CHANGES IN SCIENCE TEACHERS' PRACTICE OF LEARNER-CENTRED EDUCATION AS A RESULT OF ACTION RESEARCH IN LESOTHO.

BY

BENEDICT MAPERE KHOBOLI

A DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF DOCTOR OF EDUCATION IN THE FACULTY OF EDUCATION, UNIVERSITY OF KWAZULU-NATAL

(EDGEWOOD CAMPUS).

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PROMOTER: PROF. CLIFF MALCOLM

DECEMBER 2005

DECLARATION

I declare that "*Changes in Science teachers' practice of learner-centred education as a result of action research in Lesotho*" is my own work, that it has not been submitted for any degree or examination in any other university and all the sources I have used or quoted have been indicated and acknowledged by complete references.

Benedict Khoboli

Signed: ....December 2005

Prof. Cliff Malcolm

Signed: .....

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First and foremost I would like to give thanks to God Almighty, for protecting me, giving me strength and guiding me during the whole period of this research project.

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into your school premises and classrooms, neither as a visitor nor inspector, and were never too busy to talk and share ideas concerning the progress of the project and how you could support it. I have grown as a teacher, inspector, researcher and friend from this affiliation with you. Thank you.

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DEDICATION

The thesis is dedicated to my father Bernard Setene Khoboli and to my one and only son Relebohile Khoboli. I know how my father felt about me, my life in general and my achievements. I did not have the opportunity to meet and talk to my son but I have a feeling that he was going to be just like his younger sisters that I have now. I will always remember these two people who were so special and important to me.

May your souls rest in peace and may God bless you.

ABSTRACT

The study looks at Lesotho Science teachers' understanding, practice and explanation of learner-centred education (LCE) prior to, during and after different activities. Six Physics teachers from Maseru were selected from 20 who attended an initial meeting and workshop. The selected teachers participated in the research for two years, completing a Baseline Study, then 3 cycles of planning, acting, observing, and reflecting in the action research on LCE. During the Baseline Study and each of the action research cycles, the teachers' explanations, understandings and practices of learner-centred education were determined through analyses of discussions and meetings, lesson plans, classroom practices, responses to the literature and other support activities, and interviews with the teachers. The process was collaborative, with the teachers and the researcher working as a team in the planning, observations of classrooms, reflections and analyses.

The teachers changed their understanding and practices significantly in the course of the study. Consistent with the Concerns-based Adoption Model (CBAM), their primary concerns shifted from classroom management issues and impediments to learner-centred education in their schools at the start, to adaptation, innovation, and conducting teacher-workshops at the end. Early in the project, they opted for a model of learner-centred education comprised of three levels: caring for learners and their learning; adopting learner-centred teaching methods and allowing learners to influence the content and desired outcomes of the learning. During the research, within the team and in classrooms, the teachers developed each of these levels, though they applied the third level more in their own learning as part of the action research, than in their classrooms. At the end, the teachers co-constructed a model of LCE which they felt was doable under the conditions in Lesotho (including school constraints and competing demands on teachers and curriculum), and which would meet the expectations of principals, parents and learners.

The teachers changed not only in their professional knowledge and skills, but in social-professional and self-professional aspects. For example, they began inviting other teachers to observe their classes, they conducted workshops in their schools, and enrolled for higher degrees. The teachers persisted with the study for two years, not

because of school expectations or pressures, but because they wanted to participate. Their motivation was high, arising from a mix of personal, professional, career and school factors. Their motivations shifted during the research, as their knowledge and concerns changed, and they came to see different opportunities from what they had imagined at the start. Through participation and collaboration, they extended the objectives and outcomes of the study beyond its initial focus on learner-centred education in classrooms: they defined and addressed their own personal, social and professional interests. The data demonstrated that teachers' engagement with in-service activities that provide for long-term project-based learning, critical collaboration, support and reflection, can bring personal and group change more significantly than in conventional district and national workshops.

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ACRONYMS

MOET :	Ministry of Education and Training
LC:	Learner-Centred
LCE:	Learner-Centred Education
LCA:	Learner-Centred Approach
TC:	Teacher-Centred
TCE:	Teacher-Centred Education
TCA:	Teacher-Centred Approach
ECOL:	Examination Council of Lesotho
NCDC:	National Curriculum Development Unit
CBAM:	Concerned-Based Adoption Model

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CHAPTER 1

BACKGROUND TO THE STUDY

1.1 INTRODUCTION

Curriculum developments in the Southern African countries have moved towards Learner-Centred Education (LCE). The Botswana Curriculum Blue Print (2002) has identified LCE as an essential teaching approach that should be adopted for the achievement of a successful basic education. In Namibia, the Ministry of Education and Culture advocated LCE as early as 1993, as the framework for curriculum design and a principle for teaching at all stages in both the primary and secondary schools. Van der Host and McDonald (2003) recognise Outcomes-Based Education in South Africa as a learner-centred approach. In Lesotho, as in its neighbouring countries, there was recognition for the development and achievement of better learning through learner-centred teaching methods where there is also freedom, participation and democracy (Ministry of Education and Training, 2000).

In Namibia, Kasanda, Lubben, Campbell, Kapenda, Kandjeo-Marenga and Gaoseb (2003) identified factors affecting the implementation of LCE at different school levels. These factors included the types of learners, the environment, resources and availability of confident and qualified teachers. This does not cover the type of the curriculum itself and the setting in which this approach is implemented. The Lesotho education system in its planning to have LCE properly implemented did not put forward the majority of these factors but focussed on the teachers' confidence through in-service programmes. The issues of effective administrations in school, resources, the working environment, types of learners and policy documents, did not attract similar attention.

1.2 EDUCATION IN LESOTHO

1.2.1 The education system

The Ministry of Education and Training (MOET) is responsible for the education system in Lesotho, and co-ordinates and initiates most developments in schools (Oenama, Boh, Shute & Moore, 1989). Education in Lesotho is recognised as a means of promoting socio-economic development and self-reliance. Most of the schools (approximately 83% of secondary schools) are owned by non-government proprietors (MOET, 2003). In these partnerships, the proprietor owns the property and controls the day-to-day running of the school through representatives on School Boards who also appoint principals. The major roles of the government are to pay teachers' salaries and benefits through the Teachers Service Department (TSD), design curricula, and monitor teaching, learning and administration.

1.2.2 The school setting

Lesotho has three levels of education before tertiary or professional education: primary, junior secondary and senior secondary levels. Each level provides an end of level external examination and certificate.

Secondary schools provide the junior secondary level or both junior and senior levels, but there are no schools that provide only the senior secondary level. The junior secondary level is made up of a three-year programme. This has three forms, Forms A, B, and C, for the first, second and third year respectively (Maqalika-Lerotholi, 2001). This study was conducted in the junior secondary level.

A new Science curriculum was introduced in 2000. Science that was previously taught in junior secondary schools was called Combined Science or Integrated Science and made up of a combination of Biology, Chemistry, and Physics. In the new curriculum, there was a move towards separate Science syllabuses, which are not integrated like before, but are intended to give learners some basic knowledge in all three Sciences.

The government partly takes responsibility to provide the necessary resources for schools, especially with regard to Science. This does not rule out the schools'

responsibility to ensure that laboratory equipment is available. In some situations, the government provides laboratories and buildings for Science and other subjects.

1.2.3 The new syllabus

The National Curriculum Development Centre (NCDC), which is a department of MOET, designs and produces the curriculum for Science and other subjects. Teachers, however, are free to determine the teaching sequence of topics that appear in the syllabus and to select their own teaching approaches.

The new syllabus not only presented the subjects separately, but also extended them to include some content not covered in the past. For example, technology and environmental issues with regard to population growth and family life are covered by this new syllabus within the three disciplines. Further, teachers are expected to use contexts that are familiar to the learners to teach new concepts, in order to make sure that learners who might leave school after junior secondary, as well as those who proceed to study Science, can acquire the necessary skills and knowledge (MOET, 2000).

> The purpose of the science curriculum is to enable the learner to acquire knowledge, skills and attitudes in science and technology that would enhance permanent and functional literacy and numeracy for continuous learning and effective participation in social issues and activities.
> (MOET, 2000: 1).

This is part of the mission statement for Junior Science teaching in Lesotho, which reflects the interest in learning skills and attitudes as well as content knowledge. The syllabus highlights the need for learner-centred approaches in teaching and learning, but there is no official policy document that describes this concept for teachers in Lesotho.

1.2.4 The administration of schools

In Lesotho, the majority of schools are owned by faith-based organizations or proprietors. Monitoring and support are of great importance both to the government and proprietors. Appendix D demonstrates the structure of education administration in Lesotho. It also shows how proprietors and government departments are working directly with the schools through monitoring, support, employment and payments. The type of partnership in Lesotho between the government and proprietors goes back to before independence and has not been an issue of concern for either the proprietors or the government.

The present government has taken on another responsibility, that of in-service training of teachers as part of support in all subjects and professional issues. The in-service training can be in the form of national, district or regional workshops, which are organised by officers from the MOET. This is the only type of training which is controlled by the government. Long-term training (for certificates and degrees) occurs through Colleges of Education and Universities in Lesotho or other countries. There is some confusion about whether the government or the proprietor is responsible for training and supporting teachers and the level at which each of these stakeholders should join in the in-service training and support.

1.2.5 The Central Inspectorate

The Central Inspectorate is the government department that looks after the monitoring and support of secondary schools. This department is staffed with inspectors and advisors of different subjects. The principal concern is to inspect secondary and high schools, providing support and advice to their teachers, principals and School Boards (MOET, 1992). The inspectors provide reports to the government and the proprietors. These inspections identify common challenges facing schools, and issues to address during in-service programmes. More suggestions come directly from teachers and from the examiner's reports after external examinations.

Lesotho has 3470 teachers in its 229 secondary schools (MOET, 2003). For these secondary schools there are 11 officers (Subject Inspectors). This means that for 1

officer there are 315 teachers to be monitored and supported. Thus, schools are expected to take initiatives and responsibilities in developing and disseminating information and in-servicing teachers.

With the new syllabus in 2000, not only content but also approaches to teaching and learning had to change, hence the MOET, through the Central Inspectorate, was mandated to train teachers in the new paradigm and equip them with the necessary skills.

1.2.6 Teacher in-servicing

In this setting of administration, without clear roles and responsibilities of proprietors and government (MOET, 2003), teachers are being trained through short and long-term courses, sometimes selected by the school administration, sometimes as a result of teachers' own initiatives. The lack of documented policy statements on teacher development seems to weaken its impact. Despite this confusion, the MOET has been conducting different types of workshops aimed at teachers in specific subjects. One of these subjects was Science. The workshops were conducted according to Forms. Often, workshops were conducted where one teacher per school was invited, but those who attended were not required to report back to other teachers teaching the same subject and the same form in their schools. The training, intended for the whole school as represented by one teacher, became a personal achievement that was not shared formally with colleagues. From reports of inspectors, the workshops seemed to have yielded low results in the teachers' adoption and utilisation of LCE teaching in their schools.

I therefore, felt the need to look for a different support for teachers, which could be more collaborative and participatory, in which they could deal with the challenges at school level and hence the opportunity to share with others their experiences. This, I felt, could be achieved through action research and closer collaboration between teachers and the inspectorate.

1.3 PERSONAL BACKGROUND TO THE STUDY

I am working as Inspector Science-Physics in the Ministry of Education and Training in Lesotho. During school visits and teaching observations, I noted that teachers made little use of learner-centred approaches. The lessons are still traditional and dominated by teacher talk and a few "recipe-type" laboratory activities. In order to understand this lack of learner-centred approaches in classrooms, one needs to explore teachers' understanding and views of LCE, and alternative approaches to teacher education.

My long-lasting interest is in-service methods that are more participative and collaborative than the common "sit-and-listen" workshops. Action research, involving teachers across and within schools, offers an alternative.

1.4 STATEMENT OF PURPOSE

The purpose of the study is to investigate science teachers' understanding, explanations and practices of Learner-Centred Education (LCE), and changes that occur as a result of their participation in action research in the Lesotho educational setting.

1.5 CRITICAL QUESTIONS

The study is intended to answer the following questions through the data generated:

1.5.1 Critical Question 1:

What is the initial understanding (thinking), practice (teaching) and explanation (say) of Science teachers with regard to Learner-Centred Education?

Before engaging with the study, teachers had their own understandings of LCE. Looking at their practices and hearing what they are saying about their teaching will help determine the understanding of LCE that they have. This critical question would form the basis and beginning of the study from which support strategies could be designed that would become part of the process of action research.

1.5.2 Critical Question 2:

How does teachers' understanding (thinking), practice (teaching) and explanation (say) about Learner-Centred Education change over time as they engage with action research?

The study will engage teachers in action research, including support and collaboration. The data generated in this process will be utilised to monitor changes in their understanding and the change process they were going through.

1.5.3 Critical Question 3:

Why do teachers change or not change?

The study will look at factors and issues that seem to contribute to the observed change or lack of change.

The study, by working closely with a small number of teachers over a long period of time, is intended to provide opportunities for teachers to change in deep ways, and to reflect deeply on their practices and thinking. This can be the basis for further research in Lesotho, and further exploration of approaches to in-service education. Most importantly, it will be a learning process for the teachers, and also for the researcher.

1.6 OUTLINE OF CHAPTERS

Chapter One has provided the background to the Lesotho education system and the setting in which the research was conducted. Chapter Two reviews the literature on LCE, teacher development and teacher change. The theoretical framework of the study is discussed in Chapter Three. Social constructivism, adult learning theory and critical inquiry are discussed, as the primary theoretical lenses for the study, especially as they relate to action research and learning.

Chapter Four presents the literature behind the methodology and the process of the study. This literature is focused on action research as methodology, including its theoretical basis and its implications. The chapter goes further to justify the selection of the particular action research adopted as a methodology. It then describes the action research process as it occurred. This chapter will also look at the role I played in the process.

In Chapter Five the descriptive data are presented, based on the different activities conducted in each cycle. Chapter Six looks at the data in deeper ways, showing the changed understandings and practices of LCE, individually and collectively, during the study. In this chapter themes are used to classify features of LCE that teachers had at different stages. This leads to Chapter Seven, which focuses on processes of change, and the roles of personal interests, professional interests, career interests, and systems pressures in change through action research.

CHAPTER 2

THE LITERATURE REVIEW

2.1 INTRODUCTION

The purposes of this chapter are as follows:

- To look at learner-centred education through the use of literature: what it entails and its principles in the classroom situation;
- To review the literature on collaboration and participation, with the main focus on what they are and their contribution in the learning process;
- To explore the teacher staff development literature which would help me understand the process of staff development in schools, which would in turn lead to teacher change;
- To explore teacher change in personal and professional aspects, with intention of understanding how change in these two aspects occur and what factors contribute both positively and negatively to that change.

2.2 LEARNER-CENTRED EDUCATION

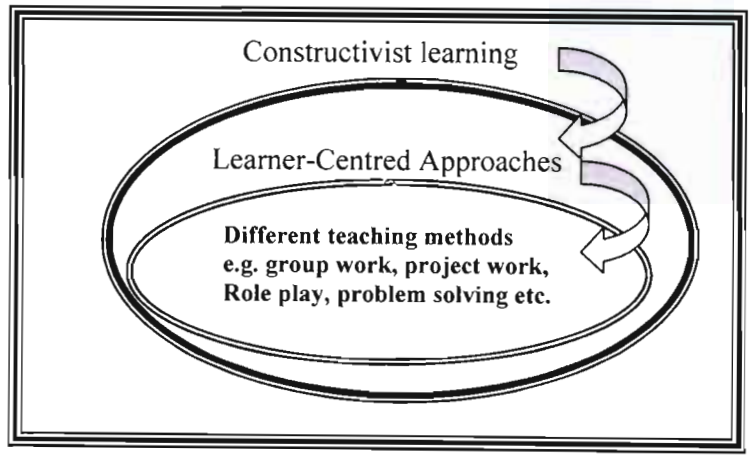
LCE focuses on the learner, and makes use of his/her knowledge, and experiences, in order to develop him/her in totality. For a country which advocates LCE, this focus has to originate from policy:

> Educational and management processes must therefore put the learners first, recognising and building on their knowledge and experience, and responding to their needs...the curriculum, teaching methods and textbooks at all levels and in all programmes of education and training, should encourage independent and critical thought, the capacity to question, enquire, reason, weigh evidence and form judgments, achieve understanding, recognise the provisional and incomplete nature of most human knowledge, and communicate clearly (Department of Education, 1995: 7).

