:15). These teachers tended to commit to enhance the experience of mathematics learning for their students. They did this by increasing and extending their own mathematics content knowledge. Their beliefs were that knowing more about a topic would make teaching easier and personally more gratifying. They also believed that students would learn more as a result of their enhanced content knowledge and that they would feel as if they were better teachers. Of importance for this study is that such teachers tended to be more reflective about their mathematics teaching, constantly engaging in action research cycles of changing practice, reflecting on this change, and then changing practice again. These teachers were also more willing to take risks in their teaching of mathematics as they engaged in the content and not just the process of mathematics reform. They constantly strove to understand the mathematics content as well as how to teach it.

The above is relevant for this study because it is important to identify what exactly the prior experiences of teachers are with regard to the subjects they teach. This must be done as a starting point to professional development. It explains why, when teachers are exposed to identical reform programmes, they respond differently. Their response depends in part on the disposition and beliefs which are embedded in their identities as teachers and as students (Spillane & Jennings in Drake et al 2001:3). It is for this reason that Adler (2002:10) asserts that it is sometimes better to discuss what is learned and how it is learned rather than decide if teachers have changed in any of the intended directions. These two questions will be explored in this study via personal interviews with teachers.

3.6.3.2 Professional development in mathematics and science teachers to promote inquiry into students' knowledge, reasoning and participation

Professional development of teachers for teaching mathematics and science is now envisioned to involve inquiry into students' knowledge, reasoning and participation. In addition, it should foster teachers' interest in the assessment of that thinking (Borko 2004:6; Hammer & Schifter 2001:464; Kazemi & Franke 2004:223; Saxe et al 2001:61). Due to their daily interaction with students, teachers are in a prime position to learn more about their students' reasoning and thinking abilities in terms of the mathematics and science topics that they teach.

One way to develop and refine teachers' abilities for engaging in such inquiry is to involve teachers in writings and conversations about classroom episodes as in the Teacher's Intellectual Resources project (TIR) and the Teaching to Big Ideas (TBI) study (Hammer & Schifter 2001:456). Other successful initiatives are conducting clinical interviews with students (Smith & Neale in Borko 2004:6); the Cognitively Guided Instruction (CGI) programme (Saxe et al 2001:57, 59); and the Integrated Mathematics Assessment (IMA) Development Programme.

Teachers may gather episodes from classroom teaching in a number of ways. In the classroom situation teachers may use audiotapes and video recordings, take notes in class or use samples of students' work. Teachers may also write from recollection as soon as the lesson is over. The data that is used in discussions are narrative accounts of classroom events and transcripts of interactions with students (Hammer & Schifter 2001:446,459). These modes of conversation allow teachers to articulate what they saw in students' thinking - perceptions that would otherwise remain private, tacit and unexamined.

In the TIR project teachers collected, presented and discussed snippets, which are small samples of information about their students. Reading, watching and listening to these snippets, the group talked about what there was to see in the students'

participation, exploring a range of possible interpretations. In this way the snippets and conversations provided a window into teacher inquiry (Hammer &Schifter 2001:446).The teachers found the process of collecting and discussing snippets helpful. Discussing the snippets provided for an exchange of diagnostic possibilities along with ideas on how a teacher may respond. The teachers, reflecting on their experiences in the project, reported benefits to their teaching including new ideas for activities, increased awareness of their students, increased emphasis on student's active participation, and changes in how they interpreted their students' knowledge and reasoning (Hammer & Schifter 2001:456).

In another project of longer duration called TBI, moments of classroom interaction were written about in more formal, refined essays (Hammer & Schifter 2001:459). Whereas the snippets of the science teachers consisted mainly of data from their classes, the TBI teachers wrote more extended essays about their experiences with students in mathematics classrooms. Teachers reported that being asked to write down and reflect on the mathematics of what their students said and did forced them to attend to the students in new ways (Hammer & Schifter 2001:464,465). What the teachers discovered in their students' reasoning informed their interactions with them. Teachers learnt to listen with a new ear and new appreciation for their students' ideas. In the course of the project they developed and refined their abilities to hear. The teachers also found ways of eliciting more student ideas.

Experiences in other projects had shown that the exercise of capturing student dialogue in writing facilitated changes in practice. At the same time, the episodes teachers wrote provided a database to study students' mathematical thinking (Hammer & Schifter 2001:460).

Another professional development activity that assists teachers in exploring student thinking is by conducting clinical interviews with students as in the conceptual change science teaching project (Smith & Neale in Borko 2004:6, 8). These interviews

revealed students' conceptions and typical misconceptions about key scientific concepts. They also showed what the role of these ideas was in learning.

The CGI programme (Saxe et al 2001:57) focused on enhancing teachers' knowledge of students' strategies for solving addition and subtraction word problems. With a greater understanding of student mathematics, CGI teachers argued, teachers should be empowered to structure classroom practices in relation to their students' thinking.

The CGI programme successfully afforded teachers the opportunity to explore students' thinking (Carpenter et al in Borko 2004:6).Teachers who participated increased their knowledge of the strategies that students used to solve problems, the kinds of problems students grappled with the most and discovered different ways to pose problems to students. The benefit for the students whose teachers participated in this project were that they were more advanced in knowledge of both basic arithmetical facts and problem-solving strategies than a comparison sample of children in non-CGI classrooms. Furthermore, as teachers gained expertise with CGI approaches to student thinking, they created practices that led to subsequent cohorts of students to show even greater improvements than prior cohorts (Saxe et al 2001:57).

The IMA programme was organised as a repeating set of activities around teachers' mathematics, students' mathematics, students' motivation and integrated assessment (Saxe et al 2001:59). The goal of the integrated assessment component was to enhance teachers' competence with assessment that built upon students' thinking. A range of practices focused on: whole class discussions (e.g. how to interpret and address "wrong" answers), observation, guidance and inquiry during student activities (e.g. how to focus observation on a key developmental issue); assessment of students' written work (e.g. sample rubrics); peer problem-posing and peer assessment; and portfolio assessment. Teachers analysed these practices, role-played, piloted assessment tools, and shared assessments of their own designs

(Saxe et al 2001:62, 72). Students of IMA teachers had a stronger conceptual performance than those of the support group teachers.

In each of the projects discussed above, teachers reported an increased awareness of the role that students' thinking played in the learning process and the importance of listening carefully to students in order to build on their understandings and misconceptions (Borko 2004:6; Hammer & Schifter 2001:474; Saxe et al 2001:62).

3.6.3.3 Professional development in mathematics and science teachers to teach in difficult contexts

The preparation of teachers to teach diverse populations in urban schools stands out as a critical area for improvement in teacher education (Ball 2000:228). A matter to address is each teacher's efficacy which is an important construct in student achievement (Pang & Sablan in Ball 2000:229). Teacher efficacy concerns what teachers believe about their ability to teach children from various cultural and linguistic backgrounds and about their power to produce an effect on students. Teachers with high efficacy believe that all students can be motivated and that it is their responsibility to explore with students the tasks that will hold their attention in the learning process.

It is important to also consider the profile of a teacher. Transitioning teachers, that is teachers who start a course with a commitment to the issue of diversity and who display evidence that their commitment is developing further, learn within the zone of proximal development (Ball 2000:233).

Tobin and Roth (2005:314) describe a model of education, induction and development of science teachers that is particular to urban contexts. The model is based on two complimentary fields: co-teaching and co-generative dialoguing. Co-teaching is premised on the idea that working with one or more colleagues in all phases of teaching (planning, conducting lessons, debriefing and grading), supports

teachers to learn from others without having to stop and reflect on what they are doing at the moment and why. Their view is that co-teaching is a praxis that can be used in programmes in the entire continuum of teacher learning from pre-service to in-service teachers.

In co-generative dialoguing, groups talk about specific incidents occurring in the classroom. Co-generative dialoguing is similar to reflection on practice with one crucial difference (Schon in Tobin & Roth 2005:315). When co-generative dialoguing is associated with co-teaching, teachers and a selection of students reflect together on a lesson they had recently shared. The participants of this discussion have a concrete, common object on which to focus their verbal interactions. The purpose of the session is to articulate salient elements of what worked and what did not work for the purposes of designing strategies for improving future science lessons.

The power of co-generative dialoguing lies in the fact that all participants refer to the same set of events which are often replayed using videotapes of the lesson. Moreover, the views and understandings of all the participants are valued. Thus, understandings and explanations are co-generated. Co-generative dialogues can be used by new and experienced teachers to learn from their own and others' experiences, especially from the perspectives of their students (Tobin & Roth 2005:315).

The aforementioned represents a radical shift from endeavouring to establish control over the learning environment to collaborating with colleagues and students to establish and maintain effective learning environments (Tobin & Roth 2005:315, 316). By being in a CoP, teachers can continually learn more about science content and science teaching methodologies.

Of great significance for teaching in difficult school contexts, collaboration in a CoP allows teachers to develop the necessary symbolic and social capital with a critical mass of the students they teach (Tobin & Roth 2005:320). This symbolic and social

capital allows teachers to interact with students and establish productive learning environments, without which teachers are unlikely to succeed regardless of their knowledge of science and science teaching. Co-teaching with teachers who have already built the necessary social and symbolic capital can provide structures that enable co-teachers to learn to teach successfully in urban science classrooms.

The focus now turns to the professional development of school teachers in South Africa.

3.7 PROFESSIONAL DEVELOPMENT OF TEACHERS IN SOUTH AFRICA

There is an acknowledgement that professional development programmes in South Africa should meet the challenge of developing teachers' subject content knowledge and pedagogic content knowledge (Kriek & Grayson 2009:2; Welch 2002:28-29). This development must be integrated with a thorough understanding of the changing social character of schools as well as the skills required to manage learning in diverse classrooms (DoE 2006: 20). Professional development should also improve the professional attitudes of teachers that are related to late coming, being unprepared for lessons and omitting sections of the syllabus that they do not understand (Kriek & Grayson 2009:2). Ultimately, learning gains must be a primary goal of in-service professional development (Adler & Reed 2002:45).

The mandatory requirement that all teachers in South Africa devote 80 hours a year to in-service professional development (Educator Labour Relations Council Resolution [ELRC] 2003) and that all schools implement the Integrated Quality Management System (IQMS) should result in positive learning outcomes for teachers' learning. Despite these mandatory requirements, teacher development is not always viewed positively and is not always embraced willingly (Mestry et al 2009:482; Robinson 2001:107).

There was no evidence of any kind of traditional development (workshops) or reform (reflection) at four out of five schools studied by Robinson (2001:107). In a study conducted by Mestry et al (2009:482) it was revealed that teachers viewed professional development as neither meeting their needs nor benefitting the students in any way. They further found that reform activities such as peer appraisal was viewed as judgmental rather than developmental and that principals did not visit classrooms much.

According to Jessop (in Foulds 2002:2) there are teachers who simply opt for pedagogical conservatism. Regardless of whether faced with a personal growth plan, a new demographic profile of students in their classrooms, or even a radical change in curriculum, they continue to do more of the same year in and year out.

Some reasons given for the above findings are that teachers have low self-efficacies (Selaledi in Foulds 2002:2), and that they are constrained by their schools' organisational culture which may neither embrace change nor promote learning (Carrim & Shalem in Foulds 2002:2; Robinson 2001:113). Other reasons were found to be related to teachers having heavy workloads, schools being disrupted due to union activities and school managements constantly being in crisis mode (Robinson 2001:106-107). Unfortunately, some teachers also have to teach in very violent and poorly resourced contexts. The demand of caring for students plagued by many social ills as well as the demand to produce good results impact on classroom practices in contradictory ways. These tensions and accountability pressures may inhibit teachers' aspirations to higher levels of effectiveness (Adler 2002:8; Harber & Muthukrishna 2000:425).

For the above mentioned reasons among others, teacher development initiatives are sometimes not self-generated but rather mandated by the school management team, district or state. This being the case, the development initiative is viewed as others getting teachers to change rather than as teachers learning (DelliCarpini 2008:222; Johnson et al 2000:184; Steyn 2008:17).

The problem of teacher willingness to participate in in-service development is compounded by the quantity and quality of some developmental courses provided by schools and school departments. Much has been written on the development provided to teachers in South Africa when they were expected to undergo a radical paradigm shift to Outcomes–based education (OBE) and its version in South Africa called Curriculum 2005. For this, the cascade model of professional development and the UNIVEMALASHI project were used. The acronym UNIVEMALASHI is used for a stakeholder partnership project between the Limpopo University, the schools in the Malumele district and the Shingwezi College of Education in the Limpopo province.

3.7.1 The cascade model of development

The cascade model has attempted to train small groups of teachers at each school on a limited workshop basis, with the expectation that they, in turn, would be able to train their colleagues (Foulds 2002:1; Ono & Ferreira 2010:59). This widely-used model has been criticised for being a watered-down approach that leads to the misrepresentation of crucial information (Ono & Ferreira 2010:59, 61; Ramparsad 2001:290), and for conforming to the “transmission model” of schooling.

Furthermore, the pace of the training was seen as poorly timed (Ghanchi Badasie 2005:7; Foulds 2002:2), of being too theoretical and not sufficiently school and classroom-focused (Sigabi & Mputhini in Foulds 2002:2), and of having a one-size-fits-all agenda which ignored that teachers are at different developmental levels (Ghanchi Badasie 2005:83; Foulds 2002:2). The teachers would have benefitted more from lengthy programmes involving active peer support networks and the opportunity to learn from master teachers.

Other complaints of the cascade model of OBE development and training, centred on the dubious knowledge and competence of facilitators. This resulted in a lack of consistency between the training and OBE methodologies, and an insufficient focus on the practical application of the OBE methodologies in school and classroom

contexts (Ghanchi Badasie 2005:70-71; Foulds 2002:2). In schools where there was some measure of success in the implementation process the contributory factors were proactive self-directed learning and collaborative team work (Ghanchi Badasie 2005:1,65).

3.7.2 The UNIVEMALASHI project

The goal of the UNIVEMALASHI project of teacher professional development was to empower the participating teachers on OBE related knowledge, skills, attitudes and practices (Onwu & Mogari 2004:165). The project was different from the cascade model in that it offered a longer duration for learning, with multiple opportunities for discussion, reflection and engagement. The programme began with workshops but offered ongoing support as well as opportunities for teachers to explore, discuss and explain their views, ideas and perspectives to each other.

Through the above mentioned open-ended discussions and problem-solving, a culture of what is called ‘reflective planfulness’ was introduced into the competence repertoire of the teachers. Teachers reported that they were beginning to accept constructive criticism from a supportive but critical colleague (Onwu & Mogari 2004:165-166).

Other reform activities that formed part of this programme were ‘feedback workshops’ cluster meetings and class visits. Teachers were also encouraged to keep a journal which was read fortnightly (Onwu & Mogari 2004:165-166). The project ended with an evaluation research component in which data were collected using a variety of methods including individual interviews, focus group interviews, and interviews with principals and Early Childhood Development specialists from the district office.

With regard to the above evaluation, Onwu and Mogari (2004:166) found that change at classroom level took some time. After a year and a half, teachers were seen to be incorporating more co-operative learning strategies with their students especially in

dealing with unfamiliar content or problem–solving. This increased the teachers' confidence and motivation to continue using student-centred methods of teaching. This experience also brought about 'personal satisfaction' when teachers observed that this methodology made students increasingly more confident and that the students tried to a greater or lesser extent to take more responsibility for their learning than before (Onwu & Mogari 2004:165-171).

The cluster meetings of the project provided the intellectual and social forum to help build a trusting and mutually supportive relationship amongst the teachers. There was also in-school community support that included teachers, parents and other relevant stakeholders (Onwu & Mogari 2004:171, 176). What has emerged is that collaboration among stakeholders is necessary where partners have a shared interest in solving a problem. In the case of UNIVEMALASHI, its success may be attributed to the fact that the partnership stakeholders, each with their own defined roles and responsibilities, have been effective in influencing the classroom, the school and the wider education system.

3.7.3 A holistic professional development model

Kriek and Grayson (2009) designed a holistic professional development model for in-service physical science teachers. They regard their model as holistic because it addresses all of the needs identified for South African teachers, namely the need to improve teachers' content knowledge, teaching approaches and professional attitudes.

In conducting the research, Kriek and Grayson (2009:2-3) also set out to ensure that it conformed to elements of local and international successful professional development models. The criteria they set out to meet was that their holistic model catered for the following: a year-long duration; development of teachers' content knowledge; provision of opportunities to try out new teaching strategies; reflection on teachers' own practices; provision of infrastructure to support teachers' collaboration

with fellow teachers and researchers; development of teachers as lifelong students, and recognition and development of teachers' beliefs.

The professional development took place as a distance-mode course over one year in which teachers from urban and rural schools in Gauteng, Limpopo and KwaZulu-Natal worked through a study guide, did assignments, and wrote their reflections in journals. They could attend voluntary workshops which allowed face-to-face interaction with other students and with researchers. Peer support was part of the model. They also used a science kit as a tool of learning and conceptual understanding (Kriek & Grayson 2009:4).

Qualitative data from classroom observations, assignments, journal entries, pre- and post- tests, examination scripts, workshop evaluation forms, interviews and peer observation forms were coded in terms of three dimensions of interest: content knowledge, teaching approach and professional attitudes (Kriek & Grayson 2009:6). Sixty percent (60%) of the participants reported an improvement in content knowledge. From interviews and other data the researchers established that there was a significant relationship between improved content knowledge, teaching approach and professional attitudes. Overall, teachers reported an improvement in confidence and an improved willingness to learn more. One of the teachers in the study was so successful that he was selected as a leader in the subject and expressed his willingness to assist other teachers who were experiencing problems (Kriek & Grayson 2009:9).

Teaching approaches do not change easily with a one-way teacher dominated "chalk and talk" method seen as very prevalent in South African classrooms (Taylor & Vinjevold in Kriek & Grayson 2009:7). However, Kriek and Grayson (2009:8) found that this approach was transformed into animated teacher-student and student-student interactions through professional development.

Finally, on the matter of professional attitudes, the following improvements were noted. Of the teachers, about 40 % started working harder. This happened even though there was an initial reluctance to do more than the bare minimum in terms of time spent on school related tasks (Kriek & Grayson 2009:9, 7). Teachers did not leave topics out of the teaching curriculum simply because they did not understand it as was the practice before.

3.7.4 Teacher clustering as professional development

A cluster is a group of people who teach the same subject and usually meet once a month. Jita and Ndlalane (2009:58) used a qualitative case study approach incorporating hypothetical questions and responses from mathematics and science teachers in Mpumalanga to examine the efficacy of clustering as an approach to teacher development. The structural change required was getting people together to meet and talk. However, a process that can address teachers' fears and stimulate some measure of risk-taking and personal change in teachers was also required. Time was found to be of critical essence (Jita & Ndlalane 2009:65).

It takes a while for teachers to open up and expose the inadequacies in their content knowledge and pedagogic content knowledge. The requirement that every member of a group contributes something from their individual experiences to the discussion was an important part of the process of opening up for the cluster leaders. Each teacher leader felt an obligation towards the group members, and was therefore willing to expose themselves to the group (Jita & Ndlalane 2009:65).

Over time, the discussions, interactions and sharing of personal experiences among teachers, together with relationships of trust and identity, make clusters an attractive vehicle for challenging and possibly changing teachers professional knowledge and practice (Jita & Ndlalane 2009: 58). When teachers shared a variety of ideas on a topic instead of some imposing their ideas on others and when they participated as

peers with each colleague they each made a contribution to the resources of the cluster and this fostered a successful clustering process.

Cluster leaders believed that they had adequate resources among themselves to enhance one another's strength and competence with regard to content knowledge and pedagogic content knowledge. Those teachers whose content knowledge and pedagogic content knowledge were better than that of the other teachers, tended to assist their colleagues. They did this through discussion and debate of the concepts and of students' responses. These interactions within the cluster promoted the co-construction of new knowledge by some members of the group. Thus, Jita and Ndlalane (2009:64) argued that there was evidence of learning and growth resulting from interactions within the cluster.

It is the co-construction of new knowledge that is the critical stage in the functioning of a group (cluster). Several participants stated that the group discussions enabled them to learn and improve their content knowledge and to better organise their content knowledge and pedagogic content knowledge relating to the topics under discussion. Jita and Ndlalane (2009:65) posit that it is this link between content knowledge and pedagogic content knowledge that helps teachers change classroom practices. The evidence gathered in their study suggests that cluster workshops provided opportunities for the teachers to make this link explicit.

Discussions and dialogues that lead to sharing, challenging and reflecting on classroom practices seem to provide opportunities to challenge and change teachers' content knowledge and pedagogic content knowledge. This depends on teachers' sense of commitment towards collaborative learning and support in the cluster meetings with peers. This commitment is based on trust which gives teachers the confidence to share what happens in the classroom, with the aim of improving classroom practices (Jita & Ndlalane 2009:65).

3.8 CONCLUSION

In this chapter empirical results of research done worldwide and in South Africa on the professional development of teachers were presented.

In the next chapter I outline the research design of this study. In the chapter detailed information is given on the action research project that has been implemented for the professional development of a group of teachers.

CHAPTER FOUR

RESEARCH DESIGN AND DATA COLLECTION

4.1 INTRODUCTION

In chapter one a justification for the research was presented and the research problem was stated. In chapter two the conceptual framework of the study was explained. This was followed by a literature review of research on the professional development of teachers in chapter three.

In this chapter, I explain the research design and methods of data collection used in conducting the research. In particular I delineate the ethical measures that were undertaken to protect participants; the research design and data collection methods, methods of data analysis, and finally, measures to ensure validity.

4.2 ETHICAL MEASURES

Three unifying ethical principles considered in this research were: (i) Respect for persons (which included autonomy of participants, informed consent and confidentiality of participants), (ii) beneficence and (iii) justice (Nolen & Van der Putten 2007:40-402). I noted all these ethical measures and ensured that they were the principles guiding the study from beginning to end as follows.

4.2.1 Voluntary participation

Whilst practitioners have the right to devote their own time and effort to research, they do not have the right to demand the co-operation of others (Pritchard in Nolen & Van der Putten 2007). This principle, often referred to as voluntary participation, stipulates that participants cannot be compelled or coerced to participate in research, as also

pointed out by McMillan and Schumacher (2010:118). A key concept in determining that participants had, in fact, volunteered is ‘informed consent’. In the research, this issue was central to making sure that participants had the information they needed to decide whether or not to participate (McMillan & Schumacher 2010:118). Individuals were treated as autonomous agents whose decisions on whether or not to participate in the research were respected. All the teachers who participated voluntarily agreed to be part of the collaboration project and chose the subject/s they would plan for the other teachers.

4.2.2 Informed consent

In general, informed consent for action research is complicated by the following matters:

(i) The university, school district or ethics committee may not have the ability or authority to alter the daily classroom management practices of a classroom or school.
(ii) Prior consent by a student, parent, school administrator or teacher to certain activities and to monitoring on a normal schooling basis does not automatically extend to research undertaken around those activities.
(iii) Schools or districts may conduct quality assurance and evaluations that have been consented to as part of the culture of accountability, but that consent does not necessarily extend to research activities (Nolen & Van der Putten 2007:402-403).

These aspects were of particular concern to me as researcher as I was also the principal at the school under study. Therefore, at the point at which the research was conceptualised, informed consent was obtained through dialogue with each potential participant (McMillan & Schumacher 2010:339). At that point all matters relevant to the research project were outlined and

explained. These matters included the times that the groups would meet, the roles of all participants (including my role as researcher), and the need to take notes and record meetings. This was done to establish an open, honest and trusting relationship with all participants (McMillan & Schumacher 2010:339).