In Lesotho, LCE is advocated as a means of catering for individual differences and social diversity, and promoting democratic participation and critical inquiry (MOET, 2000), even though there is no documentation available that interprets this further. In both the Mathematics and Science disciplines, learners are recognised as learning effectively when they are participants in and responsible for their own learning through necessary engagement in activities. They are not passive individuals who learn by being told (Matlejane & Doidge, 2004; Eisenhower Professional Development Program, 1999).

LCE advocates learning that is responsive to learners' lives and needs, and builds on their experiences. The idea of learning which emerges in this setting is a result of cognitive working. Relevant theories have stressed the process of learning new knowledge which is tied to existing knowledge and the surroundings. Learning that is based on the learner's existing knowledge, background and interests and processes of meaning-making could be viewed as learner-centred.

Figure 2.1: Demonstration of LC approaches and methods and their relationship with constructivist approaches.



The general idea that is demonstrated by Figure 2.1 is the relationship between the constructivist paradigm and LCE and its methods. In this paradigm, learning theory puts its focus on the learner, his or her learning process and the construction of knowledge. In this thesis, LC teaching and learning fits with constructivist views of learning, with constructivist learning to be achieved through the use of LC approaches

and methods. The diagram seeks to demonstrate the relationships between three aspects: paradigm, approach and the methods.

Learner-centred education requires power-sharing between the teacher and the learners in learning and engagement with activities as a way of attaining democratic practice and allowing different students to work in different ways. Kasanda, Lubben, Campbell, Kapenda, Kandjeo-Marenga and Gaoseb (2003) showed LCE as a method of extending the practice of democracy to the classroom. This power-sharing can be at different levels of LCE. Malcolm and Keane (2001) define learner-centeredness by identifying three levels: the caring relationship between learners and teacher; instructional practices or pedagogy; and curriculum goals and outcomes (see also, Brodie, Lelliott & Davis, 2002). At each level, power sharing is an essential aspect which results in learners actively participating and having ownership of the learning process in deeper ways (Harris, Mkhomazi, Misser & Sitsha, 2002). It leads to the establishment of conducive learning environments in which the learners are recognised as partners in their own learning process and development, not recipients.

2.2.1 Caring for learners and learning conditions

The relationship between the teacher and the learners is basic: caring for learners, knowing them, believing in their capacity to learn and learners feeling comfortable in classrooms. This first level also includes encouraging and building on learners' ideas, experiences and interests. In the LC classroom, learners feel accepted and safe to learn in their own ways. The development of an atmosphere that facilitates learning and meaning-making supports them as they take the risk of acquiring new knowledge (North Central Regional Educational Laboratory, 1997).

> Learning requires emotional safety, caring and respect, especially when students must be able to ask and answer questions, to explain their ideas, to take intellectual risks and to give and receive help.

LCE encourages learners' points of view and takes into consideration their ideas. DeVries and Zan (1996) offer an example of learners who were requested to make classroom rules. The learners in that study first and foremost wanted to be called by

their names by both their classmates and the teacher. They were not happy with words regularly used in classrooms such as "naughty boy" or "naughty girl", which sometimes were used by other learners and not the teacher. Brodie, Lelliot and Davis (2002) advise that teachers have to welcome learners as part of the lesson and understand their achievements. They point to the abolishment of corporal punishment as a way to develop a classroom where learners are without fear.

Caring for learners means establishing an environment in which all members are important in the activities and their contribution is recognised and appreciated. There is a greater sense of belonging when learners feel they are known and treated as friends in the situations they encounter. Listening to and helping each other in an LC lesson becomes part of the construction of knowledge and meaning. McCombs (2002) argues that we need to address the climate for learning, expectations, different methods of support, time allocations for collaboration, developing partnerships in learning and student needs.

Gould (1996) observes the roles that friendships between learners themselves and the teacher play in the learning process. Learners learn significantly from other learners and acquire the skills of building and negotiating conclusions. When teachers listen to learners' concerns and support them in a conducive learning environment, learners are more likely to engage in critical thinking about concepts. Learning from and with others through sharing ideas and discussions, seeing different ways of thinking and diversity in knowledge, emanates from the democratisation of classrooms.

Compared to traditional teaching approaches, teachers in an LC classroom have different roles, namely, facilitating, guiding and administrative roles (Ezewu, 1983). Facilitation includes identifying suitable content for learners based on their context (Northwest Regional Educational Laboratory, 2002a), and giving learners the opportunity to define their learning experience, solve problems and establish conclusions.

The idea of the teacher 'facilitating learning' rather than 'teaching' is an acknowledgement that ultimately every learner must assume responsibility for learning. Effective teaching provides the necessary support for this. It identifies and

builds on learners' previous experiences, relates the content with real-life, and promotes deep thinking (DOE, 2004). It provides the required physical resources, the classroom setting, and the type of curriculum and available support material.

2.2.2 The teaching methods adopted

At the second level, teachers coordinate the interactions of learners with content and context through teaching methods, so that they can learn in different ways and link learning to their current knowledge. This involves recognition of individuals, and also groups to which learners belong. A variety of teaching and learning methods are required to suit the variety of individuals and groups, and the learning outcomes required (Kasanda, Lubben, Campbell, Kapenda, Kandjeo-Marenga & Gaoseb, 2003). Methods include problem-based learning, group work and practical work. Especially in classrooms with few resources, teaching methods that allow learners to interact, and move freely while helping others are important. Baird and Northfield (1992), in the Project for Enhancing Effective Learning (PEEL), list many different methods, including concept mapping, role playing, creative writing, problem-solving, project-based learning.

Some of the methods that are advocated in the MOET (2000) policy are discussed below.

- *Practical work*: Harris, Mkhomazi, Misser and Sitsha (2002) recognise the widespread use of "recipe-type" laboratory work, which most teachers take to be learner-centred because it allows all learners to engage with the equipment and procedures. Within limits, learners work in their own ways and at their own pace. However, Harris et al. (2002) argue that this should not be classified as LC since it does not give learners enough responsibility in the design of the learning, for example to plan, design and carry out the activity and take it through to the analysis of results. Allowing considerable autonomy in practical work challenges learners to think through their activities in order to come up with conclusions which they could justify (Lock, 1990).

- *Group work*: Group work provides ways of distributing power and responsibility in the classroom, increasing the intensity of interaction, challenge and support over what is possible in a 'whole class' situation. Brodie, Lelliot and Davis (2002) note however, that while LCE is likely to involve group work, group work need not be LCE. Harris, Mkhomazi, Misser and Sitsha (2002) in their study found that learners in groups worked independently most of the time. Furthermore, talking to each other does not mean engaging in critical and creative discussion. Much effort is needed in facilitating this type of engagement to develop the learners' social skills (Imasiku, 2000). Group work could be used in investigations where the group explores one concept in the interest of answering a specific question that leads to understanding (Lock, 1990).

- *Problem-solving*: In the process of meeting the learners' daily concerns and challenges as required by LCE, a problem-solving method of teaching can be used. Lock (1990) describes "problem-solving" as a way of answering the concerns of the daily activities that affect both the learners and the teacher. It is a learning process that is centred around a puzzle, a query and a problem the learner wishes to solve (Plowright & Watkins, 2004). In this process, the learner achieves an understanding of the specific content knowledge and develops skills in problem-solving in that context.

  "Problem-solving" as a teaching approach can be an extremely complex process, which requires different skills from both the teacher and the learner. Different principles and concepts are brought together through combinations of creative (divergent) thinking, analytical (convergent) thinking and metacognitive processes of evaluation and strategy (Davis, Alexander & Yelon, 1994).

- *Project-based learning:* Project-based learning is a variation on problem-based learning, in which learners, individually or in groups, learn as they produce an artefact of some kind – a poster, a report, a play, a model. In this sense it uses problems in real life, usually in collaborative endeavour with others (Jacobs, Power & Inn, 2002). These projects are related to learning in which learners are interested and motivated. It requires utilisation of different skills on the way to

producing the artefact. Learners select the focus based on the outcome and determine the processes necessary to reach such an outcome. In large projects especially, issues of democracy and management are important as learners find agreement on different stages and processes and ways of organising the work. Muthukrishna (1998) recognised that the planning of tasks shapes the way learners approach learning.

- Hands-on activities. "Hands-on" is a process of learning from materials or equipment through direct interaction, experimentation and observation. Hayes (2000) finds that the activities that are hands-on focus generally on laboratory experiments, group work and real life applications. Learners might make use of materials such as water, plants and animals/insects, either in the laboratory or outside, in ways that support and facilitate learning and meaning construction. These demonstrate that the interactions with materials vary for different purposes.

It is clear from this discussion that teaching methods that are LC could be not classified based on the methods only. This classification could be made based on the utilisation of different teaching approaches; how they ensure inclusion, response to diversity, interactions, power sharing, a democratic environment and engagement that challenges all learners and groups in the classroom.

Kasanda et al. (2003) argue that LCE activities have two core indicators: critical inquiry and active learning. Critical inquiry engages teachers and learners in understanding and reflecting on the learning process and the problem at hand, requiring deep thinking and justification of their views. Active learning requires learners to actively (mental activity especially) participate in their learning at different stages from the planning through implementation and evaluation.

2.2.3 The outcomes of learning

Teachers have very little choice of outcomes that their learners are to achieve. Outcomes are prescribed in two ways: through the policy documents, and through the way external tests are set. While the policy documents might describe outcomes that make a "rich curriculum" and allow learners to influence the content and emphasis of

the lessons, tests typically relate to a narrow and crowded syllabus. It is difficult for teachers to encourage the third level of LCE where there is a fixed syllabus leading to tests that are content-oriented.

In any curriculum, learning theories, classroom management and the desired outcomes work together. In the traditional curriculum, behaviourist learning theories, bureaucratic management and the transmission of knowledge and skills worked together. In an LCE curriculum, the outcomes extend to competences including problem-solving, critical thinking, communicating in a variety of ways, creativity and self-management in a constructivist learning theory. Certain kinds of activities are necessary if we want to generate problems, opportunities for creativity, development of communication and the opportunity to demonstrate creativity and self-management, and they require participative management approaches. Basic education and training intends to develop in individuals, both youth and adults, broad skills, knowledge and values which are necessary for both the economy and social growth (Lesotho Country Report, 2000).

In South Africa, for example, the educational outcomes describe a learner who is able to (Department of Education, 2002):

- Identify a problem, make decisions using critical and creative thinking in the process of solving such problems;
- Properly work with other learners in a setting where they are a team or group;
- Exercise self-management and organise responsibly their activities;
- Adopt various effective communication methods in different modes such as visuals, symbolic and language skills;
- Show their understanding through dealing with adoption of problem-solving to solve challenges in different contexts.

With a view to outcomes such as these, Dimmock (2000) believes that learner-centred teaching is the highest goal of every teacher or policy maker in the modern schools. Learners are given a chance to take part in the process of determining how their own learning should occur.

Learners are given opportunities to link the content with their questions of interest and are allowed to shape lessons in LCE (Rankin, 2000). All levels of LCE require organization, planning and intellectual engagement from the teacher and the learners. These forms of inquiry demand teachers and learners who interact, with the teacher providing interventions at strategic points, whether as additional information, demonstration, discussion or classroom management, and not necessarily providing learners with immediate answers to learners' questions.

The different views of learners provide teachers with instructional points that are relevant to their experiences. Teachers from this constructivist viewpoint support learning and not taking control; they prefer inquiry to orthodoxy and they regularly evaluate themselves, the learners and the system in which they operate. They have the potential of being able to collaborate with learners and to support collaboration amongst the learners themselves.

For learners to successfully achieve the Science outcomes in LCE, lessons have to accommodate the diversity of students' backgrounds, interests and talents, and be able to provide mechanisms for those who fall behind since all learners cannot learn at the same rate. DeVries and Zan (1996) argue that learners' lack of motivation in traditional classrooms is not due to their inability to analyse or examine situations, but as a result of always having to obey the rules and authority of the teacher, which are specifically intended to keep them occupied and maintain order in the classrooms. In the process the outcomes are achieved in the ways wanted by the teacher. If teachers change the way they exercise their authority on learners in classrooms, they could pave the road towards the development of learners who are responsible, independent, motivated and creative. In the constructivist perspective and LCE, this entails the idea of power-sharing, which in turn has implications for the teacher's authority by allowing learners to have power in the classroom.

2.2.4 The roles of the teacher

The role assumed by the teacher in LC classrooms is distinctive in two ways, that is, in its pedagogical and regulatory aspects. The two work together, characterized by participation and shared responsibility. The distribution of management of activities

and resources makes special demands: the goals and the purposes of lessons have to be clear, and so do the processes. The monitoring of activities and learning also shifts, because learners are working in different ways, and assume more responsibility for themselves. The teacher has to move around the class, observing, questioning, encouraging, as well as calling for reports and ideas. The pedagogical and regulatory aspects are both part of the facilitation of learning.

Facilitation can be a highly challenging activity for teachers who are used to teacher-centred approaches. The Missouri Department of Elementary and Secondary Education (2002) describes the roles of the teacher as facilitating the process of learning, observing individuals' progress and learning strategies and ensuring different levels of collaboration. Wallace and Adams (1993) note that facilitation is done in a teacher-centred classroom by organising resources, providing suitable explanations, giving elaborate notes and providing instructions and support during the lessons. Facilitation in the LC classroom is more complex. Foster (2001) argues that it includes challenging, motivating, reinforcing, emphasising, stimulating and supporting feelings, as well as encouraging a suitable atmosphere and valuing differences.

The point these authors make is that the teacher's role of facilitation has always been central to teaching; it is not that the roles have shifted, but the learning theory has: in transmission theories of learning, facilitation means clear explanations and demonstrations, but in social constructivism, these are not enough. The learner has to be challenged to critique and reconstruct knowledge, through processes such as those described earlier.

2.2.5 Challenges of adopting LCE

If we accept that LCE is one of the highest goals of education, it starts to look like an ideal rather than a practice, and the difficulties of achieving it are fore-grounded. Brodie, Lelliot and Devis (2002) recognise LCE as a very strong concept, but demanding in its implementation.

A major challenge of implementing LCE is the availability of resources – from classroom equipment to photocopiers and worksheets – which could be used for production of teaching and learning materials. Kasanda, Lubben, Campbell, Kapenda, Kandjeo-Marenga and Gaoseb (2003) demonstrate that the lack of textbooks, laboratory equipment and other learning materials seem to create a learning environment that does not support LCE. Therefore, for LCE to be properly implemented availability of teaching and learning materials is a matter of priority.

The second challenge is the availability of competent and qualified teachers who would be able to adopt these approaches in their classrooms. The preparation for lessons in which LCE principles are to be utilised requires much work in the planning and managing of such lessons, and it is a different way of working for teachers used to traditional approaches. Kasanda et al. (2003) note that LCE can be a risky move for the teacher and learners.

Thirdly, learners' lack of competence in communicating in the medium of instruction can be a challenge (Kasanda et al., 2003). Most learners are unable to communicate fluently in English, which makes the discussions, critical inquiry and formulation of conclusions difficult, especially if the learners' first languages are not all the same. However, allowing students to work in groups, and switching languages as they prefer, is one way of getting around this.