While I had the opportunity to visit every teacher's classroom and was privy to all mark analysis, book control and IQMS information, other special precautions were undertaken. Special permission was obtained to tape record class visits and only the data from volunteering teachers were used as part of this research.

Informed consent was later also obtained by asking participants to sign a form that indicated their understanding of the research and their consent to participate (Appendix B). Consent was also obtained from the SGB and the GDoE (Appendix A and Appendix C).

4.2.3 Anonymity and confidentiality

The privacy of research participants needed to be protected (McMillan & Schumacher 2010:121). This meant that access to participants' characteristics, responses, behaviour and other information was restricted to me as the researcher. I ensured privacy by using three practices: (a) anonymity, (b) confidentiality, and (c) appropriate storing of data.

Anonymity meant that other researchers could not identify the participants from information that had been gathered (McMillan & Schumacher 2010:118). Thus, the data were reported in such a way that the identity of the school and of the participating teachers was not revealed.

Confidentiality meant that only I had access to individual data or the names of the participants and the participants were informed accordingly (McMillan & Schumacher 2010:122). Confidentiality was ensured by making certain that the data could not be linked to individual participants by name. First, during the process of data collection members' concerns that information may be divulged to other groups were frequently addressed and participants were constantly assured of total anonymity and confidentiality. Second, great care was taken to ensure the appropriate storing of data. All minutes taken, field notes and tape recordings were stored at my home where no one had access to them. Data were also stored on a personal computer and not on any server where it could be accessible to others. Finally, while the views and comments of teachers were used, these were reported using pseudonyms so that no information could be linked to any specific person.

4.2.4 Avoidance of deception

Full disclosure about the purposes of the research was provided right at the outset of the investigation (McMillan & Schumacher 2010:117). All participants were aware from the onset of the collaboration programme that it was going to be the subject of my thesis. I was open and honest with the participants about all aspects of the study.

4.2.5 Competence of the researcher

In the action research project, I was a member of and played a role in the system under investigation and thus issues surrounding role definition, role ambiguity and role conflict were significantly greater (Nolen & Van der Putten 2007:403). As an existing member of the education system, I had multiple roles in the school context. These roles were negotiated with all relevant stakeholders in the setting (Stringer 2007:48). The development of the role of research facilitator could be conceptualised as having three elements: agenda, stance and position.

4.2.5.1 Agenda

All stakeholders were informed and were part of the decision-making regarding the move to home-based teaching as well as the setting up of collaborating groups as a means of improving the learning gains of all students. Thus the agenda was always clear among all participants.

4.2.5.2 Stance

I presented myself as skilled, supportive, resourceful and approachable. I adopted a friendly and purposeful stance (Stringer 2007:48).

4.2.5.3 Position

As a researcher I set out to position myself in a way that did not threaten the social space within which each group operated (Stringer 200749). Aiming for a reduced hierarchical role and a flatter organisational structure, I positioned myself as a resource person in each group. In most cases each group meeting was facilitated by the grade leader. I facilitated most of the end of term meetings and the final evaluation phase.

However, even with the best of intentions, I could not perceive the effect on participants that I was school principal. At the end of the third year of studies it was clear to me that one teacher was feeling threatened and was no longer willing to be part of any tape recorded sessions. This teacher’s feelings were respected.

The action research project took place by means of the following research design.

4.3 RESEARCH DESIGN

As indicated, the research design used in this study was an action research design. More specifically, it was a *participatory* action research design. Action research is systematic inquiry and critical reflection by practitioners such as teachers, to improve their daily practice, namely teaching (McMillan & Schumacher 2010:444). *Participatory* action research in the context of this study, is a research paradigm in which my function is to serve as a resource to the teachers, to empower them to act capably for the benefit of the students and of themselves (McMillan & Schumacher 2010:4451). Thus, following the action research steps of planning, acting, data collecting and reflecting (Hughes & Seymore-Rolls 2000:1), I aimed to explain the benefits of grade collaboration interacting with subject collaboration. I also aimed to explicate what and how teachers learnt through working together collaboratively in a CoP. In this way, action research by teacher practitioners using their own site as the focus of their study, was a means of fostering meaningful professional development (Goodnough 2008:433). It was phenomenological (focusing on people's actual lived experience/reality), interpretive (focusing on the interpretation of acts and activities), and hermeneutic (incorporating the meaning people make of events in their lives) (Stringer 2007:20). It provided the means by which stakeholders, those centrally affected by the issue investigated-explored their experiences, gained clarity and understanding of events and activities, and used those extended understandings to construct effective solutions to the problems on which the study focused.

The above mentioned processes, however, did not occur in a socially neutral setting, but were subject to deeply seated social and cultural forces that needed to be taken into account (Stringer 2007:20).The ethical issues unique to action research also needed to be considered (Nolen & Van der Putten 2007:402) – see section 4.2.

The planning, acting and data collection of the project were as follows.

4.3.1 Planning phase

In this first phase the collaboration groups and members of the school management team brainstormed all the possible needs and problems that could arise from moving to home-based teaching and made decisions on how to proceed with this innovation. Minutes were taken of this brainstorming session and tape recorded. Decisions were taken with regard to meeting times, meeting dates and work roles. Teachers were informed of avenues in which they could access additional support and guidance outside of grade collaborative teams. This was provided in subject groups. Minutes of these meetings were taken. In subsequent cycles of action research we would revisit work roles where teachers were on leave or were feeling overwhelmed. These work roles were changed as required. However, the meeting days and times remained the same throughout the project.

4.3.2 Action phase

The duration of this phase was a school year, broken up into two terms. In the action phase teachers met once a cycle (once every six school days) for up to two hours to plan content knowledge, discuss methodological issues, plan assessment strategies, undertake analyses of results and decide on the required intervention strategies. Each teacher was responsible for the total planning (content, methodology, lesson resources and assessment) in one or two subjects depending on the curriculum needs of the grades. During the project the curriculum changed and the nine subjects that were prescribed were reduced to six subjects.

During a typical meeting, teachers would take turns to present to their teams, the work plan of a subject, for example, mathematics, which all the teachers would implement over the following six school days – or what we called the next ‘cycle’. The planning was often done after each teacher had consulted with his/her respective subject HOD. Depending on the particular leadership style of the HOD, the consultation was a moderation process where the HOD gave feedback on where the

teacher should improve in an assessment, or a collaboration process where the HOD would assist the teacher in the actual planning of daily lessons as well as assessment tasks and tools. In mathematics and natural science we strove for a collaborative interaction between the planning teacher and the HOD, although there were many challenges in this regard.

The expectation was that each lead teacher would be thoroughly prepared for the required lessons per subject, that the lessons followed the topics prescribed in the syllabus and that a sequence of lessons were to be followed by an assessment activity. Lead teachers presented these to their colleagues. They could employ many methods to do so (the transmission method, the lesson demonstration method or the collaborative engagement method). As teachers were given information on what to do for the next cycle they could share their thoughts and views, pose clarity seeking questions, as well as ask for more guidance and/or give feedback to the planning teacher. Each assessment given had to be accompanied by an assessment tool and had to be explained to teachers beforehand so that everyone had a common understanding of the assessment process. Marks for each assessment had to be disclosed, discussed and analysed and teachers had to make decisions in terms of remedying poor performance in any assessment.

When teachers left each planning meeting, they were equipped with the lesson plans, activities, notes, assessment tasks and assessment tools *in up to eight different subjects* that would be implemented over the next six days.

The school management team was further involved in a book control and file control process, an assessment moderation process, and a mark analysis process. In these processes a check was conducted on teachers' content coverage, assessment work in terms of quantity and quality and term mark analyses. The documents compiled in this regard were discussed in subject meetings which would be attended by the relevant planning teacher. After the first year, all teachers, not just the planning teacher, were required to attend the mathematics meeting.

The above mentioned action plan was evaluated by means of the data collection methods explained in the next section. This section starts with an explanation of the school context where the study took place, the participating teachers and the researcher as instrument. Thereafter, the data collection methods are explained.

4.4 DATA COLLECTION

4.4.1 The school context

The school where the study took place is 78 years old. It is an English medium primary school and is highly regarded in the town in which it is situated. It has a diversity of staff members. At the time of the study there were 35 teachers for just over 800 students. The student-teacher ratio in grades four and five was 25:1. In grade 6 it was 32:1. The majority of the student enrollment comprises Black students from the surrounding township. The school also has so-called ‘Coloured,’ Indian and White students who form the minority of the school’s population. There are a small number of poor children for which the school runs its own nutrition programme. Most children come with a packed lunch and/or pocket money in order to purchase food at school.

School fee payments range from average to good in some years. The contributing factors to poor payment are related to parent apathy rather than poverty as the parents who are in dire need are able to apply for a school subsidy. At the time of the study 100 children were receiving a school subsidy; however not all these children participated in the school feeding scheme.

Attendance of parents at school meetings ranges from 50% to 70% of the parent body. The percentage attendance is higher at the beginning of the term and for children from the lower grades. Teachers often complain about the lack of parent involvement in parenting matters and academic matters. However, over time, certain teachers’ efforts to improve parent involvement have reaped the desired outcome.

These teachers increasingly report improved involvement of parents in ensuring that homework has been done after school.

The school is regarded as the best English medium school in the town. This reputation has been hard earned as most students are English second language speakers (English is often a third or even fourth language). Students generally perform well in English internal and external assessments. The barriers posed in terms of the English language have often been more evident in other subjects, such as mathematics and natural science.

The first ANA results in 2009 were, in general, average in English and poor in mathematics. This assessment served as a driving force in the school and led the school management team to consider all the ways in which it could address its local problems and improve learning for all students. One of the recommendations was to embrace a form of home-based teaching for grade 4 students. What followed was the recognition that since teachers could not be expected to equip themselves with the knowledge and skills required to teach eight different subjects effectively on their own, we embarked on a collaboration programme with the grade 4 teachers.

Over time we extended the programme to grade 5 and then to grade 6 teachers. We also set up mathematics and natural science collaboration teams.

The evaluation of grade collaboration and subject collaboration is the focus of this study as is the role played by the school management team in ensuring a development orientation of collaboration and a focus on improved teacher learning and student learning.

4.4.2 The sample

Circumstances may bring people together in situations that are sufficiently and inexpensively tapped for research. In such situations the researcher uses subjects

who happen to be accessible and may represent certain characteristics or have certain attributes (McMillan & Schumacher 2010:136; Stringer 2007:43). The above statements describe the situation at our school site where the move to home-based teaching opened up an arena of possibilities where we explored, in particular, a way for teachers to engage collaboratively with each other.

A non-probability sampling procedure, using both purposeful and convenient sampling, was employed. The sampling was regarded as purposeful as the school teachers and school leaders involved in collaboration teams were regarded as “information rich” participants (McMillan & Schumacher 2010:138). The sampling was also regarded as convenient as it involved teachers and school leaders who were accessible and willing to participate (Castillo 2009:1). These were both important in the project -- a major issue was the extent to which the participating teachers were affected by or had an effect on the problems of interest (Stringer 2007:43).

In each grade, the teachers involved in the action research project were the class teachers of the grade. One of these teachers was also the grade leader. The HOD, deputy principal and principal were also involved. Each teacher agreed to be a teacher in the relevant grade and to be part of the move to home-based teaching. Each teacher chose which subjects he/she planned for the other teachers.

Table 4.1 illustrates the biographical data of the participants who were divided into four groups.

Table 4.1 Biographical data of participants

	Group	Number of teachers	Age range (yrs)	Years of experience	Race	Cycles completed
1	Grade 4	5 (A – E)	22 – 51	4 – 31	2B, 1W, 1C, 1I	6
2	Grade 5	5 (F – J)	26 - 54	3 – 32	1B, 3W, 1I	4
3	Grade 6	4 (K – N)	27- 37	4 – 15	2B, 1W, 1I	2
4	SMT	8 (O – V)	30 – 56	15 – 35	2B, 4W, 2I	6

SMT = School Management Team; B = Black; W = White; C = Coloured; I = Indian

Table 4.1 illustrates that in Group 1 (the grade 4 CoP), there were five teachers: A, B, C, D and E. Their ages ranged from 22 years to 51 years. One teacher had 31 years of experience, one teacher had 16 years of experience, two teachers had nine years of experience, and one teacher had four years' experience as a student teacher (teacher intern).The team was racially diverse and comprised of members from each race group, namely two Black, one White, one Coloured and one Indian. The team was not consistent throughout the duration of this study. In the second year a male joined the team but left by the first term of the third year. This team started the collaboration project in 2010 and underwent six cycles of action research.

In Group 2 (the grade 5 CoP), there were five teachers: F, G H I and J. Their ages ranged from 26 to 54 years. Two teachers had over 25 years of experience while the other three teachers had less than five years' experience each. In this grade there were five teachers because an additional teacher was required to teach English and also to mentor one of the novice teachers who came to the school as a teacher intern and qualified during the duration of this study. The team was racially diverse in that it consisted of two White females, one Indian female, one Black female and one White male. This team started the collaboration project in 2011 and underwent four cycles of action research.

Group 3 consisted of four teachers: K, L, M and N. They were doing a form of semi-home based teaching. Two teachers, instead of one, were assigned to teach each class. Two of the teachers were part of the mathematics, natural

science and technology team and two teachers were part of the English, social science, life-skills collaboration team. The age range of this team of teachers was 27 to 37 years. One teacher had 15 years of experience, one teacher had eight years of experience with two of them having fewer than five years of experience each. The grade 6 team embraced a semi-home based and grade collaboration scenario in 2013. This team underwent two cycles of action research.

Group four, the school management and leadership team, consisted of eight teachers. The age range of this group was between 30 and 56 years. The years of experience ranged from 33 years to eight years. Each school leader was part of at least one collaboration team in the school and was involved in the book control, IQMS, assessment moderation and marks analysis processes at the school. Some of these teachers were also class teachers of either grade 4, 5 and 6. As class teachers their comments in chapter five are acknowledged as either A to N. However, as HODs their comments are acknowledged in chapter five as follows: HOD Natural Science (2011). The year is indicated because the school management team changed with respect to science and mathematics over the course of the study.

The school management team was involved from the onset of the project, and the input from this team came from subject communities of practice, end of term subject meetings, school assessment meetings and then finally through their focus group evaluation of the management of collaboration. This team underwent six cycles of action research.

Table 4.2 illustrates how teachers participated in two communities of practice which intersected with each other in order to learn the required content knowledge teaching approaches and assessment strategies needed for effective classroom implementation.

Table 4.2 Learning path for effective lesson implementation in home-based scenario

Individual teacher

	Mathematics CoP	Natural Science CoP	English CoP	Social Science CoP	Other subjects
	HOD	HOD	HOD	HOD	HOD

First Level of Planning (Participation in a subject CoP)

Grade 4	Teacher A	Teacher B	Teacher C	Teacher D	Teacher E
2nd level of planning	Mathematics lead teacher	Natural Science lead teacher			
Grade 5	Teacher F	Teacher G	Teacher H	Teacher I	Teacher J
2nd level of planning	Mathematics lead teacher	Natural Science lead teacher			
Grade 6	Teacher I	Teacher J	Teacher K	Teacher L	
2nd level of planning	Mathematics lead teacher	Natural Science lead teacher			

Third Level of Planning

Independent teacher learning

Classroom Implementation

As Table 4.2 illustrates, the individual teacher participates in first, second and third level developmental activities to plan for effective classroom implementation in a home-based or semi home-based scenario. The vertical arrow indicates a lead teacher's interaction in a subject CoP. The mathematics CoP, for example, comprised of mathematics lead teachers from each grade that would meet with their HOD's at least once a term in whole subject teams but more frequently in regularly scheduled time on a one-to-one basis. In this CoP the lesson and assessment planning for a cycle (six days of teaching), was initiated, quality-assured and approved. This quality assurance was essential before it was mediated to peer teachers and is thus referred

to as the first level of lesson planning. HOD appointments changed during the course of this study. Thus HODs are distinguished on the year of involvement. (Comments given in chapter five would thus indicate HOD Mathematics 2011, for example).

The horizontal arrows indicate a teacher's interaction in a grade CoP. The grade 4 CoP, for example, comprised of grade 4 teachers who taught many different subjects to the same class. Each grade 4 teacher had one or two subject contributions to make to the grade CoP. Teacher A's contribution was the planning of mathematics lessons and assessments to the grade 4 CoP, while teacher B's contribution to the grade 4 CoP was the planning of natural science lessons and assessments. In the grade CoP the lead teacher presented their subject contributions to the team, and facilitated engagement around content, methodology and assessment. The lead teacher was also a peer in respect to other subjects such as English and Social Sciences. This is referred to as the second level of planning.

In chapter five teachers are referred to as teacher A to N. Information will also be given in terms of whether the comment was made in a grade CoP, a subject CoP, or specifically in a personal interview or a focus group discussion.

A third row was included because of each teacher's unique effort in terms of planning for classroom interaction based on the students' needs in their own classrooms.

4.4.3 The researcher as instrument

In action research the role of the researcher is not that of the expert that *does* the research but that of a resource person (Stringer 2007:24). Thus, I became a facilitator or consultant who acted as a catalyst to assist stakeholders in defining their problems clearly and to support them as they worked toward effective solutions to the issues that concerned them.

I followed a bottom-up or grassroots orientation using stakeholder groups as the primary focus of attention and the source of decision-making. I worked in close collaboration with stakeholders and formulated a ‘flat’ organisational structure working towards stakeholder decision-making (Stringer 2007:25).

4.4.4 Data collection methods

4.4.4.1 Participant observation

Participant observation required a form of observation that was distinctively different from observational routines common in experimental research or clinical practice. The observation in the project was ethnographic, enabling me to build a picture of the worlds of the teachers who were being observed and an understanding of the way they ordinarily went about their activities (Stringer 2007:75).

In particular my role as a participant observer enabled me to observe how teachers went about planning and sharing their teaching plans with their peers. It enabled me to observe and get a clear picture how they communicated with each other, the extent to which they asked questions, sought clarification or provided feedback. The lengthy data collection period of three years also allowed me to observe changes in the modes of communication over time.

These observations were recorded as field notes during or soon after events had occurred. I took notes during meetings, but also tape recorded each meeting as my writing was not fast enough and became illegible. In particular I took note of the following: the role played by each participant as a planner; the way that participants interacted with each other; the modes of communication; the time frames (how allocated time was shared among the subjects); and the sequencing of subjects (which subject was discussed first,

second and so on). I also noted any feelings, emotional orientations and responses to people, events and activities (Stringer 2007:76).

4.4.4.2 Field notes

I attended a large percentage of the planning meetings. I took notes in shorthand. However, in order to capture detailed notes of the interactions of participants I tape recorded each meeting. It was very time consuming to transcribe every meeting verbatim, and often, when a transmission mode of reporting what to do and when to do it was employed, a summary of the meeting was presented. However, when teachers were engaged in reform activities, or any activity that I perceived to lead to more clarity and learning, I wanted to avoid merely summarising what was said and to record things in terms with which I was familiar or comfortable (Stringer 2007:72). It was the participants' perspectives in their own language that were most important in these cases and it was important to me to record precisely what was said, using the respondents' language, terms and concepts. Thus, while parts of my notes contained summaries, some parts would have quotations of perceptions and feelings shared and there would also be a verbatim transcription of sections of dialogue.

Very often member checking was used to verify the information. Member checking was often done with the HOD as well as she was accessible (Stringer 2007:72, 73). The member checking process was also informative and provided an opportunity to reflect on ideas or events and allowed for participants to extend or modify their comments.

4.4.4.3 End of term reflection meetings

Reflection and evaluation were an important part of the project. End of term reflection meetings were conducted twice a year and were tape recorded and transcribed verbatim. Various tools were used to reflect on the work of each group. The tools used were the stop, start, continue tool where teachers would indicate aspects of the

planning meeting that they wished would stop, start or continue; the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis tool; and the TCAR (an assessment rubric – see section 1.5.5 and 3.5.5), in order to evaluate the progress of each team. The meetings were usually facilitated by the head of the grade, the HOD or me.

These transcriptions were reduced to brief minutes for the purpose of member checking in the new term. The discussions that followed helped shape how the team would engage in the new term and formed part of the planning in the new term.

4.4.4.4 Semi-structured personal interviews

Each participant was asked whether or not they would participate in the semi-structured interview. I informed them that I would be conducting the interview and that it would be tape recorded. A mutual date and time was set aside for the purpose. I tried to make each participant feel welcome and at ease. I explained that I would pose one broad question and proceed to specific ones to probe for more depth. The broad question was: *What have you learnt by participating in this programme?* (See appendix E). The specific questions focused on what activities undertaken by the group enabled and what activities hampered or did not at all contribute to teacher learning and development. I conducted 12 of these personal interviews.

The personal interviews provided opportunities for participants to describe the collaboration project in their own terms and from their own perspectives (Stringer 2007:69). It was a reflective process and each interviewee was able to explore their experiences in detail and to reveal many features of the experience that had an effect on the collaboration issue investigated. The interview process did not only provide a record of each individual participant's views and perspectives but also symbolically recognised the legitimacy of his/her experience (Stringer 2007:69). Each interview was transcribed verbatim and was then analysed for themes and patterns (see section 5.2).

4.4.4.5 Focus groups

A focus group can be characterised as a group interview and provides another means of acquiring information (Stringer 2007:73). Four focus groups were conducted. I conducted the focus groups at a date, time and venue agreed by all. Each focus group was led by three main questions:

(i) What worked well?

(ii) What did not work well?

(iii) What could be done to improve teacher collaboration in future? (See Appendix F)

Each participant in every group was given an opportunity to describe their experience and to present their perspective on teacher collaboration. I kept the conversations focused on the topic and enabled participants to express their experiences and perspectives in their own terms, without the constraints of interpreter frameworks derived from researcher perspectives, professional or technical language, or theoretical constructs (Stringer 2007:74). I used neutral language and maximised opportunities for participants to express themselves in their own terms.

Each focus group was transcribed verbatim. The transcription was then analysed for themes and patterns (see section 4.5.3).

4.4.4.6 Documents, records and reports

Researchers can obtain a great deal of information by reviewing documents and records (Stringer 2007:77). The documents in our school were prolific and I needed to be selective, briefly scanning the contents of documents to determine their relevance to the issue under investigation. It was also important to check for accuracy of information with various stakeholders and to ascertain which information would be made public and which would be kept confidential (Stringer 2007:78).

Documents and records used in this research included minutes, book control reports (Appendix H), mark analyses documents and graphs (Appendix I and Appendix J), lesson plans, assessment plans and assessment moderation reports (Appendix K), as well as notes from classroom observations (appendix L). I made a photocopy of each of the relevant documents.

The documents provided detailed information on the content covered in each subject in each grade. These were matched with the relevant syllabus requirements. Information was also gathered on the assessment plans for each grade for each term. Each assessment plan was matched with what was actually achieved in books, the time frames in which it was achieved and the degree to which it met the syllabus requirements. Finally, the mark analysis tables and graphs were analysed to see if we were in fact meeting our goal in achieving higher learning gains for all students. The results of internal assessments were also compared to external assessments.

These reports were generally discussed in both grade and subject meetings, the minutes of which were also analysed. The minutes of these meetings revealed how teachers analysed and interpreted their results and what intervention strategies were put in place for the following term.

A summary of the book control process and term assessment results were prepared in table and graphic form. The accuracy of the information was verifiable in that each teacher and each HOD firstly signed each book control and mark analysis form and secondly discussed these results in a subsequent meeting. While book control information is a part of teacher appraisal and is confidential (only seen by the teacher and the HOD), the graphical representation of term results was made available to the entire staff, the SGB and the parent population.

The intent of summaries was to provide stakeholders with information that enabled each group to review and reflect on its own activities and to share relevant

information with other stakeholder groups. This information provided key elements from which a jointly constructed account was formulated (Stringer 2007:78).

4.4.4.7 Questionnaire

A questionnaire is a written set of questions that is used to assess attitudes, opinions and beliefs (McMillan & Schumacher 2010:489). At the end of the project, a questionnaire was given to each participant. In the questionnaire 22 statements were provided. Each question was followed by a scale of potential responses. A Likert scale was used comprising of the following three possible responses: “Disagree”, “Neutral” or “Agree”. A justification for each response was asked for (see Appendix G).

Before the questionnaire was given to participants, I conducted a pilot test to check the relevancy and the wording of the items (McMillan & Schumacher 2010:204, 205). I also conducted a pilot test with a selection of school leaders as well as teachers who were part of collaborating groups but were not part of this study. The respondents were given space to write comments about individual items as well as the questionnaire as a whole. The pilot test also revealed how long, on average, it took for participants to complete the questionnaire, and whether or not the directions and items were clear (McMillan & Schumacher 2010:205). The questionnaire was modified based on the pilot test. The changes made were mainly in the spelling and grammar of words and a space for justification of responses was included where initially it was omitted.

The questionnaire was administered in the staffroom. Thirty-two participants comprising a mixture of teachers from different grades as well as school leaders completed the questionnaire.

The data that were collected by means of observation, field notes, reflections, interviews and document analysis, were analysed qualitatively. The questionnaire data were analysed quantitatively. This is explained next.

4.5 DATA ANALYSIS

4.5.1 Segmenting

Data analysis of the qualitative data began by identifying small pieces of data that stood alone. These data parts, called segments, divided the data set. Each segment was a text that was comprehensible by itself and contained one main idea. Segments were then analysed to come up with codes. One or more codes constituted each segment (McMillan & Schumacher 2010: 370-371).

4.5.2 Coding

A code was used to provide meaning to a segment. Codes were activities, quotations, relationships, contexts, participant perspectives, events, processes and other ideas or actions. For example, an activity that teachers were often engaged in was working out the class average and sharing this information with team members (McMillan & Schumacher 2010:371).

Labels that used participants' wording were called *in vivo* codes. Participants' views, actions and explanations that were distinctive to the setting or people were *emic* terms or codes. My key strategy in this process was to allow the data to suggest the codes (McMillan & Schumacher 2010:371, 376).The initial codes were many. These codes were refined and then later grouped into categories.

4.5.3 Forming categories or themes

Categories or themes are entities comprised of grouped codes (McMillan & Schumacher 2010:376). A single category was used to give meaning to codes that were combined. For example, codes such as ‘class average’ and ‘failure rates’ made up the code analysis of results. The categories or themes represented major ideas that emerged from the study.

The decisions taken regarding the categories represented my first level of induction. Similar codes were put together to form a category, which was then labelled to capture the essence of the codes (McMillan & Schumacher 2010:376).

4.5.4 Discovering patterns

A pattern is a relationship among categories (McMillan & Schumacher 2010:378). Pattern making involved examining the data in as many ways as possible and from as many sources as possible (triangulation). In searching for patterns, I tried to understand the complex links among various aspects of people’s situations, mental processes, beliefs and actions (McMillan & Schumacher 2010:378, 379). Negative evidence and alternate explanations were actively searched for in order to modify or refute a pattern. The major patterns served as a framework for reporting the findings. I focused extensively on which data was central in illuminating the research problem.

4.5.5 Checking for inter-coder and intra-coder reliability

When I was engaged in forming categories, a recursive process occurred. This recursive process involved the repeated application of a category to fit codes and data segments (McMillan & Schumacher 2010:377). I undertook a process of constant comparison. I continually sought both supporting and contrary evidence about the meaning of the category. Thus the coding of participants’ statements went through much iteration.

Furthermore, as I built categories and searched for patterns, I also searched for other plausible explanations for links among categories. I regarded plausibility as a matter of judgment about the quality of data within the design limitations (McMillan & Schumacher 2010:380).

4.6 VALIDITY IN ACTION RESEARCH

Rigour (not mortis): the research is alive and well (Stringer 2007:57)*.*
Rigour in action research is based on checks to ensure that the outcomes of the research are valid - that they do not merely reflect the particular perspectives, biases, or worldview of the researcher and that they are not solely based on superficial or simplistic analyses of the issues investigated (Stringer 2007:57). Checks for validity, therefore, are designed to ensure that researchers have rigorously established the veracity and truthfulness of the information and analyses that have emerged from the research process.

According to McMillan and Schumacher (2010:451-452), validity in action research is ensured by means of the same techniques that are generally used for both quantitative and qualitative research and has already been referred to. In addition, five main criteria determine the credibility of action research. These criteria are: democratic validity, outcome validity, process validity, catalytic validity, and dialogic validity. A brief description of these types of validity follows.

4.6.1 Democratic validity

Democratic validity is concerned with “the extent to which research is done in collaboration with all parties who have a stake in the problem under investigation” (Anderson & Herr in Newton & Burgess 2008:8). All stakeholders involved in managing the professional development of mathematics and science teachers in

grades 4, 5 and 6 are represented in this study. Democratic validity also involved member checking and participant debriefing.

4.6.1.1 Member checking

Concepts and ideas within the study should clearly be drawn from and reflect the experiences and perspectives of participating stakeholders rather than be interpreted according to schema emerging from a theoretical or professional body of knowledge (Stringer 2007:59). Reports and other communications were thus grounded in the terminology and language of the research participants to ensure that it reflected their perspectives and could be clearly understood by them.

Participants were given the opportunity to review the raw data, analyses and reports derived from the research process. This enabled them to verify that the research adequately represented their perspectives and experiences. It also provided an opportunity for them to clarify and extend information related to their experiences (Stringer 2007:58). Document reports such as mark analyses and book control forms were often discussed at length at subject meetings. Points from end of term reflections were often brought into the new term as items for discussion to allow participating teachers to reconfirm their stance and to guide the processes of the new term. The semi-structured personal interview (see section 4.4.4.4) was also a means to check with members on any relevant matters. The perspectives of school leaders were also incorporated into this study. All teachers and school leaders' views were regarded as important regardless of the number of years of experience each teacher or school leader had.

4.6.1.2 Participant debriefing

Debriefing focuses on the feelings and responses of the participants rather than the information participants have provided (Stringer 2007:58). Debriefing was achieved when members needed additional meetings to resolve conflicts or clarify matters.

Debriefing was also achieved via member checking. This process allowed participants to deal with emotions and feelings that might have coloured their interpretation of events.

4.6.2 Outcome validity

Outcome validity refers to the extent to which outcomes of the research were successful. Put another way, outcome validity refers to the extent to which the outcomes of the research matched the intended purposes of the research (Anderson & Herr in Newton & Burgess 2008:8). As are indicated in the next two chapters, the outcomes of the study were improved teacher learning and improved student results which closely matched the purpose of the study (see Chapter 5 and 6).

4.6.3 Process validity

Process validity focuses on “the much debated problem of what counts as ‘evidence’ to sustain assertions” (Anderson & Herr in Newton & Burgess 2008:8). This validity is concerned with the efficacy of the research approach in addressing the research problem. To enhance process validity in this research, I undertook measures to ensure that the data collection methods were effective and appropriate for obtaining the information needed to answer the question guiding the study (McMillan & Schumacher 2010:451). The strategies that were employed are explained in the following sections.

4.6.3.1 Prolonged engagement

The outcomes of the research process were deep seated understandings (Stringer 2007:57, 58). This was achieved with extended opportunities provided to participants to explore and express their experiences of the acts, activities, events and issues related to the problem investigated. Teachers met once every six days to meet and plan content, methodology and assessment matters. This added up to approximately

30 meetings a year over an average of three years. Additional meeting times were made possible for members to meet in subject teams and for members who required one-on-one mentoring. Teachers often reported to finding more times to meet on their own to clarify matters or to deepen their understandings.

4.6.3.2 Persistent observation

Merely being present in a situation does not imply *observation*. The credibility of the research was enhanced when events, activities and the context were observed over a period of time. A high premium was placed on noting what was actually happening (by means of constant observation and active note-taking), rather than describing it from memory or from an interpretation of what I *thought* happened (Stringer 2007:58) – see section 4.4.4.2. I attended most of the meetings and took notes at each of them. Tape recordings were taken of every meeting attended and was used to extend the field notes as it was not possible to write at a speed that matched the dialogue and decision-making.

4.6.3.3 Triangulation

The validity of the study was enhanced with the use of multiple sources of information. In accordance with Stake (in Stringer 2007:58), this inclusion of perspectives from diverse sources enabled me to clarify meaning by identifying different ways the phenomena were being perceived. These perspectives could be complimented *and* challenged by information derived from observation, reports and a variety of other sources.

Various data collection strategies were employed. Field notes and minutes of meetings were the starting point. End of term reflections were recorded and transcribed. Document analysis involved a study of book control forms, mark analysis forms and a study of teacher's reflection notes. Semi-structured personal interviews

and focus group discussions were done at the end of the project. Participants' also completed a questionnaire. (See sections 4.4.4.1 to 4.4.4.7.)

4.6.3.4 An audit trail

I needed to be able to confirm that the procedures described actually took place. An audit trail can enable an observer to view the data collected, instruments, field notes, journals, or other artifacts related to this study. These could confirm the veracity of the study, providing another means for ensuring that the research was valid (Stringer 2007:59). All tape recordings, documents collected and transcriptions done are available for confirmation.

4.6.4 Catalytic validity

Catalytic validity refers to the ability of the research process to transform the participants, deepen the understanding of the participating teachers, and motivate them for further social action (Anderson & Herr in Newton & Burgess 2008:8). Catalytic validity addresses the extent to which participants were compelled to take action (McMillan & Schumacher 2010:451).

The data of this study indicated that teachers changed in the ways that they related to each other. Teachers became more organised in their planning of content and assessments. Change was seen in how teachers dealt with test and other assessment results. A more detailed analysis of results were undertaken, there was an open disclosure and discussion of results. Teachers used activities in classroom not just to cover content but to allow for engagement and consolidation of concepts. Furthermore, teachers employed various means in class to check for student understanding. Teachers adopted the professional attitudes required to enhance student learning especially in the subject mathematics (see Chapter 5).

4.6.5 Dialogic validity

Dialogic validity is akin to the peer review process in academic research. In practitioner research, however, it is suggested that “practitioner researchers participate in critical and reflective dialogue with other practitioner researchers” (Anderson & Herr in Newton & Burgess 2008:8). The relevant issue here was the sharing and dissemination of the results of the study in some type of public medium.

This type of validity was easily achieved in an ongoing way throughout the project. At the end of each term a review and reflection on the way teams engaged with each other and the results that were produced were discussed in informal conversations as well as formal meetings set aside for that purpose. The final results of the study would also be presented at an information-sharing meeting at the school. (The results could also be presented at teacher development conferences in future.)

4.7 SUMMARY

In this chapter the research design was presented. Detailed explanations were given about ethical measures that I undertook with the study; the research design and data collection methods, data analysis, and finally, measures to ensure validity.

In chapter five I present the findings of the studies.

CHAPTER FIVE

RESEARCH FINDINGS AND DISCUSSIONS

5.1 INTRODUCTION

In chapter four, I explained the research design and methods of data collection I used in conducting the research. In this chapter, chapter five, I present the findings of my research. This chapter will be presented in two sections based on findings of the qualitative study and findings of the quantitative study.

In the qualitative section I describe the learning and developmental path taken by teachers in their efforts to plan to teach many subjects in one class. This was achieved by teachers participating in a subject CoP as well as a grade CoP. In these communities of practice teachers undertook various traditional as well as reform developmental activities to plan for classroom implementation of the various subjects. In particular, I explain the learning gains of teachers in terms of content knowledge, pedagogical repertoires, assessment literacy and professional attitudes. In explaining these learning gains of teachers, I allude to the managerial strategies and challenges in ensuring high functioning teams. Finally, I evaluate the school's successes in terms of internal and external results and look for lessons that can be learnt from the more successful teachers.

In the quantitative section I give the findings of the teachers' responses to the questionnaire and analyse it in terms of the conceptual framework.

5.2 FINDINGS FROM THE QUALITATIVE STUDY

Wesley and Buysse (2001) noted that the current focus on communities of practice was stimulated by a need to improve practice as part of a schools' professional development program (see section 2.4.2.1). In this study a diverse group of teachers

were assembled to form subject and grade communities of practice to foster site-based professional development in terms of subject content knowledge, methodology, assessment practices and professional attitudes.

Each grade CoP had a distribution of labour and leadership in terms of lesson planning for different subjects. In grade 6, for example, one member of the grade CoP planned natural science lessons and assessments and another member of the grade CoP planned mathematics lessons and assessments. Each teacher thus had a specific *subject* contribution to make towards the grade CoP and was called the 'lead teacher' of that subject. The other team members in the grade CoP were called 'peer teachers' in respect of that subject. As described by Wenger (1998), the complementary contributions by the lead teachers allowed for the mutual engagement of team members thus enabling the knowledge sharing and problem-solving required for effective CoP functioning (see section 2.4.2.1).

To ensure that each lead teacher had a high quality contribution of lessons and assessments to make to the grade CoP, they were also part of subject communities of practice. Thus professional learning for each teacher was a function of participation in both subject and grade communities of practice. This is in accordance with Brown and Duguid (in Schlager and Fusco 2003) who posited that a CoP was an effective learning environment that enabled teachers to talk about practice while simultaneously engaging in the day to day practice of work (see section 2.4.2.1).

In subject communities of practice, professional development was fostered by the interaction of the lead teacher with the subject HOD. In these meetings the first level of planning of lessons and assessments was undertaken to prepare for grade level mediation and engagement. In grade communities of practice, each subject lead teacher presented their contribution to their team members or peer teachers. This was to allow each teacher to effectively teach that subject to their students noting that they had other subjects to teach as well. This presentation of what to teach and how to teach involved the subject lead teacher and their peer teachers and represented a

second level of planning for classroom implementation. In addition to participation in communities of practice, independent teacher learning was also essential for classroom implementation based on the unique needs of the students in a particular class. This was called the third level of planning.

Each of the above learning activities will be discussed in turn, illuminating the main finding of the study which was that the professional development of primary school teachers could indeed be initiated, managed and constantly improved on by means of action research. When school leaders organised teachers into communities of practice and managed the quality of their work and the quality of their dialogue and interactions during subject and grade meeting times, as well as encourage and monitor the personal effort of each teacher, the potential for teachers to learn in a context-sensitive way was enhanced.

5.2.1 Participation in a subject CoP: first level of planning

From a situated learning perspective (see section 2.3.3), learning in a subject CoP was a matter of a lead teacher participating and collaborating with a HOD who was a member of the school management team. As found by Oliver et al (2009) mathematics and science teachers at schools were often unqualified to teach the subjects, in particular novice teachers (see section 3.6). The lead teacher was developing and refining expertise in leading a subject in a particular grade while the HOD had a demonstrated expertise in the subject across all the grades as well as beyond the boundaries of the school.

In accordance with Mason (2007), learning subject domains like mathematics and natural science involved a process of becoming a member of a particular subject community (see section 2.3.3). Observations showed that the teachers' participation was as much characterised by 'taking part' as well as 'being part of' a subject CoP. In this study, taking part involved preparing lesson plans and assessments for input, engagement and quality-assurance from the HOD. Being part involved what Lave and

Wenger (1991) describe as coming to know *how* to participate and engage collaboratively with somebody who is your mentor in a subject (see section 2.3.3).

As teachers participated in the mathematics and natural science communities of practice, they engaged in activities that involved the sharing of knowledge. Observations indicated that the knowledge sharing in the subject CoP allowed each lead teacher access to the craft knowledge of the experienced subject HODs who served as mentors. This is in accordance with the views of Street (2004) (see section 3.5.1). The HODs were able to offer subject-specific as well as context-specific guidance and benefited teachers by engaging them in what they did on a day-to-day basis. Lead teachers thus accomplished more in terms of planning for lessons and assessments than they would have done on their own. The teachers in this research learnt how to receive feedback and act on it to improve on their work. They learnt how to plan lessons to make maximum use of contact time by actively engaging students in worthwhile activities. They also learnt how to meet deadlines for planning and assessments and how to analyse results. More importantly they learnt to account for poor performance and improve on their teaching strategies.

Lead teachers often observed HODs teach, and also presented lessons to them thus creating a more open culture in which to give and receive feedback. The following comment indicates a lead teachers' view on the mathematics CoP.

> *When you are in this.. [CoP]… context… there is guidance, there is monitoring … there is feedback ... and you are constantly engaged in discussion…I have actually grown. I am able to speak more and express myself more … and yes I feel, you know what, as a new [mathematics] teacher coming in this definitely works.* [Teacher F – lead mathematics teacher - personal interview 2011.]

As teachers participated in the mathematics and natural science communities of practice they also engaged in activities that involved the collaborative creation of artifacts such as lesson plans, activity worksheets, baseline tests, speed tests, longer

length examination papers, memoranda and mathematics and natural science remedial lessons and quizzes. The teachers also presented model lessons on topics such as fractions, tessellations and electric circuits, which were recorded. According to researchers such as Alfred and Garvey (2000), and Palombo (2003), the generation of such artifacts increases the 'best practice' knowledge base of the CoP (see section 3.5.1). Accordingly, the teachers attested to the fact that they also benefitted in this regard. The artifacts were shared among the participating teachers and made accessible to all members of the community to use as is or to build on as required to teach a particular topic. They regarded this as more beneficial to extend their knowledge base of a subject as compared to them having to start from scratch each time a topic was taught. The following comment is illustrative:

> *We can build up our own pool of resources. I can make a chart…[and] you can make a better chart. Then we know we got it [and] we can pass it around.* [Teacher F – lead mathematics teacher - Grade 5 CoP 2011.]

The interaction between the lead teacher and the HOD fostered mastery of the lead teachers' content knowledge and pedagogic content knowledge related to a particular subject. This, coupled with learning about the links in the subject matter across grades, enabled some lead teachers to gradually move from peripheral participation towards more central and full participation in their subject communities. This is in line with Lave and Wenger's (1991) theory (see section 2.3.3). Lead teachers displayed central participation when they took on further leadership roles in their subjects with respect to extending achieving students from all grades in mathematics and natural science quizzes and Olympiads.

The HODs observed that they learnt how best to participate in the subject CoP. Some HODs attested to the fact that they initially adopted approaches found by Feiman Nemser (2001) to be ineffective (see section 2.4.1.2). One such an approach was a traditional top-down method where the lead teacher was expected to give work to the HOD to determine what was wrong and send it back for correction. There was very

little interaction and engagement with the lead teacher until they asked for help or a crisis emerged in terms of poor planning and low student achievement. Another ineffective approach was when HODs did all or most of the work for the lead teacher, adopting a more extreme supportive and 'hand-holding' approach as compared to a developmental approach.

The teachers noted that what worked best was when the participation in the subject CoP was based on more equitable roles, recognising the voices that the HOD as well as the lead teacher brought to the discussion. This is in keeping with critical perspectives such as that of Freeman (2002) and Brookfield (2005) that espouse a democratic form of engagement between diverse people (see section 1.4). The following comments are illustrative:

> *Management is working with people to get the job done. So you're working side by side with [the lead teachers] to get the job done …I've gone to the media centre. I've got grade 4, 5 and 6 textbooks such that when I receive their planning and I am not happy with something, I've got something to give them. [I say] look at this... this is better. But, you've got to know what they are supposed to be doing per term and you've got to have resources to assist in helping them.* [HOD Natural science in SMT Focus group 2013.]

> *If you've got something designed in a certain way and … you are submitting it to your HOD, …your HOD has the authority or the right to change it according to what he or she thinks …[by]…saying I suggest you do it this way - suggest - and that's where you need to have the collaboration saying this is why I've done it this way [and this is] what my reasoning behind this is. [Then you and the HOD]…can now negotiate based on reasoning* [Teacher K - lead mathematics teacher - Grade 6 focus group 2013.]

With time, frequent engagement and willing participation, the subject CoP served an enabling function for collaborative engagement between teachers with diverse expertise in a specific subject. The subject CoP provided a space for the different

voices of the HOD as well as the lead teacher to be heard and to be respected. Learning for all members was a socially negotiated activity where the planning skills of the lead teacher as well as the mentoring and moderation skills of the HOD were developed. This is in keeping with the results from Gilberts' (2005) study (see section 2.4.2.3). The result for the school was that high quality lessons and assessments were prepared in the mathematics and natural science subjects. The high quality of work implied that there was an increase in cognitively challenging tasks which aimed at building students' problem solving abilities. A similar finding was observed by Stein, Smith and Silver (in Borko 2004) in their QUASAR school study where the mathematics teachers worked with resource partners (see section 3.6.3.1). The comment below illustrates the quality assurance and excellence culture that informed the interaction in the subject CoP.

> *You know the thing is we have to set the bar …[I am] demanding excellence because [I am] giving it – to me it's like a two-way street of respect.* [HOD Natural Science – SMT assessment meeting – 2011.]

5.2.2 Participation in a grade CoP: second level of planning

Each lead teacher presented their subject contributions in the relevant grade CoP. The engagement in the grade CoP offered lead and peer teachers an opportunity to learn by participating in activities that were distributed among the team members who each brought forward their own tools and artifacts necessary for classroom implementation in the different subjects (see section 2.3.3). The teachers in this scenario were positioned as both receptors and creators of the knowledge base they applied in the classroom, as also found by Geyer (2008) (see section 2.4.2). Furthermore, they were presented with an opportunity to link the subject content with the grade context through discussions and engagement. This is in keeping with Lave and Wenger's (1991) view that cognition must be linked to context and intention (see section 2.3.3).

However, it was observed that for the first two years of this study, most lead teachers adopted what Feiman-Nemser (2001) would regard as a transmission mode strategy: "Lesson one: do this, lesson two: do that" (see section 2.4.1). According to Chalmers and Keown (2006), the lead teachers in this scenario were positioned as the 'expert' who instructed while the peer teachers were positioned as passive and inferior and needed to obtain the required subject content information.

With time, a more reform orientation to the mediation of the lesson and assessment planning was undertaken. As found by Smylie et al (in Schlager and Fusco 2003), the grade CoP indeed played a catalytic role in the teachers' professional development (see section 3.5). Observations showed that the grade CoP served an enabling function encouraging collaboration among team members and instilling a more team-minded approach as compared to an individual approach.

The findings of this study concur with that of Chalmers and Keown (2006) and Hew and Hara (2007) with respect to the important role played by the lead teacher as a facilitator of the learning in their subject (see section 3.5.1). The mathematics lead teachers led the way in fostering a norm of greater interactive dialogue among CoP members. They initiated this by providing notes and worksheets with detailed, written explanations often accompanied by a teaching aid. They presented clearer verbal explanations around what to teach and how to teach it. The following comments from two mathematics lead teachers indicate this.