These three levels of LCE (caring for learners, selection of methods and learner-centred outcomes) basically work hand-in-hand. The failure of one results in the failure of all. The developed LCE environments ensure that the teacher is able to source out information necessary for him/her to have a clear understanding of the learners and their backgrounds, which have been indicated as necessary controlling factors for the methods (pedagogical selection). However, the space for learner-centred outcomes is limited when the curriculum remains strongly oriented to a crowded syllabus and exams. In this situation, level 3 can only be achieved to a small extent.

In light of what has been determined as the principles of LCE, its requirements and the challenges mentioned, there is the question of whether it is achievable or just a

theoretical idea for academic debate. The requirements for teachers are diverse and need ample support at school level and in the classroom, which is not normally provided. Just as important is the social support which is required in the change process. LCE as described above will be possible only if there are concerted efforts from all those who have a stake in education (teachers, policy-makers, parents, learners, the community, proprietors etc.). They must ensure that the necessary support is available, the "rich curriculum" is the one that is assessed, and professional development for each teacher is provided.

2.3 COLLABORATION AND PARTICIPATION IN LEARNING

Participation and collaboration are often taken to be one thing. However, participation might not be active. Collaboration requires the participants to work together, in combination. In LCE classrooms, there is generally collaboration amongst teachers and learners, as well as participation. So too, at the school level, LCE principles can be applied to 'teachers as learners', for teacher and school development. This points to the importance of collaboration of teachers.

2.3.1 Teachers' collaboration

Collaboration means working together with others in order to meet a certain requirement. At the school level, those requirements will include activities like projects – joint development of the class science programme, new organisation of chemicals in the laboratory, or projects directly concerned with developing teachers' knowledge and skills in particular ways. Sometimes it will be much simpler, such as sharing resources and teaching aids or teachers helping each other with particular concepts or problems. Wu (2002) recognises the different settings that could support collaboration in schools. The proper atmosphere sets or establishes the necessary platform for discussions of different problems that each teacher meets in a classroom. Teacher professionalism is also demanded, as is being able to accept other teachers' views and comments positively and allowing the exchange of ideas on teaching and learning.

Collaboration through meetings and sharing of resources, ideas and information provides support and accountability, which make teachers more willing to take the risk of adopting new methods and approaches (Borko, Davinroy, Bliem & Cumbo, 2000). Innovation and collaboration are complementary conditions for change, supporting one another. Sandholtz, Ringstaff and Dwyer (1997) show that in schools where the teachers supported one another emotionally, they were able to share their instructional innovations and demonstrated an increase in collaboration, due to the help they provided to each other during the project.

Very little school-based support and training is provided in Lesotho, with most schools depending on national or district level training and support. Therefore, at school level, teachers have to depend on one another, which is difficult in a situation where there is little or no collaboration, where teachers basically work alone in their preparation as in their teaching. Jaafar (2003) indicates that despite collaboration being a complex idea, its foundation is the established relationships within those who are participating, and their shared commitment to the group's goals. When participants discuss and work together, they build each other's confidence and provide feedback. However, Jaafar (2003) points out that collaboration can also be subversive, in a situation where participants with the same attitude towards a project team-up against the project's achievement.

2.3.2 Learners' collaboration

The value of learners collaborating with each other and their teachers was discussed earlier, from the perspective of constructivist learning, learner-centred education, and the achievement of outcomes such as team work and problem-solving. Sandholtz, Ringstaff and Dwyer (1997) highlighted different researchers who demonstrated that peer interactions in classrooms increase learner performance in different aspects of learning. It also has been seen to improve self-esteem, social status and individual motivation.

Teachers also gain in the collaboration that is developed in the classroom, since learners can provide tutoring/support to others inside and beyond the classroom walls. This peer collaboration and interaction frees teachers from, for example, having to

repeat all the information that is being communicated by other learners. When peer interactions are properly engaged they provide one-on-one support, which can yield better results than whole class support (Sandholtz, Ringstaff & Dwyer, 1997). It is not only the high achievers who provide the support, but also low achievers who learn to take part in time, and see how their current knowledge might relate to future knowledge. Self-esteem and confidence build in each learner in the process. Sconlo et al. (2002) demonstrate that learners who engage in activities that bring them together tend to benefit more than those who work on their own, though there is no identified process of how this occurs.

2.4 TEACHER CHANGE

To some extent 'teacher change' is a 'learning' process, therefore the theories of learner-centred education, constructivism and collaboration described above can be adopted and applied to teacher change. Teacher change is complex, in part because teachers argue that they have 'already learned', and have been teaching more or less competently; they have developed their own teaching style and it works for them. It is a complex issue because each new idea that is encountered brings up unique reactions, especially with teachers who have vast experience in their work. Their experience makes them cautious of certain innovations. Wu (2002) indicates that change need not occur as expected (or desired) and can lead instead to another form of change.

The areas of change that could be considered in schools are wide, and often interdependent (for example, when changes in school administration and school accountability are matched to changes in curriculum). Tobin (1993) points especially to curricular and cultural changes. Practice could change in either curriculum or culture or both, in the way teachers present and conduct their lessons and their understanding of their roles in classrooms and beyond. Wu (2002) finds that for change to occur, teachers must understand the theoretical basis for such a move. They have to see the need for change, by bringing a deficiency or challenge to the conscious mind and recognising its impact on their practice. Day, Hall and Whitaker (1998) argue that change, which is productive, is a result of trying to find understanding and being aware that finding understanding is a journey with no final destination.

Instructional change does not call for teacher change only but requires organisational cultural change (Sandholtz, Ringstaff & Dwyer, 1997). Administrators have to recognise their roles in the process, through providing the necessary resources and support, and creating the needed working environment (Sandholtz et al., 1997). Any teacher is surrounded by different challenges and demands that can frustrate him/her unless proper support for a particular change is provided. Borko et al. (2000) find a number of research projects aimed at supporting teacher change in education. Findings in general show that as well as features of interventions, type of teachers and the institution themselves can play an important role in the achievement of change.

Fulton and Torney-Purta (1999) cite Cuban's study entitled "How Teachers Taught", where there was little observable change even though a variety of reform programmes and efforts were adopted to support teachers to move from the then dominant paradigm of teacher-centred classrooms to the new one of student-centred classrooms. Cuban (1993) went further to show that teachers choose what they want to do depending on their experiences and beliefs, which are all the products of their daily encounters.

Teacher change is necessary if educational reform is to avoid incidental or superficial progress (Di Bease, 1998). An individual's attitudes are socially constructed through extensive interaction with others in life's different contexts. Hence, the necessary change of professional and personal aspects requires a conducive social process and engagement. It is also possible that some teachers are not open, outspoken, able to share and willing to take risks in the presence of others due to a lack of confidence (Hyde, 1992).

In endeavours to understand human change, Beasley (undated) refers to Butler's model of human action, which looks at the social-context (public knowledge and professional practice) and the self-context (personal knowledge and world views) of the teacher. In this model, the reflective process is a process of dialoguing – with the self, or with other social contexts. Critical and creative reflection is seen as an important aspect of development.

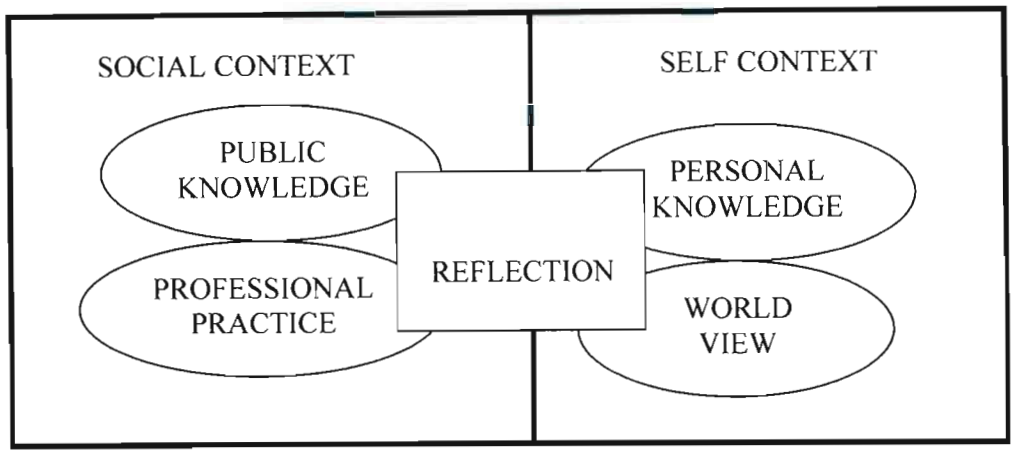
In the social context, public knowledge includes literature and information that is available to teachers from research, theories, policy documents and other stakeholders. Subject pedagogy is part of public knowledge, helping the teacher to rationalise and adopt different teaching strategies at different levels of content development (Ward & Haigh, 1999).

Professional practice relates to the actions and decisions that individuals have to take or make in order to perform their work according to expectations and responsibilities. This knowledge is often not 'public' in the style of literature and policies: it is the ways teachers do things as part of their professional life in the school and more widely in daily life.

In the personal context, world-views concern the individual's deep values, understanding, and picture of the world. The individual's worldview seems to be fairly stable in the context in which the individual is based. It is also stable over time, especially for teachers who have been in the profession for a long time. They express their worldviews in their values, interaction styles and instructional routines and resist challenges to their worldviews or scrutiny from colleagues. Teachers need time and freedom to try a little change and see what happens.

Personal knowledge is knowledge that has been accumulated through different encounters that an individual has in life, including self-knowledge. Harry (1997) indicates that individual change is a personal process of understanding new roles, trying new practices. Harry goes further to say that change is an internal drive: external pressures cannot produce personal change if there is no internal drive. Gollop (1992) proposes a model of change in which change is considered to be a personal process that first takes the form of a deep loss, which promotes a feeling of disempowerment for an individual and may lead to rejection of new activities rather than learning them.

Figure 2.2: The elements of the model of human action as presented by Beasley, (undated), adapted from Butler.



There are four areas of change that should be recognised: change in public knowledge, professional practice, personal knowledge and world-view.

2.4.1 Factors affecting change

Whether teachers feel willing to take part in an activity specifically intended to bring about change depends on situational and personal factors.

Situational factors that play a major role in teacher development are:

- Active participation in meetings and workshops, having regular meetings and workshops which do not focus on administrative issues only but which also provide support in professional knowledge issues. The principal and all those who worked together as change agents are to be supported by people of different status in education; at school level all have to work together to support each other (Cusworth & Dickinson, 1994).
- The type of team involved when looking at personal and professional experiences, encounters and achievements. Teachers value the activities which bring them together to understand practice and share challenges and discoveries.
- Additional material and resources provided to teachers that support practice and the literature provided about teaching and learning.

- The collaboration between teachers themselves and those individuals who provide school-based support; the engagement in continuous professional development both long and short-term, which is also supported by others who are in the same position and who share the same understanding (Cusworth & Dickinson, 1994).

Supovitz and Zief (2000) recognised that the school culture plays an important role in teacher development practice. The school culture includes the working environment in which teaching and learning take place. Many teachers resist change in a pendulum swing by being for change in one moment and not for it in the next, due to situational factors.

Personal factors are responsible for change in the self context as provided by Butler's model of human action (Beasley, undated). These personal factors are recognised as making a contribution to the teacher change process, and include:

- Beliefs about teaching and learning.
- Views about the teachers' roles in teaching and learning.
- Understanding of LCE based on theory and teachers' own encounters with the practice.
- Views of the school culture and practice.
- Teachers' view of the learners' roles in the classroom.

The failure to meet the change factors mentioned above creates barriers to change. Sandholtz et al. (1997) identify the following as barriers to change:

- Limited access to resources necessary to support the required change. Resources include material and human aspects. The laboratory can have enough equipment but if the teachers are not supported both from colleagues and the administration to gain the proper skills to use such equipment, his/her efforts yield poor results.
- Technical problems: the lack of basic content knowledge and how to use equipment, and how to fix malfunctioning and broken equipment. These latter aspects are hardly dealt with in the pre-service training in teacher colleges.

- Lack of time: time is needed for different practical work, the teacher's establishment of knowledge of different learners' backgrounds and out-of-school knowledge, and a heavily congested Science syllabus. It is also needed for the reflective process that would give teachers the opportunity to analyse their experiences and encounters.
- The management structure, assessments and other demands (Moeletsi, 2005). For example, if the assessment benefits those who go through rote learning of concepts, memorisation of definitions and rules and the coverage of syllabus, then it works against the newly-proposed approaches.
- The social group, the system and the general stakeholders' perceptions of what constitutes a teacher and what a teacher does has an influence on whether to change and go for a new understanding.

Changes in practice are often not suggested by teachers but by policy-makers and curriculum reformers. Without any other option, teachers receive the mandate and implement it without much commitment (Ferrer, 1996). Planning for and supporting change needs involvement of and respect for teachers, policy-makers, parents, administration and learners.

For the success of teachers in this new role, more focussed support is needed at different levels, within the school in which they work and from the professional community. Suitable opportunities and platforms where teachers can meet and exchange ideas and personal experiences need to be established for them to assess and analyse their day-to-day practice. This could be achieved through teacher research and/or action research, where the results could be shared locally, nationally and internationally.

2.4.2 The Concerns-Based Adoption Model (CBAM)

The Concerns-Based Adoption Model (CBAM) was developed and used to explain the different stages of adoption and use of new teaching innovations by Hall (1974). The model proposes that teachers experiencing change go through different stages

(Loucks-Horsley, 2001). The model describes how people develop in seven stages as they learn about new innovations (Sweeny, 2003).

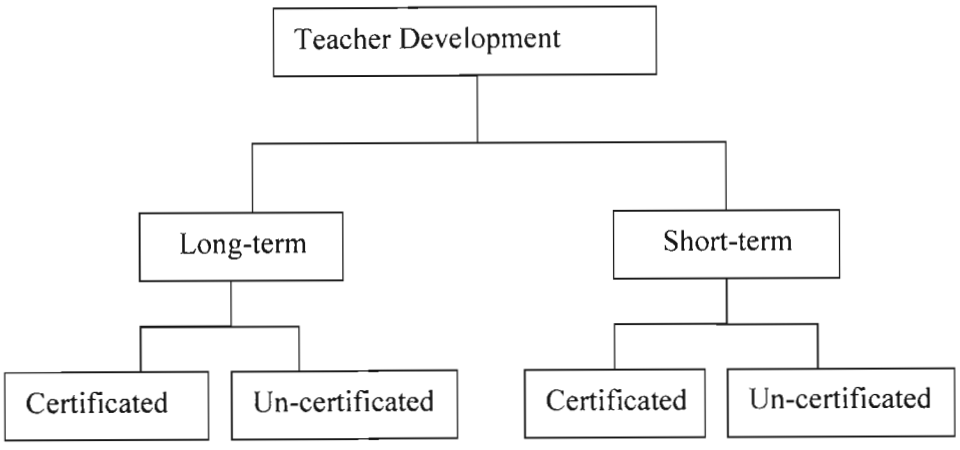
Awareness is the initial stage, which centres on concern for understanding the innovation and why it is being proposed. The *Information* stage involves getting to know the innovation and if it works. The *personal* stage involves the analysis of the innovation focusing mainly on how it impacts on the person going through change, and concerns for personal skills and adequacy. In this process of learning an individual reaches the stage where his/her major concern shifts to *management* and implementation, for the innovation as it stands. The *consequences* stage is when the user's concern is to review the innovation. Over time, this establishes patterns of use that have been tested, refined and evaluated, leading to the *collaboration* stage. Lastly, the *refocusing* stage is taken up, where the user's concern is to revise and adapt the innovation seeking more effective versions of it.