> *I make little folders like this…and I write exactly what we are going to do each period. So say… we are doing addition combination then I've got the written explanation for them [telling them] what they must do – [and] a little aid that they need to use…and the worksheets…and the test and the memo. So they just follow this… the whole cycle.* [Teacher F – Lead math teacher - Math CoP 2012.]

> *I think the first time that we got here we just handed out notes. We said you have to do this on day one you have to do this on day two. But now you must*

> *…come with your planning [and] you have to explain to the teachers exactly where you are going with this. [You have to explain] what is the goal, what it is you want the children to know. [This is not about] what notes you want to hand out [but rather] you must have some idea what the children have to learn…and you have to share that with the teachers.* [Teacher A – lead math teacher - Grade 4 focus group 2013.]

As the lead teachers brought more written and verbal explanations to the team interaction, they opened the door to questions from team members thus enhancing their learning and increasing their confidence for classroom implementation. Furthermore, in line with Hew and Hara (2007), knowledge sharing was very much based on reciprocity and community motives (see section 3.5.1). The following comments from a peer teacher indicate this.

> *There has to be a lot of explanation. Because one disadvantage of worksheets, they encourage laziness. Because if I have the worksheet I don't have to research, I've got blinkers, I only want to understand [the four points on the worksheet]…and that's it. ... It's the worksheet plus explanations in our level meetings that helps us to learn. The more we talk about it … the more I am also gaining as a teacher. I am ready for any questions a student might ask me because I am not only depending on the knowledge from the worksheet.* [Teacher E - peer teacher - personal interview 2011.]

> *As an individual, you can't be selfish. That's what I have learnt. If you don't want to share what you have, you won't make it, especially when you also expect some people to share [with you]. Because it is giving and receiving and working together that's the main thing. [It is important to] just be a good member of the team. Whether you are a leader or a follower you need each other as much ... equally.* [Teacher E – peer teacher - personal interview 2011.]

The sharing of knowledge in the grade CoP built the knowledge base of the grade teachers. While lead teachers each presented *subject* contributions, the interaction and knowledge sharing were linked to what is relevant and more importantly achievable in that specific *grade*. This is in accordance with Hodkinson (2008) who posited that learning should be approached from the location in which it took place (see section 2.3.3). The teachers' learning in the grade CoP was very much specific to, and grounded in, what was particular, practical and possible in the relevant grades.

Teachers who produced good results with their students represented a model of what was possible and achievable in the grade despite all teachers experiencing the same barriers such as students not being able to speak English well or having a poor work ethic. This is also in keeping with Kumaravadivelu's (2001) idea of a pedagogy of possibility (see sections 1.4 and 2.4.1.1.) The grade CoP played a major role in interrogating and broadening teachers' perceptions about students and student learning with a view to empowering them to strive to achieve more with their students. Successful teachers in the grade showed that they were able to separate themselves from excuse-driven and constraining modes of thinking in order to realise and act on alternative possibilities. In particular, teachers were seeing that it was possible to get most of the students to learn their times tables, to do long division, simplification of fractions and conduct experiments. This represented an important shift in the teachers' way of thinking and their efficacy in terms of certain content areas especially since some of them have avoided teaching these content areas in the past. This is in line with the avoidance strategies described by Appleton (2007) (see section 3.6.1.1).

In addition to knowledge-sharing, the diverse community members in a grade CoP engaged in many other activities with each other. There were some meetings in which teachers did tasks and tests together and took turns to demonstrate lessons. They reflected on lessons in different ways including describing specific events and interactions that occurred in classrooms as well as reported on intended and

unintended consequences of lessons. Engaging in such activities met researchers such as Garet et al's (2001) criteria for what constitutes effective professional development (see section 3.4). Observations showed that the activities were characterised by collective participation of teachers from the same grade who interacted over a long period of time within the school day discussing what to teach and demonstrating and discovering how to teach it. The learning gains were enhanced when lead teachers actively participated in leading their subject, when they presented their lessons with passion and enthusiasm and when they actively invited and facilitated interaction that enhanced their colleagues' understanding. Here is how three teachers described their professional learning even though they were at different stages of the learning continuum.

> *With me, because I was new, ..[participating in the CoP] was a lot of help because I didn't know what to do. The team members and the mentors were there to help me. I didn't know a thing about natural science until teacher B showed me. I didn't know how to teach English [or even] how to pronounce certain words until teacher C helped me.* [Teacher D - pre-service peer teacher - Personal interview 2011.]

> *Well, you learn content and you learn methodology, you just learn and learn and learn. And then…I feel…like a baby bird that is ready to fly… Last year I stuck to the lead teacher's notes, but now I know how to teach tessellations and transformations.* [Teacher I – novice peer teacher - personal interview 2013.]

> *Even though I have been teaching for so many years it is at this point in my life where I have realised that there is so much that I have gained….I actually find myself a more competent mathematics teacher now and I love the subject so much.* [Teacher F – lead teacher - personal interview 2011.]

Once the notes were handed out, the activities explained and discussed with some examples worked through, and some lessons demonstrated, the onus was then on each teacher to have the self-motivation to do final preparation required for classroom implementation. This brings us to the third level of planning.

5.2.3 Third level of planning: personal cognitive development

Cognitive development, seen from a socio-cultural perspective, is a progressive movement from an external socially mediated activity to internal mediation controlled by the individual or what Vygotsky (in Johnson & Golombek 2003) calls internalisation (see section 2.3.3). In this study, internalisation involved a process in which each teacher's planning for classroom implementation was initially mediated by other teachers through notes, worksheets, discussions and other development activities as explained (see section 5.2.1 and 5.2.2). Thereafter, the control shifted to the individual teacher as they set out to appropriate any further resources required as part of their personal planning for their own classrooms.

Seen from a constructivist perspective as that of Chalmers and Keown (2006), this personal planning and learning step was a sense-making process where teachers drew from their discussions, interactions as well as the resources provided in the grade CoP to build new knowledge and understanding from the base of their existing knowledge and perceptions (see section 2.3.2). This level of planning positioned each teacher as an independent student and it involved for each teacher, an attempt to link existing knowledge, ideas and beliefs with the new content knowledge and methodological approaches advocated by their lead teachers and other team members. Teachers indicated that they would often prepare their own charts, flash cards, transparencies as well as additional worksheets. They would go over all the mathematical problems more thoroughly on their own and practice conducting experiments at home. Each of these personal preparation activities helped the teachers find more effective strategies to teach. This was viewed by the teachers and HODs to be a part of planning because by doing it, they were internalising it. Wertsch

(in Ball 2000) refers to this as appropriating knowledge – making it one's own, whereas Hargreaves (in Handscomb 2007) described it as developing personal knowledge (see section 2.3.3). The following comments illustrate the personal commitment and effort involved in this level of planning.

> *It is very detailed – the planning - I must say, very, very detailed, but believe you me, you cannot just look at the planning and teach. You've got to go home and you've got to go and research. Like the exercises ...which are written down…you've got to go and work it out, which I feel is good. It is good.* [Teacher F – lead mathematics teacher - personal interview 2013.]

> *You have to look at the worksheets... because you go back [to your lead teacher] and you say: "This doesn't make sense" and…you're either right because they pick up a mistake or you're wrong because you did not understand it.* [Teacher B lead natural science teacher – personal interview 2011.]

The extent to which teachers undertook this level of planning was easily observed in book control, a task undertaken by members of the school management team. Some teachers just pasted in or filed the notes and worksheets that were given to them. Others wrote out things in their own handwriting, wrote methodological tips for themselves, and often wrote a sentence or two after the lesson reflecting on the effectiveness of the approach used in the classroom. HODs were increasingly insisting on lead teachers not handing out all the answers to activities to ensure that peer teachers took some time to work things out. They were also insisting on seeing visible evidence of this third level of planning as they had already approved the initial planning done by the lead teacher. Here is a comment from an HOD.

> *The planning we've accepted up until now has literally been like teacher A's planning copied in teacher B's file. Basically that's not your planning. So what I think is... now that you feel comfortable ...and you've got all your stuff from last*

> *year and this year …now you [must] take what she gives you and you [must] literally write your own planning. It must be in your handwriting with your own reflection. And feel free to indicate what didn't work. We need to see that you took the notes and gave some thought as to how to implement it. [This is also] just so that we can discuss was that a good lesson? How can we improve on it?* [Natural science HOD – Grade 4 CoP 2011.]

5.2.4 Problems experienced with planning and participation in the CoP

Some problems were experienced with poor planning and poor participation in the CoP. This is in keeping with the findings of Dunlap et al (2003), Johnson (2006), Hew and Hara (2007) and Gajda and Koliba (2008) (see section 3.5.4).

As discovered by Dunlap et al (2003), poor planning and division of labour was found to be a problem that affected CoP functioning. In this study, problems arose when there was little or no subject CoP engagement. The contributing factors of this were the poor work ethic of a lead teacher as well as a lack of ownership of the subject by a HOD. Consequently, peer teachers in the grade CoP would receive very poor quality work or no work at all. This resulted in the collapse of group work in that subject on many occasions. This was a recurring problem with respect to grade 5 natural science in the first two years of the study. The following comments illustrate this problem.

> *People don't have a sense of time management. This is seen when the lead teacher gives work for three periods when there are six [periods]. Poor time management when the lead teacher does not hand in assessments on time… What they think can be pushed for a later stage they don't realise the urgency of and the effect that it has on the entire team and most importantly the child.* [Mathematics HOD - grade 5 focus group 2013.]

> *I really believe collaboration works but…you must be thoroughly prepared…don't come here and waste the team's time.* [Teacher I – peer – grade 5 CoP 2011.]

In personal and group interviews, teachers who stated that they had previously planned poorly insisted that their planning had improved as a result of their collaboration with colleagues in a CoP. An HOD clarified this for us as follows:

> *But that person could have been better planned relative to when working alone but is still not on par to where we are supposed to be in terms of working in a team.* [HOD mathematics - grade 5 focus group 2013.]

Schlager and Fusco (2003) found that local values and norms of practice within schools proved to be formidable barriers to effective professional development (see section 3.3). This holds true for the problems experienced with level two planning and participation in the grade CoP in this research. In keeping with Johnson's (2006) findings, many lead teachers struggled to change the transmission strategy they experienced at school (see section 2.4.1). The transmission mode presentation, where insufficient guidance, explanation and active engagement were facilitated by the lead teacher, left many content, methodology and context-specific aspects of teaching and learning unexplored.

There were also problems with peer teachers in this regard. Peer teachers were generally passive and complacent and did not hold lead teachers accountable for poor planning, poor guidance and insufficient engagement. Furthermore, some peer teachers paid little attention, made no explanatory notes for themselves, and did not ask questions or get involved in discussions. According to Hew and Hara (2007), the perceived seekers' behaviours were of grave concern in these instances and actually served as a barrier to knowledge sharing (see section 3.5.1). The following comments illustrate problems that arose in the grade CoP.

> *I'll be honest…When the natural science planning comes I'm not happy but I don't know how to tell teacher G "You know what, I don't like this, I'm sorry I don't know where this is going to" and then I feel bad.* [Teacher F – lead mathematics teacher- personal interview 2013.]

> *I realised that sometimes, in the grade CoP, the teachers say they understand but they don't really...they are sort of scared or they don't really say anything. When I look at this 'bigger than' and 'smaller than' sign, then I realise that they don't know how to read it from left to right.* [Teacher A – lead mathematics teacher - mathematics CoP 2012.]

The above indicates how difficult it is for teachers to participate in collaborative learning situations. The findings of this study showed that while most of the teachers wanted collaboration some of them were very uncomfortable in participating fully in collaborative learning. Gajda and Koliba (2008) concur that isolationism and individualism are deeply ingrained in some teachers (see section 3.5.4). Jita and Ndlalane (2009) found that teachers had a fear of confronting the inadequacies of their content knowledge and pedagogic content knowledge (see section 3.6.2). This could be a contributing factor to the lack of participation observed on many occasions in this study. Teachers would rather be quiet than risk exposing themselves as incompetent.

The final problem with planning for classroom implementation arose when teachers failed to undertake any effort with regard to their personal preparation. As one teacher notes:

> *I think it's an easy way …like you get the notes at the planning meeting – you just take whatever [notes and worksheets] you are given – but [don't] take it home and [don't'] make it your own.* [English HOD – in SMT focus group 2013.]

The results of poor planning and poor participation in the CoP were evident in many unintended consequences. Having limited or no planning and/or an inability or confidence to confront their peers, and/or a poor work ethic with respect to personal planning for classroom implementation, the following consequences were observed. Teachers would do more mathematics lessons in natural science lesson time or take a small topic in natural science and drag it over a whole week. Peer teachers that did not understand the work or undertake any further personal planning would adopt what Appleton (2007) refers to as avoidance strategies (see section 3.6.1.1). These teachers would postpone lessons or make arrangements with the lead teacher to swop classes for content areas they could just not grasp. Teachers would seek guidance and explanation in learning contact time and would frequently disturb their colleagues. The following statements are illustrative of these consequences.

> *I also think that the negatives of … collaboration would be that your attitude – if you don't give 100 percent to other subjects… like the ones that you hate [like natural science]. …There are those times where I feel … I don't know the topic… I don't like the topic… it can wait.* [Teacher J – peer teacher - grade 5 focus group 2013.]

> *They've actually taken a very small amount of work … which could have been done in a shorter period of time … and they've dragged it out for a while because they are poorly planned … teachers are doing that… I see it. We are sitting in planning meetings and I'm thinking to myself you're talking about this… still...[for] three weeks! In mathematics, lucky enough we don't have time to play.* [Mathematics HOD – SMT focus group 2013.]

In accordance with constructivist perspectives such as those of Slepkov (2008), constructivist knowledge creation leads to a revelation of what is known and what is not known (see section 2.3.2). The statements above reflect how the teachers reacted when faced with what is not known and it reveals that opportunities for learning presented to these teachers in the CoP did not lead to change when there

was a disconnect with the existing schema of the teacher as a student. Furthermore, in accordance with Chalmers and Keown (2006), personal thoughts and reflection about knowledge or an activity were important and determined what skills and approaches took on personal significance to teachers and were thus adopted or neglected in a classroom.

Despite the problems experienced with planning and participation in the CoP, the advantages of collaboration and undergoing many cycles of reflection and evaluation, were that the problems were constantly brought to light and addressed. During reflection and evaluation episodes facilitated by me, the teachers were guided through a SWOT analysis which aided in the identification of the strengths, weaknesses, opportunities and threats to CoP functioning. Drawing from these, teachers also identified aspects to stop, start or continue with in order to improve CoP functioning. This was in line with the TCAR tool (Gajda & Koliba 2008) which highlighted areas to be improved on in terms of what the communities' dialogue should centre on and what should inform the decisions taken by the community (see section 3.5.5). With intervention there was some improvement, as an HOD noted:

> *I think it is improving slowly but surely. We are taking baby steps. Progress is limited, but still … we are not where we want to be but we are definitely not where we were.* [Mathematics HOD in grade 5 focus group 2013.]

5.2.5 Benefits of planning and participation in a CoP

Professional development in the subject CoP and the grade CoP was mainly focussed on subject content knowledge in terms of what to teach, how to teach it and how to reliably assess what was learned. This professional engagement around content matter enhanced the content knowledge and skills on the part of the mathematics and natural science teachers and gradually built their confidence levels. As they started to achieve success in their classrooms it enhanced their efficacy with more difficult content areas.

This is in keeping with the finding in many other studies conducted including that of Supovitz and Turner (2000), Garet et al (2001), Crockett (2002) and Palombo (2003) (see section 3.4). In the following comment a natural science peer teacher attributed her good results in class to the planning of the lead teacher.

> *The planning - the set out, the worksheets and the structure, was excellent.… I knew exactly what to do and you know what, the lessons worked wonderfully… [and] that reaped success. Ultimately, I got good results and I … complimented the lead teacher on that!* [Teacher F – lead mathematics teacher – peer natural science teacher - personal interview 2013.]

Professional development in the subject CoP and the grade CoP focussed mainly on content matter. This enhanced the content knowledge, methodological repertoires, assessment practices and professional attitudes of the lead teachers as well as the peer teachers.

I will now report on how teachers described their learning gains in these areas. I will also provide evidence of improvement in assessment results.

5.2.5.1 Improved content knowledge

According to Appleton (2007) and Kriek and Grayson (2009), teachers' core knowledge in subjects like mathematics and natural science is cause for concern (see section 3.6. and 3.6.1.1). Sharing the same concern an HOD in this study asked her mathematics teachers this question: "How sound do you feel about your knowledge of the content that you are teaching?" After listening to a few confident as well as uncertain responses, she followed this up with a caution: "When you are teaching something the most important thing is for you to understand it 200 percent".

The problem with content knowledge according to Drake (2001) is that there could be a mismatch between the developmental level of the teacher and the developmental

level assumed by the curriculum (see section 3.6.1.1). The developmental level of the mathematics and natural science curriculum was regarded to be of a very high standard and presented many challenges to the lead teachers as well as their team members. These problems were addressed first in the subject CoP in order to build the capacity of the lead teachers so that they could, in turn, build the content knowledge of their peer teachers in the grade CoP.

One of the first decisions taken in the subject CoP was to interpret the curriculum policy documents in light of the context in which the teachers were teaching. HODs and lead teachers consultatively took decisions on the topics to be covered, the pace and sequence of the topics and the depth and volume of a topic. The decisions taken were sometimes not aligned with the prescriptions of the curriculum. The following statements reveal that some school leaders felt empowered to interpret policy in a way that benefitted the school. This is in keeping with the perspective of Inglis (in Salleh 2007) who asserted that professional development should empower teachers by building their knowledge, skills and authority to act successfully within an existing system and structures of power on their own behalf (see section 1.4). Here are comments from HODs.

> *That mathematics curriculum is totally fragmented. We do 'place value' term one, term two, term three, term four. You do 'rounding off' term one, term two, term three, term four. We just decided no way we are not doing that. It doesn't suit us. We are going to change it to what suits us.* [Mathematics HOD - SMT focus group 2013.]

> *Yes [the syllabus] said there are no tests this term - what have we said? "No we want to teach our kids how to sit and write under exam conditions. We will have a test." So everything is subject to: Do you think exams are going to benefit the child? Are they going to get better at handling exams by doing more exams? Definitely practice will enhance their ability.* [Natural science HOD - SMT focus group 2013.]

The justification provided by the mathematics and science lead teachers and HODs were that the teaching of content had to be in a consolidated way and not in a fragmented way as they believed was the curriculum's design.

According to Saxe et al (2001:61), a teachers' knowledge of a subject like mathematics should be deeper than the content of the curriculum they are teaching (see section 3.6.1.1). The thorough planning on the part of the lead teacher, followed by the interactive engagement and discussion in the grade CoP and then a final personal step of personal preparation, augured well for effective content delivery in the classroom.

Even poorly planned teachers learned hard lessons and began to understand the value of having a wide content knowledge in preparation for lessons and of clearing up as many misconceptions in their minds as possible. One teacher commented that their knowledge should be vaster than their class's capacity because sometimes a bright student could know an answer that the teacher did not grasp. The following comment also indicates how an HOD drove the importance of sound content knowledge home in a grade CoP meeting.

> *You know, the thing is, we can't treat our children like guinea pigs. Unfortunately they are not at the level of any kind of intelligence that can allow us to make mistakes with them. If I make a mistake when I teach them fractions, you can bet your bottom dollar they are going to remember that. We can't afford it. That is how I see it.* [HOD natural science – end of term reflection meeting 2011.]

There was a clear acknowledgement from most lead teachers that they had to equip their team members as far as possible in this regard. However, the individual personal commitment from the teacher was regarded as an important aspect as well.

> *Maybe when they come and ask questions and they bother you a lot then you know: Oh, I didn't explain it properly. Ja, I think that's when I decided: No, I think I should explain it better in the meeting so that they won't come and ask for a book or they won't come and bother me and say "What must I do here again?"* [Teacher A- lead mathematics teacher - mathematics CoP 2012.]

> *I need to make myself 'au fait' with the content. You know what, I think that it is up to us as individuals. I don't really understand what's going on in some subjects, but I've taken a textbook and I've read through it. It has to be a self-motivation thing.* [Teacher H - peer teacher - grade CoP 2012.]

Every teacher in this study reported on having increased their content knowledge in mathematics and science. Knowing the content was a good start but delivering the content was another. In this regard there was very little guidance on paper, as the syllabus did not prescribe teaching methods. Because of the planning meetings all the teachers focused on the same content but were not reaping the same successes in their classrooms as this teacher notes: "Because we're all doing the same content [a teacher's success] clearly...starts differing where the methodology is different". This highlighted an important area for teacher learning -- that of teaching methodology. Shulman (in Hill 2004) refers to this as pedagogic content knowledge (see section 3.6.1.2).

5.2.5.2 Enhanced pedagogical content knowledge

HODs and lead teachers often shed more light on the content areas presented, focusing on much more than just the facts, figures and formulas. They often revealed tips and tricks that would assist the teachers in facilitating the learning of the content with their students. The benefits of these snippets of methodological information shared by teachers of expertise have been described as invaluable by their peers. Lead teachers often shared information on *how* to teach a topic, highlighted the difficulties the students would experience in certain areas and suggested ways to

help students that were struggling. They guided teachers on timing matters in terms of when exactly to introduce a new concept to students, and how to look for success in concept mastery and to celebrate it. Two teachers suggested:

> *To put the problem that comes from words into numbers -- that is hard for them. They love doing patterns, but it is quite hard for them to write it in a sentence.* [Teacher A – lead mathematics teacher - grade 4 CoP 2012.]

> *You know when you are doing your revision don't just put it up on the board and let them do it. This is what I do: I take each question and read it out to them, explain it to them and then make them do it. Then we mark it and move on to the next question.* [Teacher E - lead mathematics teacher - grade 5 CoP 2012.]

According to researchers such as Lave and Wenger (1991) and Alfred and Garvey (2000), this is an expected outcome of members that interact in a CoP (see sections 2.3.3 and 3.5.1). The frequent interactions and knowledge sharing provided opportunities for peer teachers to gain access to the tacit and often highly subjective insights, intuitions and hunches of lead teachers and HODs. Teachers implemented these in their classrooms and reflected on their implementation in subsequent meetings. Thus, according to Johnson (2006), the knowledge of each teacher was constructed through both the content knowledge and methodological repertoires of the members of the CoP (see section 2.3.3). Putnam and Borko's (2000) position on knowledge and learning was confirmed in this study as being the products of the interactions in a subject CoP and grade CoP over time.

As teachers shared and discussed their strategies, they developed in three critical methodological areas that enhanced facilitation of mathematics and natural science content knowledge and optimised student achievement. These were: using varied representations in class, using activities and tasks that engaged and extended the

students and becoming reflective practitioners. These developments will be discussed next.

5.2.5.3. Increased use of varied representations in class

With time, in both mathematics and science, teachers began to buy into the idea of making the subject “alive in the classroom”. In science and technology classrooms, more experiments were done and more projects were undertaken. In mathematics classrooms teachers were using practical aids such as flard cards (cards used to learn the place value of numbers), geometric shapes, and unifix blocks (to learn about volume). Teachers did symmetry, tessellations and measurements practically instead of teaching it purely from pictures and worksheets. Stories were used to make addition, subtraction and fraction problem-solving come alive. According to Walshaw (2012), these practical activities fostered connections between the subject and real-world experiences (see section 2.6.1.3). The use of these connections to real-life experiences motivated student engagement in all grades and provided a medium for mathematical thinking and reasoning. The following comments are illustrative.

> *Like I found with the vegetative reproduction -for [the students] to actually see that strawberry plant was amazing. And then today I brought the potato they were like wowed by it ... They don’t like to see me standing there all the time just blah, blah, blah ... So, have a partner with you all the time -- be it a chart or whatever it is.* [Teacher F – lead mathematics teacher - Grade 5 CoP 2011.]

> *In maths, practical work is important. I think if they do things more practically they will learn more and they will remember more because you can’t just tell students there is 10 mm in a cm. You have to show them. You have to tell them go and count those little lines ... or make a little ruler.* [Teacher A – lead mathematics teacher - personal interview 2011.]

5.2.5.4 Creative use of the activities and tasks in class

Guided by the planning that emerged in the subject CoP, teachers in the grade CoP began to adopt the practice of constantly engaging students in doing activities as compared to just copying notes or sums from the board. The activities chosen or designed by lead teachers in consultation with their HOD, met many of the criteria suggested by Walshaw (2012) (see section 3.6.1.5). Activities and tasks were designed in such a way that they covered the required content and moved students from the concrete to the abstract, thus building their cumulative understanding of a topic.

Furthermore, tasks catered for a diversity of students. Teachers designed and implemented tasks that allowed for consolidation of a topic thus building a solid base of knowledge in the students. Peer teachers appreciated the results achieved because of these carefully designed tasks and complemented their lead teacher attributing their personal success in their classrooms to the lead teacher's excellent planning of tasks.

> *You know what I realize, teacher A, … I appreciate the longer we stay with one thing the better the children are getting.* [Teacher C – peer mathematics teacher - grade 4 CoP 2012.]

> *For division I only had one failure…..because we practice, practice, practice.* [Teacher B - peer mathematics teacher - grade 4 CoP 2012.]

As teachers became more *au fait* with the content they felt more comfortable tapping into student's thinking and reasoning. This was evident in activities given to stimulate critical thinking and activities where students had to hypothesise the outcome of an experiment or to deduce a rule or a formula. These activities, according to Asoko (2002) would support the beginning of reasoning in students (see section 3.6.1.4). For the teachers in this study it represented the humble beginnings of their attempts

to tune into their students' thinking and reasoning. The following is a snippet of dialogue from a grade 5 CoP.

> *That the formula is actually 2 x (l+b)…Let's see if we can get the formula from them?*
> *Instead of us just giving it to them ja…*
> *The deductive method is much better because they will remember.*
> [Dialogue in Grade 5 CoP 2011].

Time was a barrier and creative problem solving was required to improve the work ethic of students. Teachers made a decision to foster a homework mentality in students and their parents. This would be regarded by Fullan (2007) as connecting to the outside world (see section 1.1). The connection to the parents and the resulting homework mentality that was fostered in the parents and students were given as reasons for the improvement in the students' performance in class-based assessments as well as internal and external exams. Lead teacher A enthuses:

> *What I've seen…if you give them homework every day, you must get the parents involved. When I write a note in their diary and say "Your child doesn't understand multiplication," I see the parents respond. It was amazing!*
> [Teacher A - lead mathematics teacher - mathematics CoP 2012.]

To determine whether or not their strategies in class were effective and if students were actually doing the homework independently, teachers started to design mini tests to check for student understanding before exposing them to formal tests and examinations. Using various activities such as spot tests, rapid quizzes and other drills, teachers addressed the following concern: "I taught ... but did they learn?". Teachers started to understand that it was their responsibility to gauge whether a concept had been grasped by a student and to intervene if data revealed poor student understanding. This took teachers into a new arena of constant reflection and evaluation of their teaching.

5.2.5.5 Teachers became reflective practitioners

Teachers engaged in reflection-interaction cycles to constantly check for understanding and to find ways to adapt their activities and instruction to suit their students. This represented a critical shift in the teachers' development as they started to evaluate the outcome of a teaching and learning episode more often. This evaluation informed their planning for future lessons. The reflection and evaluation also extended to assessments. Based on students' results teachers would make modifications to their teaching strategies, their revision programmes as well as the quality of their assessments. Thus teachers' learning was enhanced in terms of content knowledge, as well as their teaching and assessing skills. This is in line with Tzur (2001) and Powell (in Modisenyane et al 2004), that viewed such reflection as important to the professional development of teachers, in particular with regard to teaching for conceptual understanding (see section 3.6.1.7). For example:

> *We [can't] worry about the syllabus all the time, we've got to stop, evaluate, re-teach, move on. You can't be so focused on content and not on the skill that the child is actually acquiring or can do.* [Mathematics HOD - mathematics CoP – 2012.]

> *I looked at myself… my mathematics average was too high. It was ridiculous. Gosh, I thought [the test] was a good standard, but it was not. The kids are getting better. When the kids get better, we've got to get better and up our game as well. So that's just a learning curve for all of us. You know, it's just a game of constantly changing and adapting to the kids themselves.* [Teacher K – grade 6 CoP 2013.]

A curriculum with intellectual demands in terms of content had to be assessed in a reliable way. My next focus is reporting on how teachers have improved in their assessment practices.

5.2.5.6 Improved assessment practices

In mathematics and natural science subjects the HODs and lead teachers favoured class tests, practical tests and examinations as reliable forms of assessment as compared to rubric-based posters, presentations and demonstrations. In addition to these internal assessments, students wrote external tests such as the common quarterly examinations set by the district office and the ANAs. This represented another way in which the school connected to the outside world as part of teachers' efforts to improve on their academic results.

According to Fullan (2000), the external papers from the various departments of education served to challenge as well as support teachers in their professional learning (see section 1.1). By being exposed to externally set assessments teachers learnt how to phrase questions differently using proper mathematics and scientific language. Lead teachers began to use the same mathematical and scientific language in lessons and on worksheet activities. This helped both peer teachers and students to become familiar with the terminology.

Under the guidance of HODs who moderated every test, lead teachers were also becoming skilled at setting assessments and distributing the marks of each assessment according to a relevant taxonomy. Each test was designed to comprise of on average of 60% level one questions, 30% level two questions and 10% level three questions. The idea was that no assessment should allow the majority of the students in a class to get full marks. This being the case, the test would be construed as being too easy and of giving teachers and students a false sense of their abilities and achievement. Often such a problem was revealed when internal and external examination results were considerably lower than class test results. The following comments indicate the teacher's learning in terms of setting assessments.

> *I tried to phrase the questions the same way as it's done in the exam so that they can get used to words like 'equivalent', 'symbols', 'names of fractions', 'compare'.* [Teacher A – lead mathematics teacher - Grade 4 CoP.]

> *I actually did reflect and I said: Why is it that in my class test they were scoring good marks, but in that ANA and common quarterly tests my marks were so low? My tests were easy, they were very easy. And you know what, this moderation – it helps a lot.* [Teacher F- lead mathematics teacher – Mathematics CoP 2011.]

Lead teachers had to present their assessment to their peers, familiarise them with the assessments and ensure that everyone had a common understanding of what was required in each assessment. At first, teachers would not discuss the tools of assessment (memoranda and rubrics). They would also only mark their own students' work. When tests were not adequately engaged with prior to administration it created many problems. There were misconceptions on what was required in some questions and there were inconsistencies in the marking.

What worked best was when the test was written by all the peer teachers and then marked by or together with the lead teacher. Another good strategy was when teachers marked each other's scripts or marked in teams. These activities encouraged joint engagement and discussion and led to a common understanding of what was required on each item on each test. One peer teacher stated:

> *I like what we do with the mathematics - we all write the test and then we discuss the memos. It is much better discussing it from the point of view of having done it. It makes more sense.* [Teacher H – peer mathematics teacher - end of term reflection meeting - grade 5 CoP 2012.]

When teachers wrote tests as students, discussed possible responses to answers, and scored and analysed student work together it was aligned with what was

regarded by Little (in Darling-Hammond & Richardson 2009) as shared work around a particular pedagogical matter (see section 3.5.3). The dialogue around test answers and possible responses from students was vibrant and took teachers into uncomfortable moments of disagreement as teachers strived to reach a common understanding of how to score an answer to a question. This was an expected outcome of joint work according to Crockett (2002) who also found that when teachers were polarised, the discussions were all part of a communities' collaborative construction of meaning (see section 3.5.3 and 3.6.3.1).

Another very polarising joint work activity undertaken was the collaborative analyses of achievement data that happened in subject as well as grade communities of practice. Guided by the TCIF and the TCAR of Gajda and Koliba (2008) (see sections 1.2 and 1.5.5), HODs and teachers set goals for instruction, committed themselves to the public sharing of practices and student achievement data, to the constant feedback and evaluation of team performance and to the drive towards accountability of all CoP members.

All student performance data were analysed in terms of the following performance goals set. Teachers had to achieve a 90% pass rate in all subjects. Ten percent (10%) was regarded as an 'acceptable failure rate' to cater for special needs students who would be placed in other schools when they reached an appropriate age. Ten percent (10%) in a class of 30 students comprised only three students. This was considered as a huge challenge for teachers who were already having up to 20 failures in an assessment. In addition to the target of a 90% pass rate, teachers had to strive to achieve a 55 to 60% class average. These norms applied to class tests, end of term examinations as well as the ANA. An HOD asserted:

> *I think it is good to keep our targets at a higher standard with lower failures and a good average. If our average goes below 50 we've got a problem. That's when we really start zooming into what's going on there.* [Mathematics HOD - grade 4 CoP 2013.]

In addition to the above performance targets, the HODs also sought a correlation on performance in each of the following respects. Analyses were undertaken in terms of whether or not there was a correlation in mathematics and natural science results; between class test results and examination results; and between internal results and external (ANA) results. The analyses also focused on the achievements of each teacher in a grade. The correlations were thus sought to check if lead teachers and HODs were building the capacity of all the teachers in their teams, if the internal class tests were of the required standard to match that of end of term examinations, externally set common quarterly papers and the ANA. Here are some comments from HODs on these matters.

> *I think where the satisfaction would come in is when we have better results in the external exams. That is a benchmark for any school because we have not seen the exam papers. An external exam is totally independent, so that external exam should be our benchmark in our subjects.* [Mathematics HOD – SMT assessment meeting 2011.]

> *It is very important to evaluate because we can just carry on in a little rut for ourselves. Look at our results. If we are saying that we are being productive in the classroom, then our results must show the same thing in internally and externally set examinations.* [Mathematics HOD – mathematics CoP – 2012.]

Analyses were also undertaken to identify, recognise and learn from individuals and communities with a high intellectual output. Teachers were deeply divided on the question of who was accountable for poor results and were thus initially unable to acknowledge the successes of their team members or successes of other teams. The division centred mainly on how particular teachers and teams attributed their results. Some teachers attributed poor results to the low calibre students, a lack of involvement of parents or to having the weakest class in the grade. To effect a change in this kind of mindset the HODs and school principal intervened by holding teachers accountable for the results achieved. This is in keeping with school

improvement strategies advocated by Christie (2005) and Fullan (2000) (see sections 1.1, 1.2 and 2.4.2.1). The comments below from two HODs make a strong appeal for accountability.

> *Yes… it is true, they [the students] don't know the basics, but what are we doing about it? Because that is not going to change! If we say they are dumb, they are going to stay dumb. If we let that go, they'll stay dumb. But we've got to turn it around.* [Mathematics HOD – Mathematics CoP – 2012.]

> *Look the bottom line is that it is something that we have got to take accountability for. We can wring our hands and say these children are not brought up properly, they don't have parental support. But you know what, we have just got to make our mark. It's just the bottom line.* [Natural science HOD – SMT assessment meeting – 2012.]

Finally, analyses were undertaken to constantly inform planning for each community's participation and engagement in further action research learning cycles. With each evaluation teachers engaged in dialogue and took decisions about all the pedagogical practices they would stop, start or continue in order to enhance their personal learning as well as their students' results. The important thing to note here is that all data were subjected to evaluation and interpretation, not just poor results. Teachers had to constantly analyse, evaluate and decide on their approaches in the classroom. Undertaking these steps constantly, according to Gajda and Koliba (2008), was the path to unprecedented improvements of student learning, among others (see section 3.5.5).

5.2.5.7 Improved professional attitudes

The benefit of a long duration of study coupled with constant analysis of the data was that teacher's differences in achievement were revealed. With having as many variables as is possible in the school equal (class size, kinds of students, content,

workload and assistance in the CoP), some teachers were able to get more students to perform at higher levels. This acknowledgement improved many teachers' professional attitudes. Lead teachers started to expand more effort in terms of their planning for their peers and for their classrooms, and taught all the lessons they were require to teach. They tried out new ideas and took feedback and guidance from their HODs. Similar results were found by Kriek and Grayson (2009) who identified the improvement of teachers' professional attitudes as one of the goals that should be met as a result of professional development of South African teachers (see section 3.7). The following comments illustrate some changes in professional attitudes.

> *Speaking from a mathematics point of view… I got very, very shocked when I saw the graphs [showing the results]. It was very scary. But then I thought: you know what, I've got to dig deeper, I've got to do something else.* [Teacher F – lead mathematics teacher – grade 5 CoP 2011.]

> *I must be honest: I remember when we sat in the staffroom and I was poorly planned for my subject and the principal moaned at me. I needed that because it has almost been like a whole 180º change for me. My whole attitude has changed. My accountability has changed.* [Teacher I – peer teacher – grade 5 focus group 2013.]

> *With this collaboration way you find that you are working. There is no time for you to even say I'm going to relax now I'll pick that lesson up in another day or so. You are accountable and you've got a team and especially when everyone is work focused you cannot be the one that is the sour apple.* [Teacher F – lead mathematics teacher – personal interview 2011.]

Teachers also improved their attitudes in terms of how they viewed the external assessments as well as what the significance of the student achievement data in terms of these assessments were.

> *[At first] I thought to myself…No, my results in my class are fine! What is so important about the external results? And then you know your mindset changes. You realise the importance of the ANA over the years, like now, at this point I think it is so important.* [Teacher F – mathematics led teacher – personal interview 2013.]

Most teachers showed a commitment to growth and improvement. They acknowledged that having a professional attitude meant moving on from being excuse-driven to finding ways to improve practice. This was especially important in the context in which they worked. Students needed constant motivation, encouragement and engagement. Teachers also adopted professional *collaborative* attitudes. These attitudes were characterised by a team-work mentality. This was observed when lead teachers fully embraced the responsibility for their subject planning and for building the capacity of the peer teachers in terms of that subject in the entire grade. Peer teachers improved in their attitude towards the way they participated in the CoP and in being open and receptive to ideas from lead teachers and other peer members. For example:

> *So I'm saying I have to open my mind and accept these new ideas coming from other people and also accept how other people do it. You have to accept those strategies because it is not about me it's about the students and there are 33 [students] in the class. My method might work for only five [students]. So at least I have three ideas or four more ideas from different people. Then I know if I am stuck in class I've got option B.* [Teacher D – peer teacher – personal interview 2011.]

5.2.6 Management of professional development in the school – lessons to be learnt from successful teachers and good grades

From the onset of the collaboration project, I was guided by the TCIF and the TCAR of Gajda and Koliba (2008), and set out to raise collaboration literacy among HODs,

lead teachers and peer teachers while constantly evaluating the quality of collaboration in the school and working with the various communities to effect changes (see section 3.5.5). The ultimate goal was to have teachers participate in a CoP, contribute to the CoP and learn from that community so that the capacity of each member was built to achieve a high intellectual output in the form of good student achievement.

School leaders played an important role in the project as lead teachers and subject HODs. Seen from the perspective of Hayes et al (in Christie 2005), the leadership of learning in the school was well dispersed as it was the responsibility of so many people in the school (see section 1.1). For each individual teacher, regardless of their years of experience and level of expertise, an enabling environment was created for learning by engaging in and contributing to the practices of their grade and subject communities on an on-going basis as the following comments illustrate.

> *In my previous school you do your own stuff…sink or swim…you are on your own basically. Here they set the tone for you, you are introduced to things, you are told what to do and you are given that opportunity to voice out whatever concerns that you might have. In that way I feel that here, they cater for everybody.* [Teacher J – novice teacher – personal interview 2011.]

> *I have learnt a lot through mentorship through others because there are many people ... they've got other skills better than me and I have learnt a lot from them.* [Teacher D - In-service teacher – personal interview 2011.]

For the school as a whole, with more teachers learning and becoming proficient in subjects where there is a shortage of teachers (like mathematics and natural science), learning was as critical an issue of refining practice as it was of ensuring a new generation of members. This is in accordance with the ideas of Wenger (1998) (see section 2.4.2.1). A member of the school management team asserted: "We have continuity… as long as you are improving everybody's skills in science and

everybody's skills in mathematics". Even though it was difficult in getting every teacher to a superior level of competence in three or four years, the school management team felt there was something to celebrate in having "many teachers competent on an average level rather than only one teacher competent on an excellent level lest we lose that excellent teacher". These comments must be seen in light of the high turnover of mathematics and science teachers as well as the fact that the HODs could still work on developing that 'average' teacher with further collaborative engagement. This was a very relevant concern because during the course of the project two natural science teachers, two mathematics teachers and one mathematics HOD resigned. Furthermore, it was also beneficial that having so many teachers developed in a school allowed for engagement from more people in difficult subject areas.

Learning also allowed the school to build up a strong knowledge base in grades and subjects; develop baseline and summative assessments; and employ tried and tested pedagogical repertories such as revision, reinforcement and remedial work. The school steadily improved its academic achievement in internal as well as external examinations. Table 5.1 shows the increase in the mathematics ANA results from 2009 to 2013.

Table 5.1. A comparison of grade 4 to 6 Mathematics ANA results in 2009 and 2013

	Grade 4	**Grade 5**	**Grade 6**
	Average (%)	**Average (%)**	**Average (%)**
2009	38	17	42
2013	49	53	63

From Table 5.1 it is clear that the school had improved its performance in external assessments from 2009 to 2013. The grade 4 results improved by 11%, the grade 5 results improved by 35% and the grade 6 results improved by 21%. These improvement must be celebrated noting however that: (i) in terms of grade

performance, only the grade 6 teachers have met the target of a 60% average in performance. (ii) Out of 12 teachers, only three teachers reached a personal target of a 60% class average. These results indicate that more can be achieved in each class and in each grade as a whole. This further reflects that the goal of re-culturing the school to adopt a collaborative, site-based learning ethos, and an increased intellectual output from each teacher and each team remained an on-going quest and was a time-consuming matter. This is in keeping with results from Grossman et al's study (in Borko 2004) (see section 3.5.4). Grades 4 and 5 peaked in their third year. In this year of collaboration the teachers in these grades achieved their highest ANA results and greatest team functioning. The grade 6 teachers with their collaboration and semi-home based model achieved outstanding results in their very first year. This confirms Jita and Ndlalane's (2009) research results that groups were not monolithic and participation in the communities of practice did not offer identical benefits to the teachers (see section 3.5.4).

5.2.6.1 Lessons from successful individuals

While it was clear that all teachers improved with collaboration, the study also shed light on a few teachers that had the personal motivation, commitment and dedication to enhance learning in their classrooms in the absence of HOD involvement and in the absence of working in a team. What was evident in observing these teachers were that if the correct professional attitudes were already present when teachers worked in isolation, these teachers just soared in a collaborative setting with peer teachers and HODs. Here are comments from the teachers who achieved the highest mathematics ANA results.

> *You're an educator in your class. You have been placed in charge of that particular subject and you know what: you've got a duty and a responsibility to fulfill. So you cannot place that responsibility on your HOD. Yes your HOD is there to guide and help but it doesn't become the HODs responsibility to do*

your work. [Teacher A – achieved 60% average in ANA results in 2012 and consistently achieved the highest marks in the grade.]

I came and I did my job and I did it really well. And within a year or two I think we wrote some district test and we were placed 4th in this district….I took my subject seriously and from there eventually became subject head and I took my same seriousness and pushed it down everybody else and showed it to them. But it started with me being serious about it in my class and shining with the results in my class. So it's got to start with individuals. [Newly appointed mathematics HOD 2013 – highest results achieved in ANA – 66%.]

Teachers who achieved good results adopted a greater learning and developmental stance to subject collaboration with an HOD and grade collaboration with their peers. They were receptive to feedback, open to new ideas and experimentation and were willing to constantly ask, observe, clarify and correct. An HOD describes such a teacher in the first comment below. The second comment shows that such teachers responded to feedback and critique with reflection, introspection and maturity.

She is totally receptive to feedback, has a high standard of work but still willing to take directions from somebody who says: "Step it up, step it down". [Natural science HOD 2013.]

It was said … "bad teachers produce bad results" that killed me…and I said "No, no, I'm not a bad teacher!" I know who I am. I know what I've achieved in my past and I know what I am doing here. But, like I said, you have that moment of reflection and … it made me shift into a higher gear…And [I put in the] effort, hard work and all of that. You know I feel I've grown! [Teacher F - first achieved 25% and progressed to achieving 60% in external examinations.]

Finally, a teachers' personal motivation to learn is an absolute critical factor in determining what is learned, how much is learned and what the performance of the

students in that teacher's class will be. A study by Desimone, Smith and Ueno (in Steyn 2009) revealed that teachers' lack of motivation to learn was a big barrier to professional development (see section 3.6.2). The following comment illustrates the importance of the individual commitment of teachers.

> *You are going to have this group working with you…you are going to have this push [to achieve]. You are going to have your discussions, you are going to have your analysis, you are going to have your reflection but ultimately you are going to be on your own again and what you do with it is what is going to [determine your success]. It's that individual conviction.* [Teacher F – lead mathematics teacher – personal interview 2013.]

5.2.6.2 Lessons from good grades

The outstanding results from the grade 6 teachers internally and in the ANA in their very first year of collaboration needed to be explored. What was learnt from this was that structurally a two-by-two collaboration model with a semi home-based scenario worked well. Secondly, in meeting times there were just two people and thus both had to participate in planning, and in discussions and decision-making. However, being present at almost every mathematics and science planning meetings and from personal and focus group interviews, I can also report on a high accountability culture within this group. At the most basic level there was not just a blind acceptance of ideas. Notes, activities, assessments, and results were all engaged with, interrogated and improved on for the benefit of enhancing student learning. Unlike in the other communities of practice, the needs and development of team members were secondary to the needs and development of the students. With this in mind teachers found it easier to be critical of their peers and to hold them accountable for the quantity and quality of their work. When teachers gave constructive criticism they provided instructional support to their team members. This is in accordance with the views of Samaras et al (2005) (see section 3.5.2). Teachers constantly gave each other feedback on teaching strategies, lesson plans and assessments.

Where emotional support was more important to the grade 4 and 5 CoP, instructional support was favoured in the grade 6 CoP. The grade 6 teachers were able to separate 'friendship' matters from professional work matters. While frequent engagement and interaction allowed them to vent their frustrations and offer emotional support and encouragement to each other when required, they did not mind risking the loss of emotional support and constantly held each other to a high standard of work. The following comment is illustrative.

> *[It's just about] business! Teacher L and I are very good friends…but the amount of conflict we have with regard to work…it is a lot of conflict….We step out of friendship mode when we're talking about work.* [Teacher K – lead mathematics teacher –grade 6 CoP 2013.]

5.3 FINDINGS FROM THE QUANTITATIVE STUDY

The views on collaboration and teamwork were determined by means of 22 questions. Thirty-two teachers answered a questionnaire based on their experiences of collaboration in their teams. The results are presented in Table 5.2. The table shows the results from the highest to the lowest *agreed* scores.