CBAM is helpful not only in understanding the change process, but in designing change strategies. An effective change strategy, whether a workshop or an action research programme, is one that helps teachers through the CBAM stages, addressing the seven concerns more or less in sequence. For example, skipping the stage of personal concern, or not allowing teachers time to work through it, makes successful change overall more difficult. At the same time, the different concerns are always interactive and no one of them is ever fully resolved. For example, in the process of implementing the innovation, the teachers' knowledge of the innovation grows, raising or overcoming personal concerns.

2.5 STAFF DEVELOPMENT

There are many approaches to staff development: short or the long-term, certificated or un-certificated, workshop-based or workplace-based. In Lesotho schools, teacher development activities are mostly in the form of in-service training and institutionalised training which are mostly certificated and initiated by the s schools. Teacher-led initiatives are less common. It follows that the climate at the school is important to teachers' acceptance of and engagement in staff development programmes and their success (Cheng, 1996).

Figure 2.3: A simplified structure of teacher development



The terms "staff development" and "professional development" are often used interchangeably. Professional development is an initiative for acquisition of expertise, personal growth, improved practice, and teaching abilities as a member of the profession of teaching (Queensland Government, 2002b). It is a process of keeping up-to-date through training in areas related to one's specialisation and professional responsibilities (Commission on Applied Clinical Sociology, Undated). Staff development is oriented more to the institution. It might be initiated by a supervisor, such as training on the job, providing constructive feedback, promoting collaboration and reflection,; job rotation and discussions about job related issues. It might be organized by the staff as a whole (through meetings and programmes in the school) or by inspectors and others in the Ministry of Education. In every case, it is designed to improve the skills, motivation, and knowledge of employees. Given that the organizational needs of the school overlap with the needs of the profession, staff development and professional development are much the same, and the terms can be used interchangeably.

As indicated earlier, the effectiveness of professional development activities depends on a wide range of personal, situational and social factors. Professional development has to address teachers' understanding of content, the utilisation of the material resources, and proper selection of teaching methodologies that meet the learners'

requirements and the specific learning areas with which they are dealing (Zuker & Shields, 1997). It has to provide direct and indirect support, extended beyond particular workshops and meetings (Zucker & Shields, 1997). It has to provide opportunities for reflection, for teachers to learn together with their colleagues and decide together the type of professional development they require (Fischer & Tafel, 2001). And it has to be linked to practice. Fischer and Tafel (2001) indicate that teachers observing their learners learning, trying out different ideas, putting to practice different approaches, reflecting on their classrooms and being critical about teaching, learning and the school situation, all constitute meaningful professional development.

The principles of LCE described earlier for children as learners apply also for teachers as learners. Merely giving teachers information and new ideas does not automatically affect their daily practices (Hyde, 1992). Providing them with information does not directly mean they have learned from it. Teachers can only put their research findings and literature to effect in their classroom if they feel comfortable and if the information fit properly with their prior encounters.

Hyde (1992) shows that the staff developer has to address ideas, feelings, emotions, actions, understanding and practices simultaneously and with delicacy, by providing the necessary means through which each teacher would be willing to change. This would help teachers to:

- Analyse their own teaching practices and efficacy with all pupils.
- Reconsider and rethink their established routines, key assumptions, root metaphors and core beliefs about teaching.
- Take risks by experimenting with new practices, approaches, and strategies that may threaten control.

Teacher trainers should provide experiences in doing as well as knowing how to teach. Through such experiences teachers should come to recognise that a new approach holds promise: they can make it work in the classroom and it will be worth the effort.

Teacher development has to enable teachers to experience the processes of critical enquiry with increasing rigour, so as to enable them to research educational problems and the classroom context, and to become effective decision-makers (Ashcroft, 1992). The role of collaboration is central to this process of development between colleagues and also between the teacher and the learners.

Cordingley (undated) indicates that there is great dissatisfaction in teachers with the approaches to professional development that are commonly used, which are usually individualistic, short term, "sit-and-get" sessions and poorly supported within schools. Hyde and Pink (1992) recognise that staff development programmes are regularly a top-down mandate, like the teaching syllabi, from the national education office to the district office to schools. Teachers are aware that the school culture that commonly prevails does not encourage them to come together and collaborate in sustainable initiatives (Sport, 1999).

2.5.1 Staff development as a means of achieving change

Well-planned staff development programmes are needed, which bring together the programme goals, the school's goals, the national policy, and regularly provided external support (Rodriguez & Knuth, 2000). There is the common use of teacher development activities and in-service programmes as sit-in activities that would "fix" the schools problems in practice. This focus on technical skills and particular actions ignores deeper issues of beliefs and situational factors. Pritchard and Ancess (1999) argue that change in practice is reached through changes in teachers' understanding of their roles in the LC classroom and through change in the school culture.

Day, Hall and Whitaker (1998) show that teachers are like learners, with different backgrounds and knowledge and a variety of needs and interests. They identify three types of teachers. The rational adopter is someone who takes up innovations through a logical process, based on evidence, argument and theory. They normally have the motivation to implement new ideas and later determine their impact. The stone-age obstructionist is someone who does not accept the proposed professional change, and works deliberately to prevent it. The pragmatic sceptic is someone who can take up innovations only if he/she is able to apply them in his immediate working

environment. The most important concern of this type of person is the validity of the suggested innovations. The three types are all present in schools, and not necessarily fixed in their type: a teacher might be obstructionist for one innovation, sceptical of another, and embrace a third. The acceptability or not of an innovation is not only about ideologies and beliefs: it depends on time, working environments, perceived rewards and the assessment of teachers achievements. .

For successful professional development planned programmes have to support teachers and administrators to engage in (Pritchard & Ancess, 1999):

1. Ongoing reflection and analysis about processes and engagements of schooling both in the local and wider context. This provides a clear understanding of teaching and learning.
2. Regular planning for implementation and evaluating change in the local context that will maximise school improvement.
3. Understanding of their roles in teaching and supporting learners' achievement. In this aspect the fluid definition of a teacher as a facilitator is encouraged and supported for proper implementation.
4. Regular support for them to take responsibility for their actions and be able to analyse their actions.

Often teachers who embark seriously on staff development and the process of change are those who personally would like to grow in knowledge as well as professionally (Wetzel, 1999). They value their work and are regularly trying to do what is best for their learners and so have more inclination to change or greater potential for changing than teachers who personally do not wish to change in any significant way. In either case, change requires a shift in their perception of themselves, from classroom authorities who know all, to learners in the profession who experiment in their classrooms and learn from students.

In programmes of teacher development, Wetzel (1999) defines two different levels of change that might be addressed. The first focuses on techniques and practices, looking at improving implementation of a policy mainly by addressing efficiency and effectiveness. The second level looks at how learning takes place, seeking to deepen teachers' theoretical understanding as a tool necessary for fundamental change. At

this level, teachers examine their beliefs and explore new possibilities, experiment and reflect on their practices, and construct new meanings and new knowledge and skills (Fung, 2000). This requires extensive and intensive work, which in essence is intended to improve learners' learning and the acquisition of knowledge. The purpose of this action research study was to promote change at Wetzel's deeper level, and to chart the change process that teachers go through when they shift curriculum targets and methodologies.

2.6 PRE-EMPTING CHAPTER 3

Lincoln's (2001) constructivist inquiry was a response to the failure of traditional methods of evaluation to address programme change in any meaningful way. It has parallels with constructivist learning theories, as a response to failures of traditional methods of teaching and assessment. In my research, constructivist learning and constructivist inquiry come together in LCE, through action research with the teachers, and approaches such as problem-based learning in classrooms. In each case power is shared and distributed among participants as they engage in activities which produce intervention strategies, changes and learning.

Critical inquiry, action research and constructivism, may be brought together since they engage the same models: they are mandated for action; involve critical reflection, the need for social justice, collaboration and participation, and lastly the need to shift the relationship between researcher and researched (Lincoln, 2001).

The next chapter therefore focuses on the theoretical basis that was used to guide this study. The study adapts social constructivism and relates it to adult learning. Chapter Three further relates adult learning to the learning that teachers encounter in their in-service programme where there is both critical inquiry and reflection.

CHAPTER 3

THEORETICAL FRAMEWORK

3.1 INTRODUCTION: From behaviourism to knowledge construction

The common teacher in-servicing activities that have been going on for the past few years in Lesotho have been based on behaviourism. In this regard, learning is taken as a method of displaying certain behavioural responses to set stimuli (Fosnot, 1996). The behaviourist approach to teaching focuses primarily on objectively observable behaviours, which are deemed to be adequate measures of 'learning', but may say little about cognitive activity and understanding. Fulton and Torney-Purta (2000) indicate that the central element of teaching is thus transmission of knowledge that could yield change in behaviour. In this behaviourist learning approach, the desired responses are rewarded and thereby reinforced, leading to repetition. In this situation teachers are expected to attend workshops in which they are told what the policy expects from them and how they could attain the expected goals. Assessment in this paradigm intends to check if the learner is within the scope of the curriculum and is displaying the expected behaviours. The model advocates for 'mastery' in behavioural terms. Behaviourism considers learning to be a form of conditioning in which responses are due to some stimuli and this idea considers skills and behaviours to be acquired through a series of procedures.

Constructivism takes a view which is totally different, assuming the active role of the learner-teacher and individual as having experience and being capable of constructing independent understanding and restructuring knowledge. The constructivist perspective takes a clear stand that knowledge is not transferable and every knower has to build it up (Von Glasersfeld, 1982). Duit (2001) indicates that constructivists view the individual's knowledge as a personal-social activity of constructions to make sense out of the surroundings for any reason, which means that it would be difficult to transmit this type of construct from one individual to another. This constitutes a move from the idea of a teacher as a container that has to be filled or refilled with information. Pope and Denicolo (1991) highlighted the teacher's new role to that of a meaning seeker, an essential aspect to be considered in sustainable teacher development.

This study originates from the models of teacher in-servicing and training that are adopted in Lesotho. The purpose of this chapter is to define the research framework that has been used. It looks at the learning theory that I adapt to explore teachers' learning and knowledge and the skills that are used during teaching. I focus too on knowledge creation and change. The research framework seems to be consistent with social constructivism, in that both myself as a researcher and the teachers will collaboratively construct knowledge, through a variety of processes in which action, learning and research occur together through the use of action research as my methodology. The chapter will further explore theoretical implications and understanding of social constructivism and its adaptation in teacher (adult) learning, mainly where they are involved in action research. Learning as a process is necessary for the acquisition of knowledge, which would also be discussed in the light of how adults learn.

Constructivism is recognised as a learning theory that seems to agree and supports different paradigms and settings mainly in Science and Mathematics teaching and learning (Matthews, 2000). For several years in the USA and other countries, constructivism has not only underpinned the teaching and learning of children but also the pre-service and in-service education of teachers. In this regard, the current review will establish the different aspects of social constructivism coupled with andragogy in teacher learning through in-service programmes, with further exploration of other effects necessary for adult learning.

Vygotsky's social constructivism will be used to interrogate the adult learning process, with special adaptation of ideas of critical inquiry during learning by adults and the adult theory of learning-andragogy. The purpose is to understand how adults construct meaning given diverse experiences and challenges that they encounter. Andragogy is used initially to understand the role of these experiences when adults meet new situations that require understanding and critical inquiry in order to successfully go through that process.

3.2 CONSTRUCTIVISM

The Principal Secretary of the MOET has recognised the need for reforms in education which adopt the constructivism paradigm (MOET, 2003). She went further to highlight the role played by learners' knowledge while constructing meaning and developing understanding.

Therefore the constructivism approach is not only adopted in this study but also recognised by the policy of Lesotho as a necessary paradigm for the new reforms of the new millennium.

Constructivist teaching as a theory or practice has received great attention in the past decade (Richardson, 2003). Constructivist theory focuses on the learner and learning, not on the teacher conducting the lesson at that particular moment, the goals of instruction and skills required (Ryder, 2005; Hein, 1991) or the displayed behaviours of the learners. In the constructivist view, learning is also affected by the context, the beliefs and attitudes of the learner. Constructivism represents a meaning-making theory (Richardson, 1997), which puts the learning process under the microscope for analysis. In constructivism there is a clear distinction between what is understood as learning and teaching, with the former being the core of the process. The proper use of constructivism is to support learners and their initiatives at all levels of the learning process. During the process of learning that is informed by constructivism, there is a recognition of the importance of previous encounters, plans for the future, interests, personal and social factors.

Constructivism works towards understanding the reality of the human cognitive process with a special emphasis on the mental work which would produce meaning. This theory of learning looks at individual learners and makes use of their natural instinct and curiosity to foster learning and exposure to new concepts (Winitzky & Kanchak, 1997). Matthews (2000) warns against taking constructivism as a flag for researchers to hide behind but argues that it is a theory that supports and guides the understanding of how humans learn and the process of knowledge production. Individuals can actively experience different things in their daily encounters and hence construct specific understanding and knowledge of such encounters (Education Broadcasting Corporation, 2004a).

In the constructivist view, learning can be achieved through a number of ways which support the construction of a block of understanding that is based on provided information and past experiences, purposes and interests. There are many techniques such as those in the PEEL Project (Baird & Northfield, 1992), that support this construction effectively, for example, experiments and real world experiences of solving problems in which there is considerable emphasis on the negotiated interactive process, dialogue and higher order manipulative skills. Most of these activities go way beyond just 'doing experiments' and 'solving problems', towards the establishment of truth and usefulness.

It could be claimed that constructivism is a theory of knowledge and learning that helps us to understand what is meant by knowing and how individuals come to know something based on the fact that reality is not knowable but is a theoretical construction (Fosnot, 1996). It is a learner-centred theory which encompasses learning through experimenting and promotes self-reflection and critical inquiry. In essence, it could be said that the constructivist view requires examining the conceptualisation of knowledge and its acquisition (Duit, 2001). Therefore the constructivist view is an *active process* of *meaning making* through the use of the *prior knowledge and new information* as experiences.

Meaning-making: Constructivism is a philosophical stand which can be viewed as a way of understanding the process of meaning-making that an individual develops while working towards making sense of the new information (Illman, 1998). The focus of the theory is on the view that individuals are able to construct meaning of the new information, depending on already existing knowledge. Fullan and Hargreaves (1998) show this to be a construction of sense that basically represents the reflection process which an individual experiences to construct images and then match them with language. The process of knowledge construction depends on the exposure to different experiences, emotional situations, beliefs and social status. Kennison (in Fullan & Hargreaves, 1998) indicates that teachers used images as a method of preparing and maintaining their lessons, which demonstrates the teachers' new role as facilitator who interacts and negotiates the meaning-making process with learners.

Active process: At core of this theory is the view that learning is an active process in which an individual constructs knowledge and understanding using personal experiences in an active way (Bodzin, 1999; Richardson, 1997; Richardson 2003). Constructivist theory is based on a consideration of learning as continuous, and which allows those taking part to actively engage and source out information from the surrounding environment (Dunham, Wells & White, 2000). The learner who is engaged in and guided by the theory takes a greater role in working on knowledge acquisition.

Prior knowledge and new information: The construction of meaning engages the process of integrating new ideas with existing knowledge to create a unique understanding, which is then reflected as individual knowledge. In essence, the construction of meaning is achieved through interaction between prior knowledge and new experiences (Fung, 2000). Despite

being in the same learning environment individuals are expected to formulate different understandings and knowledge because of their varying experiences and prior knowledge.