Table 5.2 Teachers' views on collaboration and teamwork

	Statement	Disagree	Neutral	Agree
6	I easily ask questions for clarification and guidance in terms of work other teachers plan. I see this as important in terms of my own development as well as theirs.	0%	7%	93%
10	I have a greater commitment to changing practice as I position myself to be on a path of continuous learning and trying out new things for the benefit of the students.	0%	7%	93%
14	I make use of varied representation in class. I use pictures, charts, stories and various other ways of making it easier for children to learn mathematics and science topics.	0%	7%	93%
1	I am a team player and consider the needs and development of other teachers	0%	10%	90%
2	I thoroughly plan to ensure every team member feels confident to teach the relevant topics. I feel accountable to my team members.	0%	10%	90%
22	As I continue to engage with colleagues it increase my range of teaching and learning strategies targeted at specific student needs. The result is that children that struggle do improve in my class.	0%	13%	87%
13	I incorporate drill work into my lessons ensuring that students constantly revise mathematics times tables and science concepts	0%	15%	85%
18	I easily share, analyse and interpret my results for each formal activity in a collaborative setting.	0%	15%	85%
9	I have an enhanced belief in my ability to make a difference to my students' learning	0%	17%	83%
16	It is easy for me to evaluate in class whether or not I am reaching all the children. I am consciously aware of the impact of my mathematics and science instruction on the students.	4%	15%	81%
20	I engage with colleagues on ways and means to improve on the academic results of students in mathematics and science. I then implement and evaluate these.	0%	20%	80%

11	My content knowledge in mathematics and science has increased as a result of collaborating with teachers in these subjects.	0%	26%	74%
3	I ask for feedback from the other teachers regarding the notes, lessons and assessments I set up. I invite reflection and feedback on my work.	7%	23%	70%
4	I invite teachers into my classrooms to observe my lessons and to provide feedback	10%	20%	70%
12	I try out different teaching strategies as recommended by the mathematics and science team leaders and then give feedback on what worked and what did not.	0%	30%	70%
15	I easily hear what student's ideas and thoughts are in mathematics and natural science. I allow time for thoughts and ideas on a topic to be freely shared.	0%	30%	70%
17	I have the same understanding as my colleagues on how to mark and assess any activity. This is because assessment tools are discussed at length before they are used.	0%	30%	70%
21	As I continue to engage with colleagues I become a more effective teacher. The evidence is in my improved school marks.	0%	30%	70%
5	I am moving away from passing over of notes to allowing greater dialogue about what to teach and how to teach it.	7%	27%	63%
8	I have greater confidence in my ability to teach the students at this school. This is especially true of subjects I initially felt most insecure about.	3%	33%	63%
19	I accept personal responsibility for the high and low results achieved in my class.	10%	27%	63%
7	Working in collaboration with colleagues gives me an increased sense of satisfaction in my job	3%	37%	60%

According to Table 5.2, the most significant views of the teachers (indicated by the highest percentages), were the following: Most of the teachers felt at ease to ask for clarification and guidance in terms of working with other teachers' plans and

considered themselves open to change, learning and growth for the benefit of their students. Teachers report on having adopted a greater team-player mindset and ensured they planned thoroughly to build their peer teacher's confidence when they taught a topic. In terms of methodology, most of the teachers (93%) reported on their increasing use of varied representations in class, while 87% of teachers believed that they had increased their range of teaching skills to be able to effect an improvement in students that struggle. A slightly lower percentage of teachers (about 81%) indicated that on a personal level they were becoming aware of the impact of their instructional practices on students. In terms of assessment, a large percentage of teachers (85%) were comfortable with sharing their results with colleagues, their efficacy in making a difference to students' learning was enhanced (83%) and there was engagement with colleagues on how to improve academic results (80%).

Seventy-four percent (74%) of teachers believed that there is an improvement in their content knowledge; 70% of teachers had opened themselves up to feedback; 70% of teachers indicated that collaborative engagement on assessment resulted them in having a common understanding of assessing activities and that continued engagement with colleagues had resulted in them achieving higher marks.

These high results indicate teachers' learning by participating in communities of practice. The results provide evidence of reculturing as described by Fullan (2003) (see section 1.1). Teachers improved from working in total isolation to collaborative learning by participation in a CoP. Seen through the lens of learning as participation as espoused by Hodkinson et al (2008), teachers' professional development at the school site were fostered as they engaged in the communities of practice (see section 2.3.3). By being involved in planning activities with their HODs and peers, teachers shared knowledge, jointly worked together on tasks and analysed results with a view to constantly improve their effectiveness in the context in which they worked. Grade 4, 5 and 6 teachers learned because they were part of a grade CoP to which they contributed as well. Thus their participation involved "taking part" as well as "being

part of" a member of a CoP. This is a central tenet of the situated learning perspective of Lave and Wegner (1991) and Mason (2007) (see section 2.3.3).

The other results also provided confirmation of expected learning outcomes from continuous collaborative engagement. In line with findings of other researchers such as Garet et al (2001) and Kriek and Grayson (2009), teachers report on an improvement in their content knowledge, methodological repertoires and assessment strategies which have contributed to the improvement of their students' results (see sections 3.4 and 3.7.3).

The lowest scores (between 60 to 63%) of the views centred around personal planning, efficacy in teaching subjects that initially posed a problem to teachers, feeling personally responsible for low results and having an increased sense of job satisfaction due to collaboration. Ten percent (10%) of teachers did not feel personally responsible for their high or low results; 7% of teachers reported on still just passing over notes to colleagues without much dialogue; and 3% of teachers believed that collaboration did not enhance their efficacy in teaching difficult subjects and that collaboration had decreased their satisfaction at work. These matters reflect teachers' professional attitudes and confirm Kriek and Grayson's (2009) view that it is an essential matter to address in schools (see section 3.7.3).

Twenty-seven percent (27%) of the teachers were neutral on the transmission mode versus collaborative engagement with colleagues with seven percent disagreeing with collaborative interaction totally, despite the fact that most of the teachers were involved in collaboration for more than two years. This confirms Gajda and Koliba's (2008) ideas that isolationism is deeply ingrained in some teachers and Feiman-Nemser's (2001) view that some teachers were reluctant to change the transmission mode strategy that they were schooled with (see sections 2.4.1.3 and 3.5.4.).

Of great concern is that a large percentage of teachers are not at the required level of efficacy in terms of producing good results. On average, 30% of the teachers did not

feel they were responsible for producing good academic results. However, Penuel (2007) indicates that good results are an important aspect of the professional development chain (see section 3.3). Moreover, Gajda and Koliba (2008) stated that a high intellectual output is what professional developers aspire towards (see section 3.5.5). With these aspirations in mind, the 30% teachers that are not at the required level of efficacy indicate that the road ahead is paved with many challenges in developing teachers professionally.

5.4 SUMMARY OF THE FINDINGS

Table 5.3 summarises the qualitative as well as quantitative findings of my study, and is self-explanatory.

Table 5.3 Learning path for effective lesson implementation in home-based scenario

Individual teacher

	Participation in a Mathematics CoP	Participation in a Natural Science CoP
Participants / team members	Mathematics HOD Mathematics lead teacher/s	Natural Science HOD Natural Science lead teacher/s
Diversity	Based on expertise in a particular subject Lead teachers – developing expertise in the subject in a specifc grade HOD – demonstrated expertise in the subject across all grades and even beyond the bounaries fo the school	
Goals	**First level of planning** (participation in a subject CoP) High quality of artifacts to be produced: lessons, activities, assessments Develop 'best practice' work and build the knowledge and skill base in respect to the teaching of particular subjects Good intellectual output: 90 percent pass rate, 60 percent average on high quality internal and external assessments	
Activities undertaken	Planning of lessons and assessments in mathematics and natural sciences Moderation and quality assurance of all artifacts produced Knowledge sharing between subject HOD and lead teacher	
Professional Learning gains	Improved content knowledge related to specific subjects Improved planning skills in terms of increased use of varied representations in class and the creative use of the activities and tasks in class Improved assessment practices: High quality of assessments designed Teachers became reflective practitioners Improved professional attitudes in terms of time management,	

	meeting deadlines and being accountable for planning and achieving good results Efficacy built by improved student achievement Improved HOD mentoring and moderation skills Improved management skills in subject ownership and subject accountability
Particpation in a grade CoP	
Participants / team members	Lead teacher – Mathematics Lead teacher – Natural Sciences Lead teacher – English Lead teacher – Afrikaans Lead teacher - Social Sciences Lead teacher – Lifeskills HOD / Deputy principal / Principal
Diversity	Lead teachers of a subject were developing expertise in that subject in the grade (achieved in participation in a subject CoP) Each lead teacher of mathematics, for example, was a peer teacher in respect of every other subject and was developing expertise in that subject through particpation in a grade CoP
Goals	**Second level of planning** (participation in a grade CoP) High quality of artifacts per subject to be shared and distributed among team members: lessons, activities, assessments Develop 'best practice' work and build the knowledge and skill base in respect to the teaching of *different* subjects to one *particular grade* Good intellectual output: 90 percent pass rate, 60 percent average achieved on high quality internal and external assessments in all the subjects
Activities undertaken	Distribution and discussion of planned lessons in different subjects. Knowledge sharing among different lead teachers on what to teach, when to teach and how to teach it – more likely to be presented in transmission mode

	There were reform activities undertaken (facilitated by all the mathematics lead teachers and some natural science lead teachers): Peer lesson demonstration, lesson observation, jointly working through activities and tests, collaboratively implementing assessment tools, reflecting on lessons, tasks, assessments, public analysis of results, collaborative implementation of intervention strategies
Professional Learning gains	Improved content knowledge related to all the subjects taught in a home-based or semi home-based scenario Enhanced pedagogical repertoires Increased use of varied representations in class Improved creative use of activities and tasks in class Enhanced reflection by teachers Improved assessment practices Improved professional attitudes Efficacy built by improved student achievement in some subjects – all teachers improved in terms of mathematics results.
Personal cognitive development	
Participants	Individual teacher
Diversity	Diversity of the students were considered in the teacher's personal planning
Goals	**Final level of planning** (Independent preparation of classroom teaching) Good intellectual output: 90 percent pass rate, 60 percent average on high quality internal and external assessments in all the subjects Develop 'best practice' models in terms of the teachers and teams who achieved the best results
Activities undertaken	Personal construction of knowledge Take decisions on how high quality of artifacts per subject was to be mediated to students to optimise their learning opportunities. Take decisions on the distribution of time and attention to different subjects according to student ability.

	Avoidance strategies in teachers for whom sense-making in terms of the content and methodology required posed enormous challenges.
Professional Learning gains	Improved content knowledge related to all the subjects taught in a home-based or semi home-based scenario. Enhanced pedagogical repertoires Increased use of varied representations in class Increased creativity of activities and tasks in class Improved reflection in teachers Improved assessment practices Improved professional attitudes Efficacy built by improved student achievement in all subjects Teachers who displayed commitment in terms of personal development and learning achieved good results in all subjects they taught irrespective of whether or not they were the lead teacher or peer teacher for that subject - surpassed their lead teachers in terms of student achievement

Table 5.3 integrates the findings from the qualitative and quantitative approaches used in this study. The table illustrates the learning path for effective lesson implementation in a home-based scenario from a subject CoP to a grade CoP to personal cognitive gains.

5.5 CONCLUSION

In this chapter the findings and discussions of the findings of my study were presented.

In the next chapter I will draw conclusions and make recommendations as informed by the research I had undertaken. Recommendations for the professional development of teachers and for future research will be made and limitations of the project will be pointed out.

CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 INTRODUCTION

This chapter provides the conclusions, recommendations and limitations of this research. The conclusions serve to answer the main research question, namely: *How can the professional development of primary school teachers be managed by means of action research?* Conclusions from participation in a subject and a grade CoP, as well as from individual teaching and learning, are presented. Conclusions are also drawn regarding the benefits of participating in a CoP, and for the school management of professional development of teachers. The contribution of this study is highlighted. The conclusions serve to realise the aims of this research. Accordingly, recommendations are provided to school leaders seeking to develop and implement site-based professional development programmes based on action research principles in the future. Recommendations for further research are also suggested. Finally, limitations to the study are presented. These limitations reflect the shortcomings of this study.

6.2 CONCLUSIONS

This research has shown that the professional development of primary school teachers could be situated at school characterised by the ongoing practice of learning at work while being at work. When school leaders organise teachers into communities of practice and, over the course of many action research cycles, evaluate and improve on the quality of their work, dialogue and interactions during subject and grade CoP meeting times as well as encourage and monitor personal effort, the potential for teachers to learn in a context-sensitive way is enhanced. The learning gains for the teachers are in the areas of content knowledge, pedagogic

content knowledge, assessment literacy, professional attitudes and finally improved student achievement.

This study has shown that it is essential that learning for effective lesson implementation in a home-based or semi home-based scenario be characterised by three important stages, two of which are social and one independent. These stages, which can be seen as sequential for the successful teaching of any topic in mathematics and natural science, has, in this study, resulted in many teachers' developing the competence to successfully enhance student achievement in these subjects in their respective classrooms.

Conclusions from each of the abovementioned stages will be presented. This will be followed by conclusions that are drawn with respect to specific learning gains in terms of content knowledge, pedagogic content knowledge, assessment literacy and professional attitudes.

6.2.1 Conclusions from participation in a subject CoP: first level of planning

This study concludes that professional learning by participation in a subject CoP is a critical first step of planning high quality learning materials especially for, but I would argue, not limited to classroom teaching in a home-based and semi home-based scenario. When professional learning is situated in a subject CoP and distributed over people with diverse subject expertise such as a lead teacher and an HOD, the conclusions based on the findings of this study are that: (i) teacher learning is indeed a socially negotiated activity, characterised by a norm of knowledge-sharing which constantly gives the lead teacher access to the subject and craft knowledge of the experienced HOD; (ii) teacher learning is enabled and enhanced by the collaborative creation of learning artifacts and tools around which there is a constant negotiation of meaning in the quest for high quality work; (iii) participation in a subject CoP such as a mathematics CoP is mutually beneficial for the professional development of the lead teacher and the HOD alike even though they are at different points in the

knowledge and skill continuum in the subject mathematics (iv) participation in a subject CoP builds the knowledge base of that community as well as (v) fosters the teachers' progression of participation in that community from peripheral to central (see section 5.2.1).

In this study, learning is conceptualised as *participation* in a CoP. It was established that an essential aspect of the learning process is learning *how* to collaborate to enhance teacher learning and optimise student achievement. This study has revealed two forms of subject CoP participation to be ineffective in leading to a lead teacher and HOD's growth and development and student achievement. One is a traditional top-down strategy where minimal engagement is preferred and the lead teacher is expected to give work to the HOD to determine what is wrong and send it back for correction. The other is an extreme case of hand-holding and spoon-feeding where the HOD does most of the work for the lead teacher (see section 5.2.1).

I can conclude that with the benefit of variables such as time, frequent engagement, and willing participation, the subject CoP is catalytic in creating a learning space for the different voices of the HOD as well as the lead teacher to be heard and to be respected.

With this conclusion, I assert that the aspect of willing participation must be seen through a situated lens where the main vehicle of learning is social engagement and the main mechanism of learning is a constant negotiation of meaning. It is only when teachers and HODs participate in and contribute to their community in this manner, that the assessing and planning skills of the lead teacher as well as the mentoring, moderation and monitoring skills of the HOD are developed (see section 5.2.1). The consequence of this is that learning for lead teachers becomes a progression of participation from peripheral - mastery in the content knowledge and pedagogic content knowledge related to the subject at a particular grade level, to central - learning about the links in the subject matter across grades (see section 5.2.1). This

conclusion confirms the evolving nature of learning by participation in communities of practice.

It can be further concluded that such willing participation, based on negotiation of meaning as to what counts as high quality work, will result in the production of a variety of ‘best practice’ artifacts including cognitive challenging tasks, baseline and summative assessments and model lessons. In true situated fashion, teachers that participate fully in a subject CoP will accomplish more in terms of their daily planning for lessons and assessments than they would on their own and, if sharing a subject as in a home-based scenario, would be in a more confident position to mediate these artifacts to their peers (see section 5.2.1).

6.2.2 Conclusions from participation in a grade CoP: second level of planning

While participation in a subject CoP resulted in the planning of a high quality of learning materials in one subject, teachers had to teach more than one subject to a specific class. This study therefore concludes that professional learning by participation in a *grade* CoP is a critical second step of planning learning materials for the teaching of *different subjects* in a home-based and semi home-based scenario.

In this study, teachers were dependent on one another for learning materials in different subjects and they were positioned as both creators and receptors of the knowledge base they applied daily in their classrooms (see section 5.2.2). When professional learning is situated in a grade CoP and distributed over various team members and their respective artifacts and tools, as it was in this study, the conclusions based on the findings are that: (i) teacher learning is stimulated and enhanced by a norm of knowledge-sharing based on reciprocity and community motives characterised by giving as well as receiving a high quality lesson material in different subjects; (ii) teacher learning is enabled and enhanced by teachers engaging in reform developmental activities characterised by joint activities such as working through tasks together, peer demonstration of lessons, answering tests as

students and jointly scoring students' work, (iii) teacher learning is reported by and is evident in teachers at all stages in the learning continuum (pre-service, novice and in-service), (iv) teacher learning builds the subject knowledge base of the grade teachers, in particular to what is relevant, practical and possible in the context of a specific *grade* (see section 5.2.2).

However, as with participation in the subject CoP, it was established that an essential aspect of the learning process is learning *how* to collaborate and *how* to participate to enhance teacher learning and optimise student achievement. Not all people collaborate with ease and with professionalism (see section 5.2.2 and 5.2.4). While most of the teachers were motivated to plan and share work because of their need to also receive learning material, the persistence of poor planning and poor participation by isolated individuals highlight the role of all school leaders.

As learning in this study is conceptualised as participation in a CoP, it is thus essential that school leaders ensure that learning is an ongoing process of teacher's *engaging fully in* and *contributing fully to* the practices of their communities. At the most basic level it is the lead teacher's responsibility to be well-planned for their subject and to ensure that a high quality contribution is made to the grade team. It is the HODs responsibility to own their subject and ensure the lead teacher is guided and mentored into achieving this task. I conclude that such professional and accountable participation will ensure that Wenger's (1998) situated learning idea of 'complimentary contribution' bears fruit (see section 2.4.2.1). This in turn is the catalyst that leads to the learning gains that participation in a subject CoP affords (described above). This quality contribution cannot be made without the first stage of situated learning in a subject CoP (see section 5.2.1).

A high quality contribution to the grade CoP is not just about the excellent artifacts produced, but the process and mechanism in which the artifacts are mediated to peers. A traditional top-down, dialogue-free approach was found to be ineffective. Participation in a subject CoP must be characterised by the ongoing participation in

reform development activities (see section 5.2.2). It is the lead teacher's role as facilitator to ensure that the subject artifacts (lesson plans and assessments), are mediated in a reform developmental way based on detailed explanations and active facilitation of an increasingly interactive dialogue and jointly working on tasks (see section 5.2.2). However, peer teachers play a role in being active participants and in holding their lead teacher accountable (see section 5.2.4). The HOD's role is exercised in the subject CoP, where the collaborative process of building high quality learning artifacts also fosters a capacity and efficacy in mediating difficult content matter to their peers in the grade CoP. I conclude that such professional and accountable participation by lead teachers, peer teachers and HODs will ensure that Wenger's (1998) situated learning idea of 'mutual engagement' bears fruit (see section 2.4.2.1).

This study revealed that while such mutual engagement in a grade CoP fosters professional development for teachers at all levels of the learning continuum, there are still different levels of success in team members (see section 5.2.2). This presents an opportunity for the contextually-relevant teacher learning in terms of what is practical and possible in a grade especially with regard to teaching difficult content matter as well as raising student achievement. This situated nature of cognition recognises that professional development of teachers needs to be closely tied to the real situations and contexts of individual schools, teachers and classrooms (see section 2.3.2).

It can be concluded that successful teachers, more than outside experts, can serve as role models and thus professional developers to peer teachers (see section 5.2.2). Successful teachers demonstrate their ability to separate themselves from excuse-driven and constraining modes of thinking, which broaden other teacher's views on students and student learning and empowers them to strive to achieve more with their students (see section 5.2.2). The ideas, views and methodology of successful teachers must be described and implemented in other classrooms. Their major influence stems from the fact that they are teaching in the same context and are

faced with the same problems. These teachers thus represent Kumarvadivelu's (2001) pedagogy of possibility in a particular context (see section 5.2.2)

6.2.3 Conclusions from individual teacher learning: personal cognitive development

A pivotal conclusion of this study is how essential individual or independent teacher learning is, following community engagement. Personal cognitive development holds a significant place in social theories of learning based on the idea that learning should progress from an external socially mediated activity (subject and/or grade CoP) to internal mediation where the learning is now appropriated or made one's own. In what is also known as a sense-making process, teachers draw from their discussions, interactions as well as the resources provided in the grade CoP to build new knowledge and understanding from the base of their existing knowledge and perceptions. This personal cognitive learning is often undertaken in isolation and is characterised by independent planning and preparation based on the unique needs of students in their classrooms (see section 5.2.3).

However, some teachers in this study failed to undertake any further planning and preparation and employed instead various avoidance strategies with respect to difficult content areas (see sections 5.2.2 and 5.2.4). These teachers would postpone lessons or make arrangements with the lead teacher to switch classes for content areas they did not grasp. The teachers would seek guidance and explanation in learning contact time and would frequently disturb their colleagues (see section 5.2.4).

A logical follow up from the conclusion that teachers undertake strategies that lead to personal cognitive development is the conclusion that school leaders intensify their encouragement and monitoring of personal planning and preparation for these teachers' classrooms. For school leaders in the study the evidence of this personal planning was checked on when monitoring teachers' planning and reflection notes.

School leaders insisted on visible evidence in order to stimulate personal cognitive learning as well as the development of reflective practice in terms of which lesson artifacts were successful and which were not (see section 5.2.3).

6.2.4 Conclusions drawn from the benefits of planning and participation in a CoP

Professional development of teachers in this school was facilitated by a site-based three-stage model, two of which were social and one independent. Artifacts and tools based on specific content matter was planned in the subject CoP, mediated to team members in the grade CoP and finally appropriated as personal knowledge by each teacher before classroom implementation. Participation in these three learning stages enhanced the content knowledge, methodological repertoires, assessment practices and professional attitudes of the lead teachers as well as the peer teachers. I will now draw conclusions from how teachers described their learning gains in these areas.

6.2.4.1 Improved content knowledge

Every teacher in this study realised the importance of a first-class content knowledge in the classroom and reported on having increased their content knowledge over the course of this study (see section 5.2.5.1). I would attribute this increase in content knowledge to be as a direct result of participation in the three stages of learning described above. In this study teachers' content knowledge was first constructed socially through participation in communities of practice where they were privy to the content knowledge of HODs and lead teachers. New content matter was then appropriated and internalised through independent cognitive learning.

It can be concluded that each of the three stages of learning is essential in enhancing a teacher's content knowledge, particularly teachers who have to teach many

different subjects. A brief role of each stage in enhancing a teacher's content knowledge is given below.

In the subject CoP collaborative decisions are taken about the pace, sequence and level of content to be covered. A high quality of learning and assessing materials are collaboratively designed between a lead teacher and HOD in order to enhance student learning on specific content areas (see section 5.2.1). This participation in the subject CoP serves to build the content knowledge of the lead teachers so that they can, in turn, build the content knowledge of their peer teachers in the grade CoP (see section 5.2.5.1).

In the grade CoP various different content matters are mediated to peer teachers in traditional as well as reform developmental ways. I reiterate earlier conclusions (see section 6.2.2) that a reform developmental approach is more effective in stimulating and enhancing teacher learning of content knowledge and that it is the role of the lead teacher to equip their team members as far as possible in this regard (see section 5.2.2 and 5.2.5.1).

The individual personal commitment from the teachers in terms of improving content knowledge is pivotal. Self-motivated teachers undertake personal preparation activities to enhance their content knowledge. This fosters learning of content matter through personal cognitive development (see section 5.2.3 and 5.2.5.1).

6.2.4.2 Enhanced pedagogical content knowledge

While content is stipulated, the methodology involved is not prescribed. Teachers in this study improved their pedagogical repertoires immensely as a result of participation in the various communities of practice. The frequent interactions and knowledge sharing in each CoP provided opportunities for teachers to gain access to the craft knowledge of their HODs and lead teachers. Instead of going to a workshop away from school the teachers tapped into the expertise of teachers on site who

revealed ways that would assist the teachers in facilitating the learning of the content with their particular students, in line with situated learning theory. These highly subjective insights, intuitions and hunches of teachers with expertise have been described as invaluable by their peers and have been attributed as reasons for their own professional development as well as their students' success (see section 5.2.5.2*).*

I can thus conclude that the pedagogical knowledge of each teacher is constructed through the methodological repertoires of the members of a CoP. This conclusion confirms a central tenet of the situated perspective which is that knowledge and learning are the products of the interactions in a subject CoP and grade CoP over time (see section 5.2.5.2).

As teachers shared and discussed their strategies, they developed in three critical methodological areas that enhanced facilitation of mathematics and natural science content knowledge and optimised student achievement. These were: using varied representations in class, using activities and tasks that engaged and extended the students, and becoming reflective practitioners. Conclusions from these learning gains will be drawn next.

6.2.4.3 Increased use of varied representations in class

Teachers improved their pedagogical approaches in the subjects of mathematics and science. In both mathematics and science, teachers adopted approaches with the aim of making the subject "alive in the classroom". To this end, more experiments were done and more projects were undertaken. Practical aids and story sums were frequently used. These practical activities fostered connections between the subject and real-world experiences which in turn motivated student engagement in all grades providing an important medium for mathematical thinking and reasoning (see section 5.2.5.3).

The source of this learning must be traced back to the subject CoP where the artifacts, that foster connections between the subject and real-world experiences, were designed collaboratively between the lead teachers and the HOD (see section 5.2.1). The next critical step was when the artifacts were mediated to peer teachers in a reform developmental way (see section 5.2.2). Finally, personal cognitive learning and construction of meaning were essential as part of each teacher's professional development regarding classroom teaching (see section 5.2.3). I conclude therefore that each of these stages is essential in ensuring that teachers improve in their successful use of varied representations in classrooms.

6.2.4.4 Creative use of the activities and tasks in class

Teachers improved in their ability to engage students in activities and tasks as compared to just copying notes or sums from the board. The activities chosen or designed covered the required content and creatively moved students from the concrete to the abstract, thus building their cumulative understanding of a topic. Tasks catered for a diversity of students and allowed for the consolidation of a topic, thus building a solid base of knowledge in the students. Furthermore, with time, activities were given to stimulate critical thinking and a homework mentality was fostered in students and their parents (see section 5.2.5.4). Consequently student gains in achievements in class-based assessments as well as internal and external examinations were observed (see section 5.2.5.4).

Thus, as with the increased use of varied representations in classrooms, the source of the teachers' learning with respect to the creative use of activities and tasks must be traced back to the subject CoP where they were designed collaboratively between the lead teachers and the HOD (see section 5.2.1). The next critical step was when the activities and tasks were mediated to peer teachers in a reform developmental way, enabling teachers to work through the tasks as students and to clarify any problems or concerns they had (see section 5.2.2). Finally, personal cognitive learning and construction of meaning was essential as part of each teacher's

personal planning for classroom teaching (see section 5.2.3). I conclude each of these stages is essential in ensuring that teachers improve in their creative use of activities and tasks in classrooms.

The improved pedagogical repertoires, the increased use of varied representations and the creative use of tasks and activities are all evidence of teacher learning and teacher change within the four walls of the classroom. In addition to this, many teachers became reflective and evaluative in terms of their primary concern: “I taught ... but did they learn?” This enhanced their professional development.

6.2.4.5 Teachers became reflective practitioners

This study highlighted that the assumption that student learning will always be an outcome of teaching is flawed. When this realisation dawned on teachers over some time in the course of the study, they became more receptive to the impact of their teaching on student achievement. To this end teachers engaged in reflection-interaction cycles to constantly check for understanding and to find ways to adapt their activities and instruction to suit their students (see section 5.2.5.5).

It can be concluded that when teachers start to routinely and collaboratively reflect and evaluate on their teaching and learning episodes, it represents a critical shift in the teachers’ professional development. Ongoing reflection is a core practice in a situated learning model. Being reflective and evaluative about lessons, assessment results and many other aspects of teaching are essential starting points in effecting real changes in these aspects of teaching. When teachers make changes to lesson plans to meet their students’ needs or adapt their assessments to cater for higher abilities of students, these represent evidence of situated learning as it is based on the unique needs of the students at any given time. Such a reflective orientation to a teacher’s craft fosters the ongoing professional development of teachers in any context.

A curriculum with intellectual demands in terms of content had to be assessed in a reliable way. My next focus is reporting on how teachers improved their assessment practices.

6.2.4.6 Improved assessment practices

The decisions taken to focus on class tests, practical tests and internal and external examinations as reliable forms of assessments as compared to rubric-based posters, presentations and demonstrations led to many areas of teacher learning and also to the improvement of students' results (see section 5.2.5.6).

It can be concluded that with the guidance and moderation afforded by participating in the subject CoP, lead mathematics and natural science teachers became skilled at setting assessments and distributing the marks of each assessment according to relevant taxonomies. Consequently, each test comprised different levels of questions and was considered fair yet challenging enough to give students an accurate reflection of their abilities and achievement. Another benefit was to ensure that the internal standard of examination was of a comparable standard to the external examinations (see section 5.2.5.6). It was established that the exposure to externally set assessments from the various departments of education served to challenge as well as support teachers in their professional development. Teachers learnt how to phrase questions using proper mathematics and scientific language. Lead teachers began to use the same mathematical and scientific language in lessons and on worksheet activities. This helped both peer teachers and students to become familiar with the terminology (see section 5.2.5.6).

It can be concluded that a community orientation to assessment matters worked well. Teachers improved from administering and marking tests in isolation to writing tests as students and then marking these together. Teachers progressed to marking each other's scripts and experimented with marking in teams (see section 5.2.5.6).

Such a CoP orientation ensures that knowledge is socially and collaboratively constructed in a search for a common understanding of, for example, how to score an item on a test. A community orientation ensures that there is a public and collaborative analysis of student achievement data that is undertaken routinely. This causes the kind of conflict and disagreement that is initially shied away from yet is essential in a robust community and paves the way to teacher learning and improved students' results. The dialogue and disagreements around test answers and possible responses from students, the differences in opinions in how to attribute student results, as well as the differences in success among team members, all serve to frame each teacher's learning and professional development in their collaborative construction of meaning (see section 5.2.5.6).

The leadership role exercised in stimulating productive discussions around assessment matters which ultimately enhanced the assessment literacy of teachers was critical. The conclusion in this regard is that, as central participants in their respective subject communities, school leaders should position themselves as the guardians of the targets and standards set for teacher learning as evident in raising student achievement. This can be achieved in many ways. Firstly, leaders should undertake to routinely and collaboratively analyse all student performance data in terms of performance goals set at the beginning of each year. In this study, teachers had to achieve a 90 percent pass rate in all subjects. Ten percent was regarded as an 'acceptable failure rate' to cater for special needs students. In addition, teachers had to strive to achieve a 55 to 60 percent class average. These norms applied to class tests, end of term examinations as well as the ANA (see section 5.2.5.6).

Secondly, as central participants in their subject communities, school leaders must also routinely and collaboratively undertake various other analyses in order to ensure the refining of their practice. In this study analyses were undertaken in terms of whether or not there was a correlation between mathematics and natural science results; between class test results and examination results; and between internal

results and external (ANA) results. The analyses also focused on the achievements of each teacher in a grade (see section 5.2.5.6).

The analyses and resulting intervention strategies ensure the refining of practice in order to foster teacher and HOD capacity-building, to ensure that standards of internal assessments are comparable to the ANA, to identify, recognise and learn from individuals and communities with a high intellectual output and finally to constantly inform planning for each community's participation and engagement in further action research learning cycles (see section 5.2.5.6). Undertaking these steps constantly, according to Gajda and Koliba (2008), is the path to unprecedented improvements of student learning, among others (see section 3.5.5).

6.2.4.7 Improved professional attitudes

It can be concluded that teachers in this study improved their professional attitudes. The improvement can be attributed to the long duration of the study (three years) and the improved results achieved by teachers who participated in the study. The areas in which improvements in professional attitudes were apparent are in a personal capacity as well as a collaborative team-minded capacity. Personally, lead teachers started to expand more effort in terms of their personal planning and teaching in their classrooms, and taught all the lessons they were required to teach. They tried out new ideas and took feedback and guidance from their HODs (see section 5.2.5.7).

Lead teachers and peer teachers improved with respect to collaborative attitudes as well. This was observed when lead teachers fully embraced the responsibility for their subject planning, especially with respect to building the capacity of the peer teachers in terms of that subject in the entire grade. Peer teachers improved in their attitude towards the way they participated in the CoP and in being open and receptive to ideas from lead teachers and other peer members (see section 5.2.5.7).

Teachers also improved their attitudes in terms of how they viewed the external assessments as well as what the significance of the student achievement data in terms of these assessments were. Teachers started to appreciate the benefits afforded by having external assessments and consequently improved in their assessing skills as well (see sections 5.2.5.6 and 5.2.5.7).

Most importantly, many teachers showed a commitment to growth and improvement. They acknowledged that having a professional attitude meant moving on from being excuse-driven to finding ways to improve practice. This was especially important in the context in which they worked. Students needed constant motivation, encouragement and engagement (see section 5.2.5.7).

6.3 Conclusions for school management of professional development in the school – lessons to be learnt from successful teachers and good grades

I conclude that it is essential for professional developers to be guided by a collaboration framework such as the TCIF and have a means of evaluating the quality of collaboration at school using a tool such as the TCAR. These items developed by Gajda and Koliba (2008) were essential tools to me during the course of the study and helped me identify areas which could be improved (see section 5.2.6).

A single occurrence of evaluation will not lead to desired improvements. It is for this reason that it is concluded that many action research cycles are advocated for site-based professional development in communities of practice. It is essential that the quality of the collaboration be constantly evaluated while the principal as professional developer works with the different communities to effect changes (see section 5.2.6).

It is further concluded that a system of distributed leadership in the form of lead teachers for every subject per grade and HODs for every subject works well (see section 5.2.6). A distributed leadership ensures that there are many levels of leadership exercised and thus the responsibility for teacher learning and raising

student achievement is dispersed among many members of the school community. This is critical in ensuring that the community operates with a common voice and a common goal.

Finally, it is concluded that the site-based professional development model employed at school was professional rewarding for the teachers, the students and the school as a whole. All teachers in the study, regardless of their years of experience, developed professionally by engaging in and contributing to the practices of their grade and subject communities on an on-going basis. There was a steady improvement in academic achievement in internal as well as external examinations. On average there was an improvement of over 20 percent in student performance in external mathematics results. The professional development of teachers allowed the school to build up a strong knowledge base in grades and subjects. The school ensured a new generation of skilled members in terms of difficult subjects such as mathematics and science. This is important in terms of there being a poor supply of these teachers in South Africa (see section 5.2.6).

The above mentioned improvements must be celebrated noting however that the participation in the communities of practice did not offer identical benefits to all teachers and all grades. The grade 4 and 5 CoP peaked in their third year in terms of team functioning and student achievement. The grade 6 team achieved outstanding results in their first year of collaboration (over just two action research cycles) and is the only team to not only achieve but exceed that target of 60% performance in the mathematics ANA. Out of 12 teachers, only three teachers reached a personal target of a 60% class average.

The conclusion to be drawn from this is that the goal of re-culturing the school to adopt a collaborative, site-based learning ethos, and an increased intellectual output from all teachers and all grades remained an on-going and time-consuming matter.

6.3.1 Lessons from successful teachers

This study shed light on a few teachers that had the personal motivation, commitment and dedication to enhance learning in their classrooms in the absence of HOD involvement and in the absence of working in a team. While every teacher reported on having developed professionally by participation in a CoP, a few teachers soared in the collaborative settings. These teachers had an individual commitment to teaching as well as the correct professional attitudes already instilled when working in isolation. The collaborative work further enhanced their development (see section 5.2.6.1).

Thus, it is concluded that a teacher's personal motivation and professional orientation to learning are absolute critical factors in determining what is learned, how much is learned and what the performance of the students in these teachers' classes would be. The individual commitment, personal conviction and professional attitudes of teachers are key factors for teachers' professional development.

6.3.2 Lessons from good grades

In this study, the grade 6 teachers produced outstanding results internally and in the ANA over two action research cycles in their very first year of collaboration. First, this could be attributed to the fact that structurally a two-by-two collaboration model with a semi-home based scenario worked well because there were just two subjects to focus on as compared to six. Second, beside the principal being present, there were two members in each CoP as compared to four. Thus, an important conclusion is that a smaller community increases the accountability in terms of planning and thus the professional participation in terms of complimentary contributions and mutual engagement.

The study revealed that unlike in the other communities of practice, the needs and development of the grade 6 team members were secondary to the needs and

development of the students. With this in mind the teachers found it easier to be critical of their peers and to hold them accountable for the quantity and quality of their work. Where emotional support was more important to the grade 4 and 5 CoP, instructional support was favoured in the grade 6 CoP. Thus it can be concluded that the desired outcome of site-based collaborative professional development for every grade should be geared more towards instructional support based on open communication, feedback and accountability, than on emotional support, even though the latter is favoured by most of the teachers.

6.4 CONTRIBUTION OF THE STUDY

While this research programme is similar in some ways to other site-based professional development programmes organised within a social learning framework, this study makes a unique and important contribution to the field of teacher professional development.

One of the critical contributions of this study is its ability to shed light on the structuring and operation of CoPs as opportunities for teachers to effectively plan for classroom teaching in a home-based or semi home-based scenario.

Another unique contribution is that it offers a lens to view a constellation of communities of practice in action in a primary school and highlights what the roles and responsibilities of various leaders are in order to make multiple CoP participation effective.

A focus on building teachers' competence in mathematics and science by means of site-based professional development in a primary school context in South Africa offers school leaders a model of what is achievable when expertise within a school is tapped and utilised rather than exported from the outside in the form of workshops.

Finally I offer the three-stage model as a package, outlining what the roles and responsibilities of each teacher, HOD and principal are to enhance teacher development and optimise student achievement. The first critical stage, participation in a subject CoP, may not seem new in terms of what is structurally the norm at most schools. However, it is the culture of participation recommended here which needs to be addressed to enhance the learning gains of teachers, students and the professional subject knowledge base of the school. While the mathematics and natural science HOD at this school has really role modeled excellent collaborative engagement with lead teachers, there are other subject departments that have yet to embrace this model completely. Thus, if this is the case in my school, I know that many schools in South Africa can improve on the interactions in this, most critical, community.

The second critical stage is relevant to a home-based scenario or any structural arrangement where more than one teacher teaches the same subject in a grade. Once again, many schools adopt some sharing of work structure. In terms of structure these schools need to organise some form of release time during the school day. Otherwise frequent engagement will be nothing more than ‘corridor collaboration’. Secondly, based on my personal experiences and the findings of my study, I can attest to the fact that the culture of participation to ensure a reform orientation need to be nurtured over many years, in order to ensure effective professional development. In the absence of this, teachers will meet often, in the school day, but will not develop professionally. Thus, it is important for the school principal to attend most of the meetings and ensure that the planning and participation of team members is of the required standard. Poor planning must be traced back to subject CoP participation and improvements effected.

Finally, even with our best intentions to view and highlight the private engagement between teachers and their students, most teachers’ work within a classroom still remains isolated, tacit and insufficiently explored. Thus, the final stage of independent personal cognitive learning is critical whether teachers work collaboratively or in

isolation. There may be a tendency to view collaborative work as sufficient planning for classroom implementation whereas this study has shown this not the case. While collaboration has many excellent benefits in ensuring the development of high quality learning material and while this may have been well-mediated to each teacher, without the teacher taking some personal time to appropriate the content and make sense of it for themselves, they will enter the classrooms with gaps in their knowledge and skills. This will be revealed in poor student achievement.

6.5 RECOMMENDATIONS

In the light of the above conclusions, I now present my recommendations. I would recommend that all professional development of teachers be largely site-based and that teachers be exposed to the ideas of collaborative CoP engagement. This is in line with the situated learning theory.

6.5.1 Recommendations for the management of a collaborative professional development programme to effectively plan lessons for classroom implementation

With respect to the above, I recommend the following to school principals:

- The most important CoP in any school should be a subject CoP. This should be the starting point for every school regardless of whether or not teachers collaborate further with peer groups as in this study. Since most schools already have subject departments, this is a logical starting point. To be effective, school principals need to: (i) restructure the school day in order to provide an opportunity for meeting times within the school day (ii) set improvement goals in terms of student achievement; (iii) constantly brainstorm ways to reach the targets. (iv) ensure that the nature of the participation is more collaborative than authoritarian as is the norm in most schools (v) ensure that all learning artifacts and tools and all assessments designed for classroom implementation are planned collaboratively with a high quality standard in mind

(vi) evaluate student results routinely and collaboratively and ensure the teacher's make associated improvements early in the year when problems first arise. School principals achieve the above by attending as many meetings as possible, checking on the artifacts produced, and holding the subject departments accountable for the results produced. These steps should improve student achievement. Most schools focus on assessment moderation. My conclusion is that focusing on assessment and disregarding the quality of day-to-day work is ineffective for raising student achievement.

- For primary schools considering or already adopting a home-based teaching scenario I recommend a semi home-based teaching scenario. The developmental level of the curriculum is high and requires more subject expertise from teachers rather than a general competence. Mathematics and science in particular place many demands on teachers and require their focus, attention and learning in order for them to be effective in their classrooms. When teachers have to focus on many subjects it poses enormous challenges and some subjects will be ignored, especially the difficult ones. In order to ensure that a grade CoP is developmental, school principals need to: (i) restructure the school day in order to provide an opportunity for meeting times within the school day (ii) ensure that each contribution is of a high standard, if not hold HODs accountable (iii) ensure that the nature of the participation is collaborative, interactive and that teachers spend their time actively involved as students that engage with the subject matter that must be taught in the classrooms (iv) evaluate student results routinely and collaboratively and ensure that there is an explanation of poor results as well as excellent results. (Successful teachers show *what* is possible, communication describes *how* it is possible, and reflection and evaluation in the subsequent meetings will ascertain to what extent the recommended strategies are effective in other classrooms). Thus (v) the quality of dialogue should be well-managed and should centre essentially on what the best strategies are to raise student achievement. The principal achieves this by attending as many meetings as possible, checking on the quality of the contribution and participation of team

members, and holding individual teachers accountable for their respective contributions and participation. These steps should improve student achievement. However, many teachers offer student-related excuses for poor results. It is thus important for school principals to gently yet firmly highlight what successful teachers with the same type of students do in their classrooms.

- There is a possibility that teachers would view the community participation as all that is required for effective classroom implementation. In this regard, school principals should constantly monitor the personal effort and contribution of each teacher as described above. However, this monitoring must extend to the classroom. Principals must view lessons (e.g., attend every teacher's lesson every year at least once). Furthermore, with all the support provided in the subject CoP and the grade CoP, a teacher's failure to raise student achievement must be traced to aspects of a teacher's professional attitude that must be addressed. The principal must address, in particular, teachers who detach themselves from their students' results.
- The effectiveness of every site-based professional development venture must be evaluated in terms of how teachers learn best, what it is that they actually do learn and finally, what impact this has on student achievement. There will be resistance to the constant collaborative (public) analysis of student achievement. However, teacher learning is not effective or relevant in a school if it does not impact student achievement in that school in a positive way.

6.5.2 Recommendations for further research

While we, as leaders of the participating school, now understand how to develop teachers professionally by means of action research in a home-based scenario, and we also understand how different groups (grades and subjects) respond to participation in communities of practice, we have not explored the full range of learning opportunities that working collaboratively in communities offer. There is more to explore with regard to the collaboration of HODs and peers. A further study in this

regard would be to explore the learning opportunities of shared planning as opposed to planning based on complementary contributions.

Furthermore, while we have outlined a learning path for effective classroom implementation, we still have scant knowledge on how such an approach interacts with, for example, identity formation of teachers. Such insights may maximize benefits to each group and to each individual teacher.

As individuals make sense of every new experience and every new piece of information actively, in terms of their own *individual* existing needs, it may be necessary to find out exactly what individual teachers' needs are before continuing the project. This recommendation is based on the idea that the schema teachers use to interpret information are based on each individual's past experiences which may be similar too but never identical to that of another individual.

Further work is needed to explore the possibilities and arrangements that are likely to support and sustain the formation and operation of teachers who prefer team work for emotional support and friendship but are resistant to the kinds of collaborative activities that provide instructional support. While it is acknowledged that effecting changes in teachers' views, beliefs and professional attitudes is a time consuming matter, the kind of skills that HODs need to develop and hone to ensure the participation of resistant teachers on their team need to be illuminated.

6.6 LIMITATIONS OF THE STUDY

It was important to contextualise this study within a specific school, and to consider how it was situated within a web of structural and organisational relationships within the relevant school. The goal of this study to have site-based contextually relevant professional learning and development was its strength. At the same time, it limits generalisation of the findings to other contexts.

Second, a principal has multiple roles in a participatory action research project. I was aware of my personal views at all times and frequently engaged with personnel who were honest and gave critical feedback in terms of my findings and conclusions. However, such personal involvement could be seen as a limitation to this study in terms of reaching complete objectivity.

6.7 CONTRIBUTION OF THE STUDY ON A THEORETICAL LEVEL

This study advances situated learning theory in demonstrating that professional development opportunities must be authentic with respect to being connected to teachers work in the context of the content, pedagogy and assessment practices directly related to their classrooms. Furthermore, it advances the notion that teacher learning must be understood with due consideration to the social value of ongoing participation in communities of practice. The central aspect of situated learning is the movement towards more developed participation. This study elucidates how different forms of participation (traditional or reform) contribute to learning. While traditional participation is more comfortable and initially preferred, reform participation based on active involvement and engagement is the pathway to professional development gains in teachers. School leaders play an essential role in ensuring reform participation. This is best achieved in ongoing cycles of continuous dialogue, decision-making, action and reflection.

As participation is intertwined with politics, this study contributes to our understanding of the importance of critical perspectives in professional development. Democracy is fundamental to situated learning, because learning leading to full participation is dependent on access. Democracy is also dependent on equitable participation in teams, in each member having a contribution and a voice in the decision-making that impacts classroom practice.