There is an understanding that teachers have their prior constructed knowledge, ideas and understanding about LCE, that they take as part of the raw material to be used in the process of constructing new knowledge about LCE. This prior information is a product of policy document interpretation, social interactions and personal beliefs, which result in personal constructs and interpretations that were assigned specific meaning based on how they were experienced. Teachers, just like learners, are encouraged to explore different aspects of the situation, make judgements, determine solutions and have the freedom to try out ideas (Fulton and Torney-Purta, 2000). The available prior knowledge could be used to interpret experiences and plays an important role in ensuring that there are internal constructs of LCE.

In the light of the given view of constructivism, there are principles that could be adopted in addition to those cited above as a means of explaining and understanding constructivism (Cohen, Cohen, Jegede, Ahsani, Kondo & McDonough, 2001). These could also be useful for teachers:

- The presence of information and encounters around a learner calls for the teacher's attention since the individual will work on constructing meaning or implications. The attention of a learner, personal goals and interests become important because in order for focus and learning to occur, the individual has to direct his attention to that particular content area.
- For better teaching to be achieved, the educator has to understand the ways learners view their world in order to bring about suitable learning experiences that could be used for knowledge construction.
- The focus of learning is not on enabling learners to memorise the so-called the "correct" information.

In accordance with the personal constructivist theory, knowledge is an individual construct in a particular setting (Sebela, 2001). Knowledge construction and its depth vary with individuals who also differ in how they internalise it. Knowledge seems to be deepened by linking new information to existing knowledge (American Psychological Association, 1997). To further our understanding of constructivism as a theory of learning, the views of different

psychologists who helped shape it into its present state, such as Piaget and Vygotsky are discussed below.

3.2.1 Piaget: Individual constructivism

Richardson (1997) recognises Piaget constructivism as a way of constructing meaning by an individual through different stages of understanding and analysis. This constructivist view originates from Piagetian philosophy. Here the environment is established with different activities that could facilitate reconstruction of a new concept (Vadeboncoeur, 1997). The understanding and acquisition of knowledge is a result of individual development, which is due to logical and stable mental adaptations to surrounding facets.

Piaget showed how age and thinking in the sensory motor stage corresponds and leads towards the ability to think abstractly. Going from stage to stage during growth is not an automatic process but is guided by the experiences which are used to create meaning and hence further develop individuals' thinking abilities (Dickman & Van Sickle, 1999). Thus, recognising the importance of engaging and exposing learners to rich environments and activities that challenge their current thinking and prior knowledge are important.

3.2.2 Vygotsky: Social constructivism

A number of writers associate the social constructivism theory of learning with Vygotsky (Matthews, 2000; Moore, 2004; May, 2003; Fenning, 2004; Duit, 2001; Dickman & Van Sickle, 1999). Constructivism, when considered in its "social" form, suggests that the learner must be more actively engaged in joint activity with the facilitator to construct or generate new understandings and meanings (Fenning, 2004). This extension goes further to include the social aspect, which recognizes the role that social interactions play during the process of acquiring knowledge. The Vygotskian tradition views social constructivism as incorporating similar ideas to that of Piaget's individual constructivism, but then goes further to consider the interaction of learners. Learners interact with other learners in order to make meaning of their experiences. The teacher's role in this learning process is to determine the content area and activity required towards achieving meaning making (Dickman & Van Sickle, 1999).

The participants must come together to interact critically and share some experiences in the process of meaning-making. Social constructivism thus emphasizes cultural practices and context in understanding phenomena and constructing knowledge. Hence knowledge under social constructivism is part of a process whereby individuals and the group make meaning of their interactions with each other and the surroundings. Social constructivism locates or recognises in particular the role that the social context plays in the process of knowledge acquisition.

> Vygotskian theory...the development of the child's higher mental processes depends on the presence of mediating agents in the child's interaction with the environment. (Kozulin, 2003: 17).

Social constructivism recognises the role played by social factors as they affect the ways in which groups of people form understandings and formal knowledge about their world in the process of learning (Richardson, 2003). The social constructivist view of learning acknowledges social aspects with the objects and equipment around them and their contribution to knowledge development. Knowledge construction can thus be achieved as a social group. This use of artefacts in the learning environment, such as objects and laboratory equipment, are often ignored by most social constructivists since they are only applicable to Science as a discipline.

There are different levels of mediation that humans play in learning: the real interactions between individuals and the internalisation by the concerned individual (Kozulin, 2003). The social constructivist perspective in this study looks at teachers' learning, which is a product of my mediation throughout the action research process. However, their learning is not only a result of my mediation and facilitation, but also their efforts towards improving their practice. Together they mediated one another's learning, and skills acquisition. Teachers assumed the role of agents of their own learning with the idea that the context in which learning occurs was valuable when taking into consideration the type of interactions involved between others and the task in which they were engaged (Scanlon, Morris, Di Paolo & Cooper, 2002).

Putnam and Borko (2000) show that there is a lot of dissatisfaction with individualistic accounts of learning and knowing. Psychologists and educators are recognizing the role played by others in the learning process, which goes beyond providing stimulation and

encouragement. Action research seems to focus on the critical reflection, collaboration, sharing and interactions necessary for learning. Some scholars also conceptualise learning as coming to know how to participate in the discourse and practices of certain communities, as a way of enculturation into the community's ways of thinking.

Knowledge acquired is strongly influenced by utilisation of peers as resources during the process of learning. The questions they ask and type of arguments that are made during group work shape the understanding and knowledge of a particular facet (Resnick, 1993). This has shown that knowledge must in some ways be socially constructed and enables people to share their understandings with one another (Brook, Driver & Johnstone, 1989).

Social constructivism is attributed to the role played by the social context during the learning process and the impact of social environments (Moore, 2004). Therefore, learning in social constructivism is an active process that involves the individual, peers, internal knowledge, new knowledge received and different resources (Brook et al., 1989). In this theory there is a need for the learners to fully participate in their own learning though talking, hands on activities, reflection and engagement in different activities.

Another conception of learning considers it to be situated in particular social and physical contexts, distributed over individual and other persons (community practices) and as a tool (Putnam & Borko, 2000). This view of a person, within an environment, participation in social interactions and activities, all form part of a "mutually-constructed" unit that contribute towards meaning-making (Bredo, 1994). The equipment or material things are taken to be tools which also form part of the environment; the number of learners in a class and how they access all the resources thus plays an important role in socialisation.

The learning process of teaching while in action is a complex one that has to be treated with great care, hence any challenge that is thrown to teachers on their current practices has to involve them. The change process of teachers during the implementation of new policies and systems has to be given proper attention in different educational sectors. The learning of teachers during in-service training can also be explained using the constructivist view. How teachers learn through practice in schools or how they learn through work, projects and actions in classrooms becomes relevant.

Brook et al. (1989) indicate that learning Science involves more than observing and recording natural phenomena: it involves appreciating the ways in which the community of scientists interpret those phenomena and how the results can be adapted to solve real problems. Learning what is traditionally considered to be "content" in any meaningful way and desirable way involves the learners in an active process of knowledge construction. However, what the educational world considers to be the "scientific process", like observing, classifying and interpreting do not occur in isolation or from a neutral perspective without the influence of other parameters.

For learners in school, there are different expectations from parents, teachers, the school, peers and the nation at large. Yet their decision as to which interest and expectation to meet is a personal decision which is mostly rational and critical. A similar observation for teachers has been made by Moeletsi (2005). Teachers did not work towards achieving scientific knowledge, and school requirements but were interested in meeting those needs guided by the school norms and in doing what the community expected from them.

The position that has to be taken is that learning in Science is characterized neither by learning "content" nor by "learning process", but by the dynamic interaction whereby individuals with time, construct and reconstruct their understanding of the world. Furthermore, any learnt information in Science depends much on the ideas the learner brings to the class and when learning occurs, it shows that there has been a successful interaction between newly learnt and previous information. Learning theories model the way the individual is observed to behave when engaged in a task. After the task, the learning has to take place in the mind while the processes have to be observed at work when applying what has been learnt (Shipman, 1985). The focus most of the time is on the learning and the learners, leaving out the relationship between the teacher and learners.

Social constructivist principles of teaching maintain that learning has to be more learner-centred, has to make use of the learners' experiences and should encourage more interactions between the learners and the facilitator (Winitzky & Kauchak, 1997). However, Moore (2004) indicates that constructivism is only a theory of learning, not teaching. Therefore there is greater interest in motivating for teacher in-servicing to adopt social constructivism since it recognises their background and encourages its use. More often than not, teacher training is considered to be for the transmission of information to teachers that they have to put into

practice in their respective schools. It not considered to be a process of learning which should be based on the theoretical understanding of both social constructivism and adult learning theories.

Knowledge is not something that can be transmitted from one person to another, but is constructed through a negotiated process that reorganises reality (Larochelle, Bednarz & Garrison, 1998; Sebola, 2001). There is a move towards giving up the idea of knowledge transmission and adopting the idea of facilitating the process of knowledge acquisition. Winitzky and Kauchak (1997) indicate that teacher training has to produce a highly concentrated mixture of theoretical and practical knowledge in order to avoid or reduce misunderstanding. Social constructivism can also be viewed as a way of empowering participants by going beyond their beliefs and social relationships towards recognising their potential and making use of it in practice (Larochelle, Bednarz & Garrison, 1998). In this way, they are able to confront their beliefs and challenge them so they can see different facets of their experiences.

Richardson (2003) argues that constructivist pedagogy wherever presented, should demonstrate different "characteristics". It has to be:

1. Guided by the background of learners. It has to support their understandings and how their prior knowledge and experiences affect their learning process and consideration must be given to how these aspects can be utilised to attain knowledge and make meaning.
2. Seen to be facilitating collaboration in a group which deals with one particular content area, in which those taking part would like to reach some understanding and construct meaning.
3. Utilise different sources of information such as textbooks, the internet, and other methods that are found to hold required information.
4. Able to establish an atmosphere that is suitable for learning, in which learners can challenge, change their understanding, and develop new understandings through interaction with different facets of activities that are specially designed for such aims.
5. Able to support learners in their process of recognising their own ways of knowledge construction and the processes that they go through in order to acquire such knowledge.

The issue of whether social constructivism involves an individual or collective mental effort is in a sense unavoidable and difficult to separate because learners exposed to new experiences view them differently and construct meaning from them. This does not remove the presence of other learners and the objects in that experience and the role they play. Therefore, the mental experience is individualistic but also collective in the way meaning and knowledge is constructed.

3.3 SOCIAL CONSTRUCTIVISM AND ADULT LEARNING

Before exploring the relation between social constructivism and the adult learning process, I would like to focus on learning. What is teacher learning? In the process of understanding what teacher learning is, the focus is placed on three aspects, according to Tobin (1993). The first is the process of making sense of the different experiences that teachers encounter. In this aspect of learning, an individual goes through interpreting different encounters to make meaning from each. Secondly, the nature of such experiences and the environments in which they occur are significant. Those experiences and how and where they occur contribute towards interpretation and the meaning-making process. Lastly, dealing with how to bring to the conscious mind past knowledge attained in that aspect of learning which is necessary to interpret experiences is crucial. This final aspect brings the previously constructed understanding to the conscious mind for it to be assimilated and utilised to formulate new knowledge.

3.3.1 Social constructivism in teacher training

Learning could be looked at from the point of situated cognition, in which it is taken as a process that unfolds socially. The way collaboration occurs between learners, the utilisation of the tools provided, the structure of the activity they are engaged with and the social context in which activities are performed, direct the learning process. The process of learning is a way of reflecting on and challenging what an individual knows in relation to the new information that is received, and then formulating a new construct based on that interaction (Kilgore, 2001). The end product of learning in the constructivist paradigm is the attainment and construction of knowledge. Knowledge cannot be taken as the actual representation of external encounters but the constructed views and structures of the observer that have been accepted as a representation of the current subject (Von Glasersfeld, 1996).

The theories of learning where cognition is situated, can make teacher education meaningful in order to foster certain changes in school policies. This itself is a process that has to be researched at all levels. Situated cognition has its roots in critical theory and Vygotsky's sociocultural theory (Kirshner & Whitson, 1997). The main problem that situated theory is struggling with is the treatment of a person's ideas, beliefs and knowledge as autonomous from the experience and social context within the community of practice. It is an accepted view that teachers bring to the classroom their personal confidence, their threats, their respect for authority, their need for individual recognition, their need for different independent capabilities and their need for the utilisation of past experiences in a specified field (Ferro, 1993). The personal ideas, beliefs and knowledge are the result of experiences and social interactions which teachers bring in during in-service activities.

The process of learning for teachers can be taken to be part of a participatory framework, which is informed by an individual's past experiences, environment, peers and learners in the classroom. Hein (1991) identified different principles of constructivist learning that are worth considering if we accept that teachers' learning is not a passive process of receiving information. Constructivist teacher learning thus:

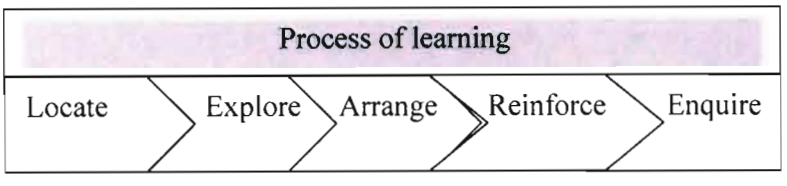
- Is a process that calls for participation to construct meaning.
- Involves constructing meaning and its systems. That is, each meaning previously constructed helps them to make meaning from new, yet similar ideas.
- Is attained through the exposure to real situations that are mentally challenging and calling for physical and hands-on engagement as a way of facilitating the construction of knowledge.
- Involves language, since to internalise information and/or discuss it with others, there is the use of language. This information does not exist on its own but is interpreted through language tools.
- Is recognised as socially constructed, which means that it occurs through interactions, discussions, arguments and debates with friends, peers, family members and all individuals who seem to share the same interest.
- Is not a once-off thing but takes time, as the information is being tested and puzzles are brought together to check if they make any sense with reference to the experience of an individual.

The concept of learning can be extended beyond physical and social contexts, and the influence and role of interactions of other people on what is learned. Richardson (1997) suggests that the learning process depends on the individual and the environment where the learning is encountered, and that the environment includes the activities and tools used. This expresses the need to explore beyond individual competence and the sharing of knowledge (Putnam & Borko, 2002).

3.3.2 The learning process

There are five steps that are identified as necessary for learning (Whiteley, 2003). This process starts at locating what is to be learned (*locate*) and then working on it to understand more about it (*explore*). It also entails making the necessary mental arrangements from existing knowledge to fit new experiences (*arrange*). The next activity in the process of learning is to adopt different methods and techniques to reinforce understanding (*reinforce*) and lastly, determine the process and effectiveness of the different styles and methods adopted (*enquire*).

Figure 3.1: The process of learning



From these steps we can say that learning is a process of constructing specific understanding, which is then in line with constructivist views. Learners begin with the knowledge and understanding they possess, locate a way of matching it with the new information which is being encountered, to construct new meaning that will result in enhanced knowledge and understanding. Learning is a component of the process, and can be facilitated by appropriate guidance and experiences in the classroom. Learners have to get in touch with the surrounding objects and specially selected activities. During the process of knowledge construction, learning takes place through activities and the individual develops understanding of how such problems can be tackled. This understanding has more influence in the case of teachers who daily gain experiences in different contexts.

Laurillard (1993) proposes an interaction model that could be used to map the prevailing interactions between teachers and learners. In this model, she refers to the learning process as a product of continuous dialogue between teacher and learner despite working at different levels of understanding and viewing the world. This is successful provided both the teacher and learner are aware of the higher order thinking involved in learning (metacognitive). Metacognition enables learners to be successful in their learning process. Thus, we engage in metacognitive activities everyday. Metacognition means having explicit knowledge of learning strategies and one's own learning process and concerns the ability to use comprehension strategies by monitoring and controlling one's own thinking and learning (Stevenson & Palmer, 1994; Adams, 1998). The understanding of metacognition should not be restricted to knowledge only nor its use, but it should also be applied to the explicit knowledge of one's learning process. An example of metacognition is where the knowledge that researchers have gained of learner-centred learning is further illuminated by looking at different ways in which they have internalised and gained from the prior knowledge.