Finally, it must be pointed out that social learning environments are not, by themselves, sufficient developmental spaces for the optimum appropriation of skills and knowledge. For situated learning to be effective, the significance of personal

dispositions, personal effort and belief about personal efficacy with respect to learning must be considered. Ultimately a CoP offers equal learning opportunities to all team members. Any differences in learning gains in teachers and students must thus be traced to the important aspect of learning that focusses on the personal motivation, responsibility and accountability that must be assumed by each individual in making knowledge their own (personal appropriation).

6.8 SUMMARY

This research project was facilitated by a concern about a lack of skilled teachers in key subjects such as mathematics and natural science. Thus, the main research question was: *How can the professional development of primary school teachers be managed by means of action research?* The aim of the study was to develop, implement and evaluate a site-based collaboration programme to promote the professional development of the teachers in these subjects within a home-based or semi home-based teaching context. The theory of situated learning within a CoP was used as conceptual framework.

Purposeful and convenient sampling was implemented to select participants. Five grade 4 teachers, five grade 5 teachers, four grade 6 teachers and eight members of the school management team participated in the three year study. During the planning phase a needs analysis was done. During the action phase, lead teachers were responsible for the planning in one or two subjects. The teachers met once every six school days (totaling about 30 meetings per year), for up to two hours to discuss content and methodological issues, plan assessment strategies, analyse and reflect on results, and decide on intervention strategies. The grade 4, 5 and 6 groups completed six, four and two action research cycles respectively, while the school management team were involved in six action research cycles.

To evaluate the professional development that resulted, data collection was by means of observation, field notes, typed minutes, four focus groups, 12 individual

interviews, teachers' files, a questionnaire completed by 32 participating teachers and students' books and achievements.

The main conclusion is that professional development of primary school teachers can be initiated, managed and constantly improved on by means of action research. When school leaders organise teachers into communities of practice and, over the course of many action research cycles, evaluate and improve on the quality of their work and interactions during subject and grade CoP meetings, and encourage and monitor the personal effort of the teachers, their potential to learn in a context-sensitive way is enhanced. The learning gains for teachers were in the areas of improved content knowledge, methodological repertoires, assessment practices and professional attitudes of the lead teachers as well as the peer teachers. The learning gains for the school were an increase in the subject knowledge base (in particular related to specific grade contexts), improved teacher competence and improved student achievement in external assessments such as the ANAs.

The study pointed out the uniqueness of the programme and made various recommendations for the professional development of teachers and for further research. The limitations of the study were also highlighted.

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APPENDIX A

Chairperson

School Governing Body of XXXX Primary School

Dear Sir

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT XXXXX PRIMARY SCHOOL

I am currently busy with my DEd (Education Management) studies at UNISA. The Gauteng Department of Education (GDE) has approved my request to conduct research (see attached copy). I have special interest in the professional development of teachers by collaborative engagement at the school site on context-specific pedagogical and assessment matters. This is an action research project and the site selected is XXXXX Primary School. The participants are the teachers and school leaders involved in Mathematics and Science teaching in grades 4, 5 and 6.

Participating in the research will enable teachers to improve their content knowledge, pedagogical content knowledge as well as assessment literacy. The ultimate goal is to enhance teacher efficacy with a view to improving the learning gains of all the students at this school. Teachers will collaborate in time set aside for that purpose every six days. The duration for each meeting is a minimum of one hour. All teachers that volunteer will also complete a questionnaire; participate in semi-structured interviews as well as focus group discussions.

There will be no risks involved to any of the participants. Participation is entirely voluntary and all information will be kept confidential. The student's and school's name will not be revealed. No monetary rewards are given to participants. Teachers are free to withdraw from the study at any point without being penalized. Teachers are expected to indicate whether they agree or disagree to participate by completing a consent form. As required, the results of the study will be made available to the GDE. The results of the study will be discussed at school in a special information sharing session. The results of the research may be published in a scientific journal or presented at a scientific meeting.

This research is conducted under the supervision of Prof Salomé Schulze at UNISA (Department of Psychology of Education). Prof Schulze can be contacted on Schuls@unisa.ac.za. Please feel free to contact me if you have any queries regarding the research or any other related matter.

Your support and willingness to allow the school to participate in this research is appreciated.

Thank you

Razia B Ghanchi Badasie Signature: _____ Date: _____

E-mail: razia.badasie@gmail.com Tel: (011) 849 6689(H) Cell: 074 1979 235

INFORMED CONSENT FROM THE SCHOOL GOVERNING BODY (SGB)

I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about this study have been answered. My signature (on behalf of the SGB) indicates our wholehearted support for the study.

_____ _____

SGB CHAIRPERSON (NAME IN PRINT) SIGNATURE DATE

APPENDIX B

ACTION RESEARCH STUDY: Teacher consent form

Dear Teacher

I am currently busy with my DEd (Education Management) studies at UNISA. The Gauteng Department of Education (GDE) has approved my request to conduct research (see attached copy). I have a special interest in the professional development of teachers by collaborative engagement at the school site on context-specific curriculum and assessment matters. I would like to invite you to participate in this research.

Participating in this research will enable you to provide valuable information on teacher collaboration and to what extent it is an enabling factor in teacher professional development and student achievement. Your information would be useful in developing a developmental model for teacher collaboration.

Please know that there are no risks involved in this study. Participation in this study is entirely voluntary and you may end your participation at any time without any penalty. I will also like to assure you of your anonymity and confidentiality as a participant in this study. Your name will not be mentioned and neither will the school's name be mentioned. Your views, comments and opinions will be reported on but anonymously, a pseudonym may be used.

The results of the study will be presented at an information sharing meeting at the school. The results may also be published in a scientific journal or presented at a meeting.

This study is conducted under the supervision of Prof Salomé Schulze at UNISA (Department of Psychology of Education). Please feel free to contact me or Prof Schulze atSchuls@unisa.ac.za for any questions you may have.

Thank you.

Razia B Ghanchi-Badasie Signature: _____ Date: _____
E-mail: razia.badasie@gmail.com Tel: (011) 849 6689(H) Cell: 074 1979 235

INFORMED CONSENT

I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about this study have been answered. My signature says that I am willing to participate in this study.

_____ _____

PARTICIPANT NAME (PRINT PLEASE) PARTICIPANT SIGNATURE

DATE: _____

APPENDIX C

LETTER OF PERMISSION FROM THE GAUTENG DEPARTMENT OF EDUCATION (GDE)

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

For administrative use:
Reference no. D2013/283

GDE RESEARCH APPROVAL LETTER

Date:	**4 February 2013**
Validity of Research Approval:	**4 February 2013 to 27 September 2013**
Name of Researcher:	**Ghanchi Badasie R.B.**
Address of Researcher:	**P.O. Box 12153**
	Benoryn
	1504
Telephone Number:	**011 849 6689 / 074 197 9235**
Fax Number:	**086 674 0316**
Email address:	**razia.badasie@gmail.com**
Research Topic:	**Managing the professional development of Primary school teachers for a collaborative culture of teacher learning by means of action research**
Number and type of schools:	**ONE Primary School**
Districts/HO	**Gauteng East**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

Office of the Director: Knowledge Management and Research
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

2013/02/05

1. *The District/Head Office Senior Managers concerned must be presented with a copy of this letter that would indicate that the said researchers has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Managers must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researchers have been granted permission from the Gauteng Department of Education to conduct the research study.*
4. *A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researchers may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

Dr David Makhado

Director: Knowledge Management and Research

DATE: 2013/02/05

Office of the Director: Knowledge Management and Research
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P O Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

APPENDIX D – UNISA ETHICAL CLEARANCE CERTIFICATE

UNISA college of education

Research Ethics Clearance Certificate

This is to certify that the application for ethical clearance submitted by

Razia Banoo Ghanchi Badasie [5598060]

for a D Ed study entitled

Managing the professional development of primary school teachers by means of action research

has met the ethical requirements as specified by the University of South Africa College of Education Research Ethics Committee. This certificate is valid for two years from the date of issue.

Prof CS le Roux
CEDU REC (Chairperson)
lrouxcs@unisa.ac.za
Reference number: 2013 MAY/35590084/CSLR

7 May 2013

APPENDIX E

SEMI-STRUCTURED INDIVIDUAL INTERVIEW SCHEDULE
(MANAGING THE PROFESSIONAL DEVELOPMENT OF PRIMARY SCHOOL TEACHERS BY MEANS OF ACTION RESEARCH)

Thank you for having been involved in this development programme. The purpose of the interview is to gather detailed information about your overall impressions regarding the teacher collaboration project. I regard you as someone who can provide such detailed information. However, please note that although you are regarded as someone who is likely to provide detailed information, you are under no obligation to participate in the interview and can therefore choose not to be interviewed. Kindly note that even though I will be making notes in a book, the voice recorder will be switched on during the interview to ensure that as much information as possible is captured. Also note that all information will be treated confidentially. Please do not hesitate to ask any question regarding what I have just explained.

Do you agree/disagree to be interviewed?

Thank you for agreeing/disagreeing to be interviewed.

If you are willing to participate in the interview kindly note and remember the following:

- You are allowed to ask me to repeat or rephrase a question, where necessary.
- Please answer questions as honestly as possible, and note that there is no right or wrong answer but only your honest opinion will be appreciated.

Please tell me about your experience of the programme by answering the following questions:
What have you learnt by participating in this programme?

_____
_____

What activities undertaken by the group lead to teacher learning? Why

_____
_____
_____

What activities undertaken by the group do not at all contribute to your learning? Why not?

_____
_____

What would you recommend in order for collaboration to maintain a learning and development focus?

_____
_____

Thank you for participating in the interview.

APPENDIX F

FOCUS GROUP INTERVIEW SCHEDULE
(MANAGING THE PROFESSIONAL DEVELOPMENT OF PRIMARY SCHOOL TEACHERS BY MEANS OF ACTION RESEARCH)

I want to thank you as a group for participating in this teacher development programme. The purpose of this focus group discussion is to get detailed information about your overall impressions regarding the teacher collaboration project. You have been involved in this project as a unit for some time now and can, as a group, provide detailed, rich and valuable information on this project.

However, please note that, although you are regarded as a group likely to provide detailed information on the topic, your participation is completely voluntary. You are under no obligation to participate in this focus group discussion. You may also withdraw your participation at any time for any reason without penalty.

If you do participate, please allow me to assure you of your anonymity and the confidentiality with which your views, comments and opinions will be treated. So please feel free to participate with ease. I really do value your honest contribution.

The voice recorder will be switched on during the interview to ensure that all the information is captured. Please do not hesitate to ask any question regarding what I have just explained.

Do you agree/disagree to participate in a tape recorded interview?

If you are willing to participate in the interview kindly note and remember the following:

- You are allowed to ask me to repeat or rephrase a question, where necessary.
- Please answer questions as honestly as possible, and note that there is no right or wrong answer but only your honest opinion will be appreciated.

Please tell me about your experience of the programme by answering the following questions:

1. What worked well? Why?
   _____
   _____
2. What did not work well? Why
   _____
   _____
3. What do you recommend?
   _____
   _____
4. Any other comments?
   _____
   _____

Thank you for participating in the interview.

APPENDIX G

QUESTIONNAIRE: (MANAGING THE PROFESSIONAL DEVELOPMENT OF PRIMARY SCHOOL TEACHERS BY MEANS OF ACTION RESEARCH)

Thank you for agreeing to complete this questionnaire. The purpose of this questionnaire is to evaluate the collaboration programme that you are a part of. In particular, the questionnaire seeks to gather your perspective on the value of teacher collaboration in the subjects' mathematics and science. Please assist in answering the questions honestly. Each question has two parts. For the first part a 3 point scale is provided. Please circle one item only. The second part of each question asks you to justify your answer. Please elaborate on your answer as best you can.

This form is completed anonymously. Please do not put your name on this form.

Topics Covered:

Team work: joint work
Impact on teacher
Instructional Practices: content, methods, assessment practices
Overall benefit of collaboration for school improvement

Format/Length: 22 closed-ended questions with each question needing and open-ended justification for the choice selected.

----------TEAM WORK

What have you learnt about yourself in terms of working collaboratively with other teachers?

Question 1

I am a team player and consider the needs and development of other teachers

Disagree Neutral Agree

…….....…….....

…….....

…….....

Question 2

I thoroughly plan to ensure every team member feels confident to teach the relevant topics. I feel accountable to my team members.

Disagree Neutral Agree

…….....…….....

…….....

…….....

Question 3

I ask for feedback from the other teachers regarding the notes, lessons and assessments I set up. I invite reflection and feedback on my work.

DisagreeNeutral Agree

…….....……

…….....

…….....

Question 4

I invite teachers into my classrooms to observe my lessons and to provide feedback

DisagreeNeutral Agree

…….....……....

…….....

…….....

Question 5

I am moving away from passing over of notes to allowing greater dialogue about what to teach and how to teach it.

DisagreeNeutral Agree

…….....

…….....

…….....

Question 6

I easily ask questions for clarification and guidance in terms of work other teachers plan. I see this as important in terms of my own development as well as theirs.

DisagreeNeutral Agree

…….....……....

…….....

…….....

IMPACT ON TEACHERS

What benefit has collaboration with colleagues had in terms of your attitudes and beliefs about your work?

Question 7

Working in collaboration with colleagues gives me an increased sense of satisfaction in my job

DisagreeNeutral Agree

…….....……..…….....

…….....

…….....

Question 8

I have greater confidence in my ability to teach the students at this school. This is especially true of subjects I initially felt most insecure about.

DisagreeNeutral Agree

…….....……..…….....

…….....

…….....

Question 9

I have an enhanced belief in my ability to make a difference to my students' learning

DisagreeNeutral Agree

…….....……..…….....

…….....

…….....

Question 10

I have a greater commitment to changing practice as I position myself to be on a path of continuous learning and trying out new things for the benefit of the students.

DisagreeNeutral Agree

…….....……..…….....

…….....

…….....

IMPACT ON INSTRUCTIONAL PRACTICES in MATHEMATICS and science

What benefit has collaboration with colleagues had in terms of your instructional practices in the subjects' mathematics and natural science in class?

Question 11

My content knowledge in mathematics and science has increased as a result of collaborating with teachers in these subjects.

DisagreeNeutral Agree

…….....…….....

…….....

…….....

Question 12

I try out different teaching strategies as recommended by the mathematics and science team leaders and then give feedback on what worked and what did not.

DisagreeNeutral Agree

…….....…….....

…….....

…….....

Question 13

I incorporate drill work into my lessons ensuring that students constantly revise mathematics times tables and science concepts

DisagreeNeutral Agree

…….....…….....

…….....

…….....

Question 14

I make use of varied representation in class. I use pictures, charts, stories and various other ways of making it easier for children to learn mathematics and science topics.

DisagreeNeutral Agree

…….....…….....

…….....

…….....

Question 15

I easily hear what student's ideas and thoughts are in mathematics and natural science. I allow time for thoughts and ideas on a topic to be freely shared.

DisagreeNeutral Agree

…….....…….....

…….....

…….....

Question 16

It is easy for me to evaluate in class whether or not I am reaching all the children. I am consciously aware of the impact of my mathematics and science instruction on the students.

DisagreeNeutral Agree

…….....…….....

…….....

…….....

Question 17

I have the same understanding as my colleagues on how to mark and assess any activity. This is because assessment tools are discussed at length before they are used.

DisagreeNeutral Agree

…….....……..…….....

…….....

…….....

Question 18

I easily share, analyse and interpret my results for each formal activity in a collaborative setting.

DisagreeNeutral Agree

…….....……..…….....

…….....

…….....

Question 19

I accept personal responsibility for the high and low results achieved in my class.

DisagreeNeutral Agree

…….....……..…….....

…….....

Question 20

I engage with colleagues on ways and means to improve on the academic results of students in mathematics and science. I then implement and evaluate these.

DisagreeNeutral Agree

…….....……..…….....

…….....

FINAL FEEDBACK ON COLLABORATION

What is the benefit for collaboration in terms of continuous school improvement?

Question 21

As I continue to engage with colleagues I become a more effective teacher. The evidence is in my improved school marks.

DisagreeNeutral Agree

…….....…….....

…….....

Question 22

As I continue to engage with colleagues it increase my range of teaching and learning strategies targeted at specific student needs. The result is that children that struggle do improve in my class.

DisagreeNeutral Agree

…….....

…….....

APPENDIX H – BOOK CONTROL FORM

XXXX PRIMARY SCHOOL
BOOK CONTROL TEMPLATE (IQMS/CMM ALIGNED CRITERIA)
DATE: _____ **LEARNING AREA**: _____
NAMES OF STUDENTS: **GRADE**: _____
_____
_____
_____

General impression of students' books	Excellent	Good	Average	Comments/suggestions
Covers				
Headings and dates				
Encouragement of neat work				
Good use of paper by students				

Assessment – Feedback to students

A Feedback to students	Excellent	Good	Average	Comments/suggestions
Books marked regularly & thoroughly				
Comments: positive, constructive				
Corrections done regularly & accurately				
Is incomplete work followed up?				
Discussion of high frequency errors				
Evidence of remedial activities				
Evidence of enrichment activities				
Evidence that work is the students' own				
Ronеod notes call for active involvement				

Assessment-knowledge of techniques

B Knowledge of assessment techniques	Excellent	Good	Average	Comments/suggestions
Evidence: self, peer assessment (different forms of: multiple intelligences?)				
Evidence: varying techniques as per LA requirements				
Case study				
Assignment				
Research/Investigation				
Project				
Test				

Assessment-Application of techniques

C Application of techniques	Excellent	Good	Average	Comments/suggestions
Evidence on reflection of techniques				
In-depth analysis has been conducted				
Analysis informs intervention strategies				
Assessment - developmental &motivational				

Administration – Record keeping

A Preparation File	Excellent	Good	Average	Comments/suggestions

File correct as per prescribed index				
Correct prep and planning forms are used				
Preparation correct and detailed				
Prep. Derived from syllabus?				
LOS & AS's are covered as per policy				

Assessment File – record keeping

D Record Keeping/	Excellent	Good	Average	Comments/suggestions
Assessment file – as per index				
Assessment tasks and tools in portfolio				
Marks & Assessments are recorded regularly				
All information on mark lists				
Marks tally with students books & indexes				
Weighting of marks correct as per policy				
Records are easily accessed/user friendly				
Good data bank of past questions				

Pace of work

	Excellent	Good	Average	Comments/suggestions
According to year plan/work schedule				
Volume of written work is sufficient				
Frequency table has been implemented				

Subject head signature: _____

Comments by subject head

_____

_____

_____

_____

Educator signature: _____

Comments by educator

_____

_____

_____

_____

HOD signature: _____ Principal signature_____

APPENDIX I – MARK ANALYSIS TEMPLATE

XXXXX PRIMARY SCHOOL
ANYSIS OF RESULTS: INTERMEDIATE PHASE
DATE: _____ **SUBJECT**: _____
GRADE: _____

LEVEL	**DESCRIPTOR**	CLASS A	CLASS B	CLASS C	CLASS D	**TOTAL**
7	80 -100					
6	70 – 79					
5	60 – 69					
4	50 – 59					
3	40 – 49					
2	30 – 39					
1	0 – 29					
	NO. OF STUDENTS					
	CLASS AVERAGE (%)					

NAMES OF UNDERACHIEVERS PER CLASS

_____
_____
_____

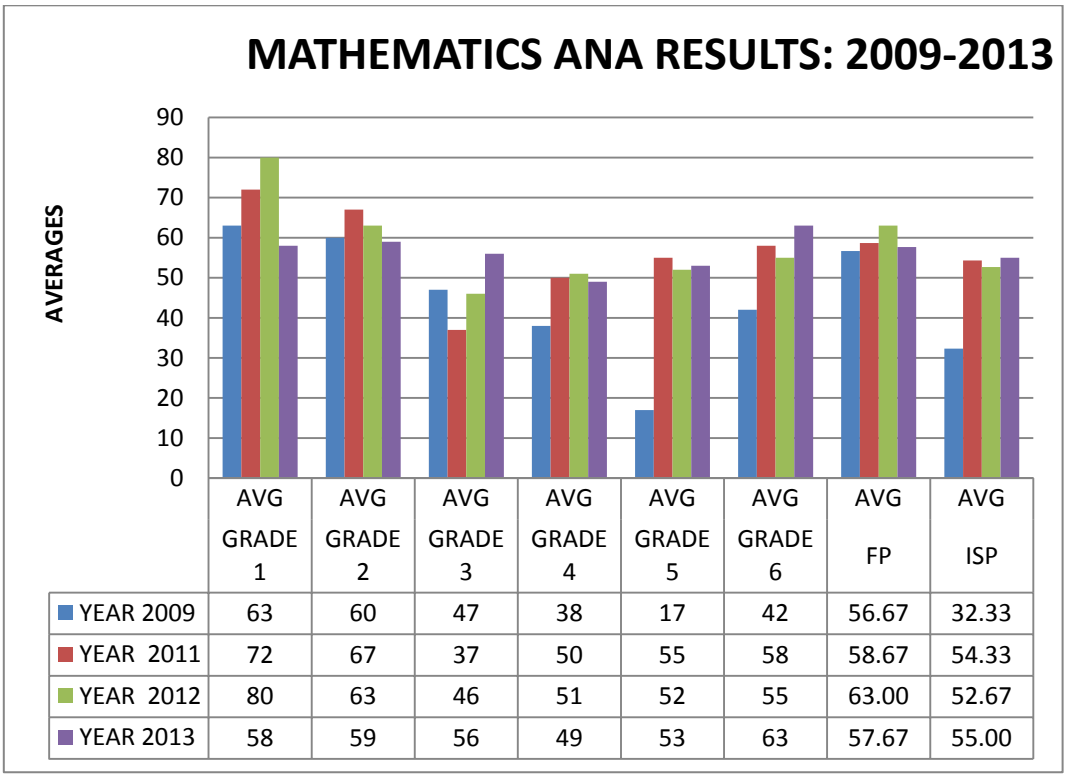
COMMENTS/REASONS

_____
_____
_____
_____
_____

SIGNATURES
EDUCATOR: _____ HOD: _____
SUBJECT HEAD: _____ PRINCIPAL: _____

APPENDIX J – MARK ANALYSIS GRAPHS

Graphs are produced for end of term results; end of year results and for ANA results.
Averages per subject per grade as well as the failures per subject per grade are anlaysed



	AVG GRADE 1	AVG GRADE 2	AVG GRADE 3	AVG GRADE 4	AVG GRADE 5	AVG GRADE 6	AVG FP	AVG ISP
YEAR 2009	63	60	47	38	17	42	56.67	32.33
YEAR 2011	72	67	37	50	55	58	58.67	54.33
YEAR 2012	80	63	46	51	52	55	63.00	52.67
YEAR 2013	58	59	56	49	53	63	57.67	55.00

APPENDIX K – ASSESSMENT MODERATION REPORTS

XXXXX PRIMARY SCHOOL
MODERATION REPORT: INTERMEDIATE PHASE
DATE: _____ **SUBJECT**: _____ **GRADE**: _____

MODERATION DETAILS

	Name of student	Examiner's Mark	Moderated Mark	**Discrepancy**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

TRANSCRIPTION OF MARKS

Marks correctly transferred to class list	YES	NO
Marks tally and totals are correct	YES	NO

MODERATION REPORT

_____
_____
_____
_____
_____

SIGNATURES
EDUCATOR: _____ HOD: _____
SUBJECT HEAD: _____ PRINCIPAL: _____

APPENDIX L – CLASSROOM OBSERVATION SCHEDULE