3.3.3 Adult learning theories

Mezirow (1991) shows that development can be divided into two phases. The first phase takes place between birth and adolescence and the second starts after attaining adolescence. The initial phase consists of decoding and encoding daily encounters and new information. This process provides structures of initial understandings and knowledge constructions that lead to individual autonomy. The second phase of development initiated after adolescence, compels an individual to revisit previously constructed knowledge while being tested by the experiences that are being accumulated. When talking about a teacher as an adult in this study, I will focus on this second phase.

There are different theories suggested by different writers in adult learning (Knowles, 1980; Cross, 1981; Mazirow, 1991), but Frey and Alman (2003) recommend the use of Knowles theory in adult learning. Andragogy is the method and process of assisting adults to learn with the utilisation of their experience. It is again a learner-centred activity in which the adult has to recognise the relevance of the engaged activity and take ownership of decisions made thereafter. In this process of adult learning, just like in LC, the relationship between the facilitator and teachers is still recognised as important for effective learning. This does not

leave out the role played by their individual experiences that they bring together as they discuss ideas and concepts. Knowles (1980) further recommends that the main objective in adult learning is the role that the facilitator assumes in the development and attainment of the learners' full potential.

Adult learners are able to learn best in situations where their accumulated experiences are used and the situations affirm such experiences, even though some human resource development professionals show that experiences are nothing less than accumulated messages that learners acquired, which have the potential of empowering or disempowering them (Kilgore, 2001). Adults have different learning styles which are based on past experiences and encounters, but these may not be up to date in terms of the current content engaged with or the method provided. Adult learners are regularly meeting a challenge when engaging with strategies that they have never met before in their life.

Andragogy is described as a theory of adult education (Warren, 1997). Merriam (2001) quotes Knowles (1998) who argues that andragogy is the art and science of supporting adults to learn. It is based on certain assumptions of adult learner. The adult learner is someone who:

- Is able to direct learning and construction of knowledge due to the individual's level of maturity (Frey & Alman, 2003; Knowles, 1980; Cooper, 2005).
- Has a rich experience that has been acquired and tested through a long time which determines personal identity and works as a resource on which new concepts are rated or compared (Knowles, 1980). This knowledge could be rigid and difficult to change.
- Has certain challenges in one's daily life directed by the roles performed.
- Is interested in the applicability of new knowledge which is based on the current challenges, and not something for the future.
- Is highly motivated due to internal factors more than external factors. Motivation is the adult learner's own internal incentives and curiosity.
- Is committed due to the recognition of the relevance of the learning process and its immediate application to solve real challenges encountered daily.

There are elements which are considered necessary in andragogy/pedagogy such as a relaxed climate, developing trust, an informal setting, mutual respect for one another and collaborative support. The debates on quality in education more often ignore teacher

development and adult education as an element contributing towards the type of education provided. Researchers who operate from the humanistic and constructivist views, place emphasis on the experience of adults as the main source of their learning process.

In andragogy, there are five issues that should be dealt with in order to achieve the set objectives of learning. These are: 1) the need for learners to understand the purpose of learning what they are learning; 2) the need to support learners in being independent and sourcing out information on their own; 3) dealing with content in the context of learners' experiences; 4) ensuring learners are ready to learn and motivating them; and 5) providing support when they deal with personal challenges and have to confront personal beliefs about learning and teaching. Roger (1989) shows that even though an adult may recognise the need for new knowledge, the person may still feel threatened when this knowledge tends to challenge the beliefs.

In this case, more of the individual experiences, needs, encounters and beliefs are directing the learning process, compared to the learner being directed by the facilitator. When adults are brought back to their learning environment, they expect the programme will be based on their "own agenda" (Warren, 2000), which means that the facilitator must be ready to work with them step-by-step in planning and implementing such plans.

There are factors necessary for the effective facilitation of learning for teachers, whether in the short or long-term. Initially there is a need to consider their experiences and how to utilise these in the process, which brings up an essential aspect of LCE. In andragogical learning environments and conditions, adult participants learn from each other in the same way as they learn from the facilitator. Learning becomes a collaborative activity where participants work jointly in interpreting real experiences, and corresponding literature, which will be used to produce individual's real encounters as part of constructing meaning.

3.3.4 Teachers as learners

Burnford (2001) shows that teachers' learning and learners' learning are inseparable, like two sides of a coin. If learners' learning is to be attained, much emphasis has to be placed in teacher in-service/training in order to improve their knowledge and practice. Participation in the in-service programmes intended for knowledge construction, learning and change, may be

enough when observing an individual teacher within a short period of time, but this does not guarantee acquisition of the intended knowledge that would reflect on the practice and understanding of teaching as a whole.

For the effective teacher learning to occur, there is a need for teachers to understand three basic concepts that are involved in learning: knowledge and understanding of how learning occurs, different ways of learning, and the ability to improve individual and group learning capability (Stouch, 1993). Teachers should then have an understanding of how learning occurs, mainly the issues concerning the operation of the memory and the internalisation of information received.

Similarly, a knowledge of individual learning strategies or styles ensures that such an individual is able to seek relevant methods that could assist in gaining better understanding from each activity being engaged. An understanding for learning strategies and how learning occurs could ensure that teachers are able to take more responsibility of learning even in the absence of the facilitator. It could be concluded that the views of social constructivism about the learners are similar to those of adult learning. The difference is that the adult has a reservoir of experience and rich prior knowledge, and is highly interested, has specific learning purposes and social interaction skills.

Cross (1981) shows that adult learners can be divided into different groups. Those who are said to be goal-oriented, those who are activity-oriented, and those who are learning-oriented. The first group of learners join the learning programme mainly to attain specific objectives such as learning a certain concept or language. The same group can also join only to meet the requirements of the employer who might have an interest in that specific issue. The second group, that of activity-oriented learners, participate in the activity for the enjoyment of it, not to attain skills nor to learn subject matter. Cross (1981) shows that some adult learners join training programmes as a way of addressing family problems, responding to loneliness, or dealing with other issues of concern, not necessary for the attainment of learning objectives. Lastly, Cross (1981) looks at learning-oriented adult learners, who pursue learning for its own sake without any hidden agenda. They have a desire to learn and know and hence grow through learning.

3.3.5 Social constructivism, adult learning and staff development

The theorists who adopt social constructivism in teacher development recognise the importance of the teachers' background experience and the level of their cognitive development. It is in this regard that planned in-service activities have to move away from the workshop type of instructional method, where participants sit and listen to the "expert" transfer information and engage in some artificial activities. Constructivist teaching would make use of learner-centred approaches in which the participant is engaged in an active learning process (Winitzky & Kanchak, 1997).

Harry (1997) shows that constructivist presenters in in-service workshops should provide inquiry based learning and allow the sharing of ideas. The process assumed for learners' engagement in learning activities is similar to that of the teacher in training or in-service programmes. Teacher in-servicing programmes have to move towards teacher-centred methods even though their teaching in this paradigm should not remain there but move towards learner-centred approaches. Teachers' learning is highly influenced by their experiences, encounters and beliefs, which were not constructed within a short period of time, but have been tested in a number of different settings until stability was reached. The techniques that could support constructivist teacher educators are those that provide participating teachers (Harry, 1997) with;

- activities that encourages the use of process skills, such as gathering and processing information.
- Skills to properly engage in group collaboration.
- The necessary skills of structuring and asking questions.
- A mechanism to take and understand challenges as events that evoke motivation.

Fung (2000) highlights the views of different researchers who stressed the importance of considering prior knowledge and acquired experience during in-service training of teachers. This could be the basis for successful curriculum implementation. Fung cites Diamond (1993), showing that the in-service programmes that are intended to foster teacher change, must support teachers during their review of current practices and existing views. In this way, we allow them to use their constructs in order to check their effectiveness and hence put forward new meanings as a consequence.

The in-servicing of teachers has to take consideration of and use their developmental and professional achievements, which they gained while teaching and helping learners to improve their learning. It is necessary to properly understand how these achievements impact on learning and interpret challenges encountered such as the assimilation and reconstruction of new knowledge. More emphasis is placed on what teachers need to do to improve their practice with very little consideration of how they internalise what they received in that process. It can be argued that there should be a move towards teacher-centred approaches in teacher development, to ensure that the experiences can help teachers to acquire effective classroom and learning skills. For this to be achieved, staff development programmes should focus more on teacher internalisation and learning, not practice and performance.

This study is based on teachers' understanding, practice and explanation of learner-centred education. The teachers who took part had their own knowledge about LCE and its principles. It was recognised that this LCE knowledge was based on the internal and the external interactions of different artefacts in an individual. LCE relies on constructivist theory, most importantly, its social aspect. Hence, the theoretical underpinnings of Social Constructivism are considered as a relevant guide towards teacher development. It is adopted in this study to help in the understanding of how teachers change as they engage in action research.

3.3.6 Critical inquiry during adult learning

Critical inquiry will be used to look at the management of the classroom with the main purpose of analysing how the teacher and learners work together, the use of learners' ideas and experiences, the ways in which different learning styles and backgrounds are respected and used, and participation and power relationships in the classroom. Managing these differences in the name of effective learning for all requires self- regulation, concern for others and the building of conceptual structures through reflection, discussion and abstraction (Dick, 1991).

Critical inquiry seeks to establish a critical, intellectual inquiry into personal knowledge, its legitimacy and uses. Part of teaching is applying different strategies/methods to develop learners. This needs teachers who are able to analyse, criticise, challenge and rethink their beliefs and perceptions (Sayler, 1984) about learning. In critical inquiry, teachers focus on

the analysis of their practice (teaching), their constructed understandings of LCE and their daily action, in the process of further developing their actions towards helping learners learn Science, than promoting rote learning. Therefore, the type of critical inquiry that teachers engage with fits well with the social constructivist standpoint of Lesotho's policy.

A constructivist professional development approach is able to give teachers the chance to personally construct knowledge through the support provided and in so doing build autonomous teachers-learners (Fung, 2000). This development should provide individual teachers with ways of interpreting and reflecting on the process of learning and teaching.

3.3.7 Implications of teacher development in the constructivist paradigm

In programmes of teacher development, Wetzel (1999) defines different levels of change that might be addressed. The first level of teacher development focuses on techniques and practices, looking at improving implementation of a policy mainly by addressing efficiency and effectiveness. The second level considers how learning takes place when seeking to deepen teachers' theoretical understanding as a tool necessary for fundamental change. At this level, teachers examine their beliefs and explore new possibilities, experiment and reflect on their practices and construct new meanings and new knowledge and skills (Fung, 2000). This requires extensive and intensive work.

The purpose of this action research study was to develop teachers' understanding of LCE and to take them through the process of change and to chart the change process that teachers go through when they effect shifts in curriculum and methodology. The action research process in this study, and the learner-centred approaches it promotes, were framed in social constructivism. Central to constructivism as a learning theory, this study takes the teachers' learning to be an active collaborative process in which teachers jointly try to understand and explain new experiences and build from their groups' existing knowledge structures to accommodate new knowledge.

In social constructivism, the group (not just individuals) is important, just as in action research, hence it makes sense to talk of group knowledge and group constructions. Learning is based on social and physical contexts, as well as personal ones: the surroundings, learning

environment, group dynamics and the beliefs and attitudes of the participants are all important.

Social constructivism recognizes the teacher's learning process as a result not only of interactions with other participants but within the different settings in which their actions were conducted. These include the type of support activities, the role that I played and the different resources provided, such as literature. In essence, the learning process is entangled within the different facets that have been previously mentioned as important aspects of social constructivism.

The action research approach used here was conducted in a framework of social constructivism. The participating teachers and the researchers worked together on a project to improve their knowledge and skills in learner-centred education. The project was action-oriented, through cycles of planning, action and reflection, at each stage using readings, workshops, experimentation in classrooms, reflection and analyses to promote teachers' learning. Levin and Rock (2003) report that when teachers engage in action research they gain new understanding of their roles more so than when other methodologies are used. Action research gives power to participants to bring about change in their own practices (Farren, 2002; Oates, 2003; Reason & McArdle, 2002; Sebela, 2001). Group commitment, as part of an action research project, helps ensure collaboration and achievement (Hughes & Williams, 2001; Bridges et al., 2001).

3.4 PRE-EMPTING CHAPTER 4

Burnford (2001) recognises action research as an effective method of staff development, but also argues that this is valid in a situation where teachers have some autonomy in decision making in areas of curriculum and practice. It is also necessary in situations where there is a need to develop collegial interactions. Therefore Burnford proposes that there is a need for school leaders, at school level, proprietors, those at ministerial and government levels, to promote and support the endeavours towards building confidence in teachers as researchers in their classrooms. This could be achieved through encouraging collegial exchange of ideas, discussing and sharing of classroom research results, and many other methods of dissemination and sharing information internationally through the print and electronic media.

Classroom research seldom occurs in neat cycles (Ashcroft, 1992). This is not because those who do such research are inefficient researchers, but because of the complexity of classrooms settings.

The next chapter will present the methodology that was adopted throughout the study. The literature on action research will be explored as a means of showing the type of action research that was utilised in the study. The chapter will also demonstrate the reality of what happened in the processes of data generation, which occurred after the planning of the study.

CHAPTER 4

METHODOLOGY

4.1 INTRODUCTION

> Ignorance of action research is not a reason to avoid it.
> (Dick, 1993: 7)

The study investigates teachers' understanding, practices and explanation of LCE and the ways they change during a period of involvement in action research into LCE. As indicated in Chapter One, different in-service workshops had been conducted earlier to develop teachers in these aspects but seemed to yield poor results. Given this problem, a more sustained approach seemed necessary, hence action research, which needed to address LCE in classrooms, and be consistent with LCE for participating teachers, as part of their own learning. The research is framed within social constructivism, critical inquiry and principles of adult learning, through methodologies that promote participation, action and reflection.

Social constructivism views learning as an active, situated and social process, which is directed by participatory approaches. Research projects framed in this paradigm centre on participation and dialogue in learning situations (Levy, 2003). This fits well with action research. I therefore carry both the social constructivist standpoint and action research in this study.

Given the focus of the research on teachers' conceptions of LCE and the processes of teacher change, curriculum designs and classroom practices are appropriate objects of the action research process: learning and research will occur as teachers work together towards designing curricula and practicing LCE. Action research will provide teachers with means and encouragement to make sustainable changes in their practices in ways that enhance the learning of their learners (Senese, 2001).

In this chapter I will examine the procedural and philosophical aspects of action research as noted in the literature, and relate them to social constructivism. Different models of action

research will be presented, leading to an account of the action research model adopted for this project. A research plan and strategies will be presented, encompassing the planned activities of the project, the sample, choice of participants and the reasons for such choices. Lastly, the chapter will discuss issues of the trustworthiness of the data, validity, and the methods adopted for data analysis.

4.2 FROM PURPOSE AND PARADIGM TO ACTION RESEARCH

4.2.1 Clarification of paradigm

> Action research is simply a form of **self-reflective enquiry** undertaken by participants in social situations in **order to improve** the rationality and justice of their **own practices**, their **understanding** of these practices, and the situations in which the practices are carried out. (Carr & Kemmis, 1986: 162).

While action research permits a wide variety of actions and research methods, its major purpose is to improve practice through social reflection and discussion by the participants in their situations, and at the same time to develop knowledge. When its primary concern is to improve classroom practice, it is a process built upon testing ideas in classrooms, carefully analyzing and reviewing the outputs of selected pedagogical activities and discussing conclusions, on the one hand for improvements to the activities, and on the other hand for understanding and theorising.

Allen (2000) explains that action research has action outcomes and research outcomes that are strongly interactive. Allen identifies four themes 1) Working together - collaboration, where the researcher(s) and participants influence the process of change and the research (*Participation*). 2) Development of knowledge, which is unique to the extent that action research findings are developed in a particular context (*Reflection*). 3) Social change, and the actions and processes that bring about new practices (*Action*). 4) Empowered participants, who are given freedom to perform as they wish as long as they move towards reaching the agreed goals (*Empowerment*).

4.2.1.1 Participation

Action research is a process by which practitioners sometimes attempt to support each other professionally in an endeavor to study their problems scientifically, so that they can guide, correct, and evaluate their decisions and actions. Significantly, it is a participative method of problem-solving which works towards knowledge construction through the collaboration and effective discussion of results/experiences with others in order to improve practice. Noffke (1993) indicates that action research seeks to strengthen the way teaching is done and the participatory role played by the teacher when allowed to take ownership of the change process.

Bridges, Meyer and Glynn (2001) cite Reason (1988) that action research is a method of carrying out research whereby participants take part in the design of what is to be done, and make appropriate decisions on the focus and the way it will be evaluated. Participants also agree on the interpretation of the results which will play a major role in their daily practice. This highlights the issue of participation in action research, which is not similar to other research approaches.

Action research can be taken to be a participative way of conducting research where whatever is done, is done by the people, for the people and with the people. Emphasis is placed on participation (Bridges et al., 2001; Reason & McArdle, 2002; Sagor, 2000).

4.2.1.2 Reflection

Action research in education is a research process in which the participants, individually and collaboratively, reflect on their work in order to change their practices towards that stage where they perceive their work to be the best. When bringing action research into education, Elliot (1997) and Weinstein (2002) describe it as a way for teachers to critically examine their teaching and beliefs in order to develop methods or compare different styles. Elliot (1997) and Weinstein (2002) go further to say that it is a type of teacher reflection system, whereby teachers evaluate the effectiveness of practice specifically selected to improve certain areas of teaching. It can be adopted by those teachers who wish to develop their practice through critical inquiry into their daily practice and collaboration with others.

Levin and Rock (2003) found that when teachers engage in action research they gain an understanding of teachers' roles, which include the recognition of the teacher as researcher and reflective practice as a necessity in teaching. Therefore it is a methodology that makes teachers "all-time" learners who regularly improve practice, which in turn builds their confidence as professionals. This viewpoint sees teachers as able, potential researchers who research their own daily activities (Noffke, 1997).

4.2.1.3 Action

Action research entails "action" and "research". Research is generally taken to be an activity used to reveal or assess what is happening in a specific situation, with a view to better understanding it, especially through theoretical ideas. Dick (1993) argues that research can be a way of improving understanding not only for researchers but also participants.

Action includes the efforts brought together to improve the quality of some service, performance or condition in a particular context (Allen, 2000). Thus, the action leads to particular outcomes, some of which are in the nature of artifacts or performances, others in the nature of learning and knowledge (Imel, 2000). These outcomes provide indicators of progress and change.

A unique feature of action research is the way in which action and research inform each other during the research process (Figure 4.5). It is difficult to locate this interaction between action and research, whether it starts from action and ends in research or *vice versa* because in reality they are intertwined.

4.2.1.4 Empowerment

Action research gives power to participants to bring change in their own practice. More broadly, it can be a political strategy that works towards giving those oppressed the chance to acquire knowledge and put knowledge to practice (Reason & McArdle, 2002). Sebela (2001) refers to this power as the opportunity given to teachers to practice what "traditional research" has put forward and releases the teacher from the confinement of having to transmit knowledge to learners. Action research could also give power to teachers to challenge their administrative establishments and practices and "un-shake themselves from constraints of

irrational, unproductive, unjust and unsatisfactory social structures" (Kemmis & Wilkinson, 1998: 24). In this process, participants of action research are supported as they deal with the constraints of school cultures and practices, which individually they could hardly challenge, question or address.

4.3 AIMS OF ACTION RESEARCH

An alternative way of defining action research is via its aims. Farren (2002) and Oates (2003) highlight three basic aims for doing action research. Firstly, the goal is empowerment of the participants, as discussed above. Secondly, its aim is the development of reflective practitioners who are critical, accountable, and able to evaluate practice and work with different people or join hands with them to solve problems in practice (Allen, 2000). Hence, action research supports the initiative of developing teachers who can view or reflect on their practices professionally with others. Thirdly, the concerted efforts of actions, which lead to discussion and support, prove necessary for the acquisition of knowledge and understanding (Hughes & Williams, 2001; Bridges et al., 2001). The collaboration during the critical examination of action by those taking part provides a necessary link between theory and practice. Basically this collaboration aims at the production of action and knowledge which are directly useful to those taking part. The participants develop different skills as they look at the practices and critically analyze them. Kemmis and Wilkinson (1998) indicated that not all theorists consider the process of collaboration to be the focus of action research. They see it a by-product for which they did not plan. Hence, it is necessary to deal with it purposefully by directing individual efforts towards the process of understanding and restructuring practice together.

It can be concluded that the aim of adopting action research is to improve understanding and knowledge of practice/actions through reflection. This could be attained by bringing together individuals of similar interests to evaluate, plan and act in the endeavour to improve the situation in which they find themselves.

4.4 A MOVE TOWARDS ACTION RESEARCH

> In my opinion, action research is an important contextualized and personalized agent of change; all teachers should try (Pamnatier, 2002: 3).

For teachers the skill of adopting research in their daily work is a complicated idea, which is not easily achieved nor gained unless there is consistent support. The need for constant support so that such research skills could be developed in teachers and how this development matches with the classroom activities is crucial.

Participants in action research have to give a practical evaluation or judgment in real situations. As was indicated, the purpose of action research is to improve practice at school and to improve the competence of those who are involved in the project. Another highly important aspect of action research is how the process evolved in education even though it was not a smooth and direct development that can be logically captured.

In the move towards action research, there are two important possible trends that make this method a viable one. Firstly, the value for this type of research is that it takes place in the context of action and is linked to action. Secondly, the distance between researcher and researched is reduced through collaboration, resulting in qualitative shifts in the kind of data produced. Through this engagement, the participants/teachers develop and improve their own research skills.

4.5 THE ACTION RESEARCH PROCESS

There are different ways of conducting action research in which most researchers agree on its cyclic nature. Kemmis and McTaggert (1998) outline details of this process. They describe it as a sequential programme for teachers who personally intend engaging in practical research in which they reflect on their actions and evaluate them. Other researchers agree on certain phases constituting each cycle and that these cycles are deemed essential, for the completion of effective action-research. The basic phases involved in action research are planning, observing, acting and reflecting even though researchers differ in the way they propose the order of these phases (Dick, 2000a; Hopkins, 1993; Elliot, 1991; Hatten et al., 1997). Figures 4.1 and 4.2 reflect this effectively. Mann (2002) has indicated that there is no order that can

be said to be correct because in actual research practice, activities do not fit within the mentioned cycles or phases.

The basic phases in every cycle of action research are to plan, act, observe and reflect for a 4 phase model (Figure 4.1). For the 3 phase model (Figure 4.2), acting and observing are contained into one phase. The diagrams demonstrate the hierarchical nature of action research and the increase in quality and standard from one cycle to the other in order to attain research that brings about change and improvement. These cycles are not circular but spiral to show the advancement of each phase.

Figure 4.1: The action-research spiral (http://www.ucd.ie/teaching/res/qua5.htm)

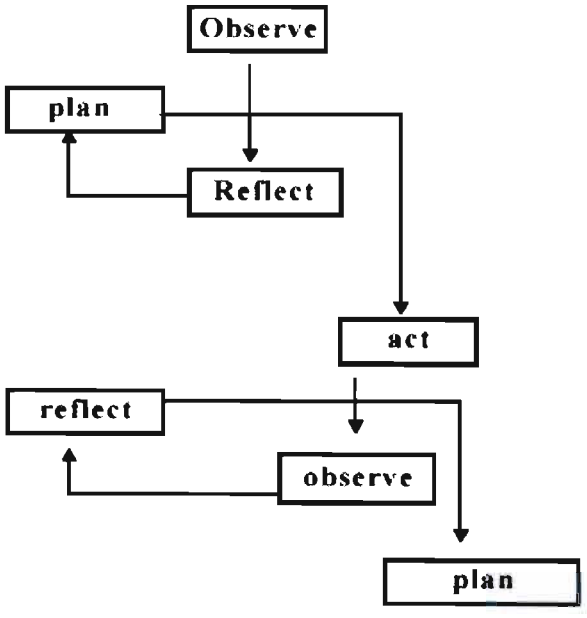
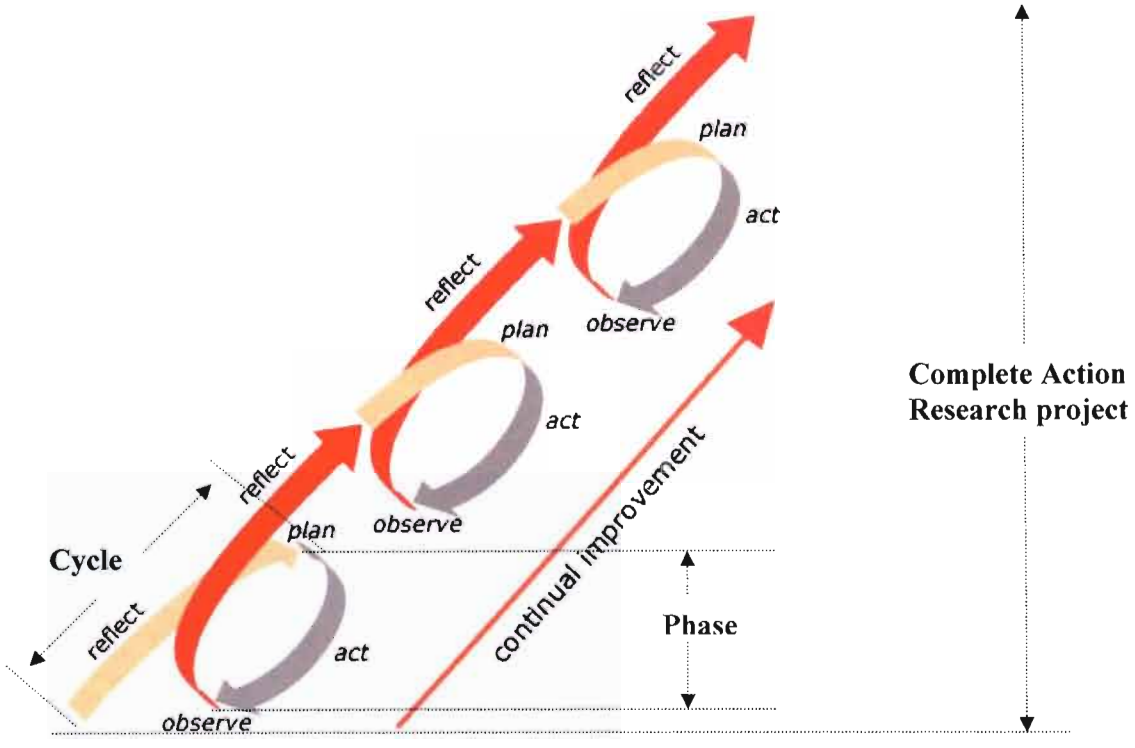


Figure 4.2: The action-research spiral

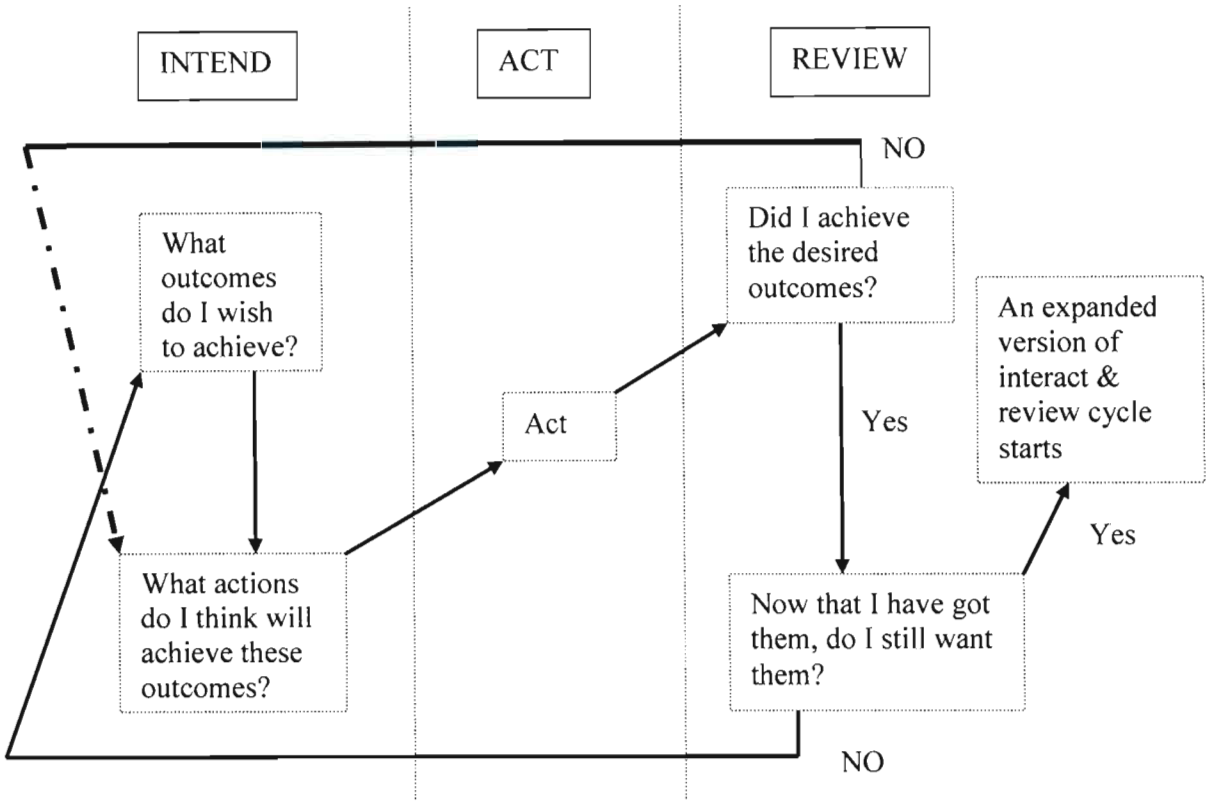
(http://education.qld.gov.au/students/advocacy/equity/gender-sch/action/action-cycle.html



From Figures 4.1 and 4.2, it is clear that this research project adapted the four phases in their own way. Figure 4.1 begins with the observation phase while in Figure 4.2 the reflection phase is the initial one. The arrangement and sequence of other phases seem to be consistent with planning followed by acting, then observation, and reflection.

Dick (1997) does not use a 4-phase model of action research, but recommends a 3-phase model with clear points of return and progress. In this model, if a desired outcome is not achieved there is a route to take. The model looks at the planning phase as made up of determining outcomes and actions necessary to achieve them. Instead of observation and reflection, Dick suggests a review phase in which the actors determine if the outcomes have been achieved and make decisions on how to proceed next. But if the outcomes have not been achieved, the model suggests the necessary review of such actions.

Figure 4.3: The model of a 3-phase action research cycle (adapted from Dick, 1997: 14)



4.5.1 Planning

Hatten et al. (1997) show that in the planning phase of action research, participants formulate a specific mission based on the general goals of the study. The indicators and tools for measurement are also designed (Seymour-Rolls & Hughes, 2000) with an understanding of what would constitute relevant data that fairly represent the unfolding of activities. Prior to the planning phase, participants are expected to know and understand the challenge they are facing. This would assist them in the designing of the project and determine suitable means of measuring its progress.

In the process of planning, measuring instruments that participants can put to action are made, which then establishes an acting phase. When the plan is being implemented, different measuring tools are used. One of the qualities of a good plan and an evaluation tool is their flexibility to accommodate the instantaneous occurrences that seem to be adding valuable angles or views to the study in general.

4.5.2 Acting and observing

In action research the action stretches throughout the research in all phases with different types of action in each phase (Education Project Unit, 1988). Hence it is considered to be complex. The planning phase still encompasses as action in which participants together engage in designing their performance objectives and indicators. The reflective process after activities are conducted could be interpreted as an action in which the participants specifically reviewed their objectives and achievement through performance indicators. Therefore action in this particular situation would be the implementation of the plan via teaching. Hatten et al. (1997) say that in action research, acting is a way of bringing into practice learnt information in a deliberate and properly controlled teaching activity.

Nunan (1992) has highlighted the need for participants to observe that there is a problem or desire to change from one level of operation to a better one in the initial level. This phase is the core of the research since the plan is never complete unless implemented. However, there would be no reflection if nothing has happened.

Observations involve a logical way of writing down special events, reactions and interactions observed during the lesson which are needed for progress evaluation and reflection (Seymour-Rolls & Hughes, 2000). It is a planned process of bench marking the activity and checking the results brought by the plan through specific, outlined methods.

4.5.3 Reflecting

The last phase is reflection, in which participating personnel (participants and researcher) critically reflect on the process of their actions with the help of the data collected and critically inquire into each occurrence. During this reflection, participants determine if their plans, goals and aims have been achieved and establish the suitability of the methods used to measure their performance. It is an individual or group activity of breaking down and analysing the occurrences from which conclusions can be drawn and further critical plans made (Hatten et al., 1997; Seymour-Rolls & Hughes, 2000). The directions and trends of the action research originate in this phase. During reflection, social interactions are expected to

take place to help participating individuals to construct specific knowledge and understanding based on the information presented, which would also shape the way forward.

Reflection is a complex activity that has no beginning and end in both teaching and research. In teaching as a process of dealing with learners' concerns and meeting their individual learning styles, a teacher regularly has to deal with some unplanned events or ideas about a concept. In action research, even before meetings with other participants, different levels of reflection have already been engaged. Hence, formal or intentional (planned) and unintentional (unplanned) reflections, all constitute a necessary experience that could be utilised in the learning construction process of teachers.

4.6 ACTION RESEARCH MODELS AS GUIDELINES

Much happens during action research, with some of the activities and engagements going beyond the realms of the phases noted, making action research a messy methodology. What happens need not fit within the theoretical boundaries. On the contrary, the theoretical presentations of phases and cycles of action research could be taken only as guidelines for those who wish to adopt this type of methodology, with the understanding that it is a free flow activity that is shaped by various occurrences. In each encounter, the researcher has to make a specific decision on how to act, making each cycle unique.

The preceding models of action research talk about major phases in the project, but there are also small steps, such as planning a meeting, or designing a single activity, which are not normally reflected in the literature. In these small steps just as in the phases, reflecting, planning, acting and reviewing are required and essential. The smaller steps in principle contribute to the success of the major phases.

4.7 RESEARCHER AS PARTICIPANT, PARTICIPANT AS RESEARCHER

Most of the situations in which action research is conducted, are initiated and led by an outsider (researcher) who approaches a specific institution in order to fulfil personal and professional interests. Even though action research has been highlighted as voluntary research where participants are to address their own concerns springing from their daily encounters, this does not happen often, which can reduce the commitment of those participating. The idea

of voluntary activity has lost its meaning in such situations, hence as a researcher in this methodology there is a need to adopt different strategies that could motivate individuals to become participants. The inclusion of the support strategy is viewed as a method of acting towards ensuring that the participants feel part of the project. Carr and Kemmis (1986) provide a warning in the case where action research is initiated by an outsider, indicating that this entails some risk.

There is the risk of not being able to place the interests and focus on the same issues for the researcher and participants. Moller (2002) argues that the issue of control of the project normally rests with the researcher, who directs all the activities of the project. But within the framework of social constructivism, I wish to share this power with the participants, with the hope that we could together still attain the purpose of the study. Hence, working towards converging these different interests and focuses to one point is a taxing activity that needs commitment and patience.

4.8 TEACHING AND ACTION RESEARCH

Dick (2000a) and Allen (2002) indicate that the action research project is usually designed to achieve both the action outcomes and research outcomes. He goes further to indicate that there are two ways of doing action research. Firstly, the researcher conducts a study where outcomes are the main source of interest, while the action outcomes are considered to be just fringe benefits for the participants. Secondly, there could be research where primary interest is on the action outcomes with few research outcomes being achieved. Similar to teaching, action research needs in its theoretical basis to cover both the action outcomes and research outcomes and not sideline any of the two. It is therefore pertinent that in teaching like in action research, participants look at ways of controlling and achieving the balance between teaching, learning and the achievement of outcomes.

In Finland, Palmu (1999) found that education seemed to be a field in which working conditions foster action research. This is probably due to the similarities between the two and their compatibility. The other view is that action research tends to give teachers the chance for personal development through professional discussions with others during the cycles in which under normal circumstances they do not engage.

Taking part in action research is an opportunity for both the researcher (who is the outsider) and teachers to challenge their understanding and the practices that contribute to and shape the direction of daily activities in the classroom. Here then was a research opportunity for teachers to explore their practice and work towards its improvement. Most importantly, to bring about change, was the main concern from the researcher's point of view. Teachers' involvement with action research could increase their commitment and make them aware of their role in curriculum development and implementation, which had been minimal in the past.

4.9 THE ACTION RESEARCH MODEL ADOPTED FOR THE STUDY

There are different models of action research that could be adopted. However, the model adopted is the technical model of action research which is usually used by business and is between the consultant and the organization, in which the consultant is interested in change taking place. The present study is considered to be technical in a sense, due to the specific outcomes to be met. It has an interest in improving Science learning through the adoption of LCE principles, which are taken as the key to effective learning. In other words, learners have an influence on the type of outcomes to be seen in level 3 of LCE (Chapter Three) and the outcomes are oriented to social transformation. Again, it was technical because of the concern and focus on pedagogy for learning that the teachers dealt with throughout the study.

The model adopted even though is technical it is a practical one, which involves participants at all stages and addresses different issues. It is a method which values the views, discussions and understanding of participants. In essence, this model calls for power-sharing in the process of action research between researcher and teachers by allowing them to have a say on activities to be done. The researcher played the role of supporter, organiser of meetings and someone who would bring the participants together during the project. He assumed the role of a collaborator and learner during the discussions and data production, depending on the type of activity done. The interactive process between the researcher, the teachers and the proposed change process, facilitated the generation of the data (see Figures 4.4 and 4.5) and the model of LCE which would be constructed. Figure 4.4 shows the type of collaboration between participants (including the researcher) during planning and then doing their individual tasks, which were later reviewed together.

The study takes a 3-phase cycle due to the classroom setting in which both acting and observing occur simultaneously, parallel to each other. The teaching (acting) takes place concurrently with the observation. Hence it would be difficult to separate the two phases. In the process of action research Figure 4.4 reflects the participation framework and the role that the participants and the researcher performed individually and together. This shows that during the planning they were together but during the acting phase they separated and the researcher became the observer while the teacher become the actor.

Figure 4.4: The participation framework

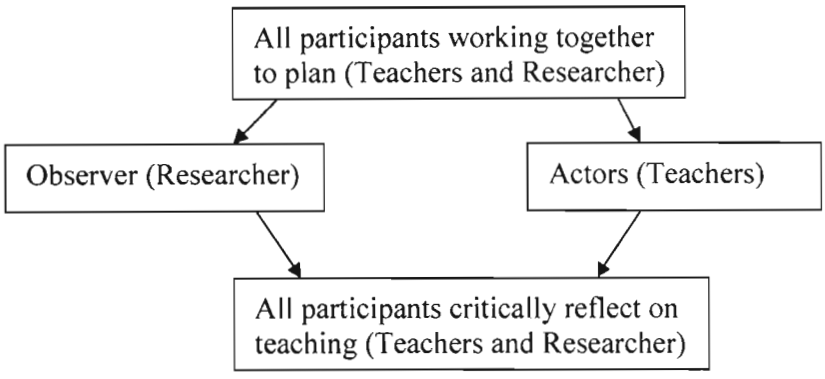
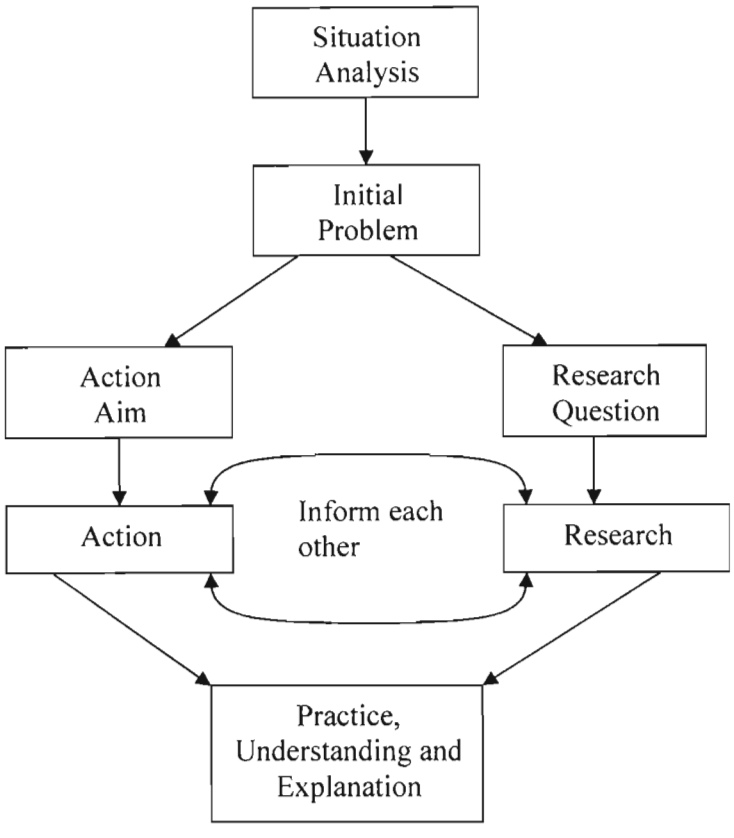


Figure 4.5 demonstrates how the research starts and progresses to its conclusion. The analysis of the present situation gives rise to aims and questions to be answered through research. There are two groups of actors in this model, the participants and the researcher, who have to develop a collaborative and cooperative environment between them to be able to carry out the action research. Hence there is high interaction needed between the actors not only from the researcher and the participants, but also within the participants.

As a process of collaboration and dialogue between the actors, they engage in action and its critical reflection. The desire to understand and explain some of the occurrences they experience in their practice produces data that is analysed, in order to determine theoretically how they would deal with similar occurrences in the next encounter, because the intentional and purposeful acts increase the chances of learning how to deal with such practices.

Figure 4.5: The developed Bamenda Model (Hughes et al., 2004: 12)



The interactive process between the actors and the desire to understand and explain the practices leads to outcomes that could be interpreted as being either positive or negative (see Figure 4.5). Even though the expected product is said to be change, it is change in different aspects such as practice, classroom methodology, general understanding of teaching and learning or the teacher's view of classroom occurrences. This change could demonstrate change for teachers while for the researcher, learning would be demonstrated by the way the teacher facilitates activities. In some situations there might not be any change observed, despite all the efforts made.

The model of action research adopted for this study could therefore be understood as a method of supporting and evaluating teachers teaching in classrooms to improve the quality of practice and learning, by purposefully altering certain aspects of practice. Therefore, the practical model of action research adopted fosters deep interactions between actions, knowledge and understanding through critical inquiry by the actors. This study adopts

practical action research through which the aims of the study would be achieved and the stated research questions answered. The 3-phase model of action research (Figure 4.3) will be adopted with the use of the Bamenda Model (Figure 4.5) as a tool to explain what happens during the action research cycles between the actions and research.

4.10 THE RESEARCHER'S ROLES IN THIS ADOPTED MODEL

> Knowing how to manage the individual and group involved in innovation is key to successful change. (Day, Hall & Whitaker, 1998: 84)

Day, Hall and Whitaker (1998: 71) ask the following questions about a leader who helps in teacher development activity: "Is he or she an authority or threat? A 'process helper' or judge with alien value?" They go further to indicate that the answers to these questions depend fully on the interpersonal relationships formed during the teacher development activity. Therefore the position of the researcher (as leader) has great impact on individual and group participation in a research project.

There are different standpoints that the individual researcher can decide to take in participative research, but in general, the researcher is expected to adapt a more social stance in order to fit into the participants' world or the setting that is to be researched (Adler & Adler, 1987). In this view the researcher is part of the research process and data generation in a broad sense. Adler and Adler (1987) suggest three different levels of participation: peripheral membership, active membership and complete membership.

In my opinion, complete participation would distract me from the focus and purpose of this study, in which I intend to track changes in teachers' understanding of LCE and its implementation. I take note of Adler and Adler (1987: 67) "The complete membership role entails the greatest commitment on the part of the researcher." This requires moving or regularly shifting of positions, not only in participation but also in social and professional ways. Depending on the setting and purpose this would still be achievable.

In this study I took the standpoint of being an active participant but not a complete member. The study was intended to help teachers learn through collaboration, while on the other hand I had to learn through participation in action research as I dealt with the issues, principles and

implementation of LCE. Therefore, in this research project the roles of researcher extended from the stand of providing information and sourcing out support where I felt it was needed, as well as the collection of data. I took part in core activities, but in certain activities I operated only as an observer. One example is in reflection meetings where discussions were conducted. Many times in the beginning of the study, I had to kickstart the discussions by identifying a critical issue in one of the videos observed or audiotapes presented. This was also intended to create some sort of autonomy for the participants in order for them to work independently even after the study was completed. Lastly, as an inspector certain things are not "culturally" acceptable, for example going into a school and conducting a lesson. Therefore I had to maintain the stand of being an active participant.

Even though the teachers were willing to take part as mandated by their principals, there were still those who would not continue to the end nor stay committed given the demands of action research and their personal interests. There was much work to be done by both the teacher and myself. Their participation had to be supported academically, socially and personally. An "adventurous" design of activities that would keep them enthusiastic and committed to the activity and the research, was therefore required.

4.11 SAMPLE

The 20 different schools were requested (by researcher) to send one Science teacher per school to attend an introductory workshop on LCE. Teachers were selected by principals in those schools and came for the introductory workshop. These teachers were from schools in Maseru Central, which is close to the Maseru Teachers Resource Centre. These schools were strategically selected by the researcher. They could travel to and from the resource centre without transport difficulties. It was envisaged that the research process would demand regular meetings. Thus, this required schools to be quite close to one another and teachers who would be committed to the study in its two-year period. The schools had similar ways of administering the curriculum that is set by the MOET. Learners sit for the same examination (junior and senior secondary), have the same period length (see Chapter Five, from the questionnaire) and were given the same type of supervision and monitoring by the MOET.

The schools were also selected because Science teachers in this area had one free afternoon per week. This time was intended for regular district and regional in-service activity, but I

later recognised that the allowance was not practised in the schools that were left in the final selection.

From the sample of 20 teachers who met the criteria, six teachers were randomly chosen using the ballot paper method, to represent all others in the study. This was done because the majority of them were willing to take part in the study. The six teachers were the representative of the general school settings, curriculum structures and teaching experiences. They also demonstrated their interest in being part of the study. During this process of selection, only one teacher declined because he was employed on contract and was not sure if it would be renewed. The six were selected since there was anticipation of the type of support that would be required from me and one another as the study progressed. The small number was adequate to enable the in-depth work anticipated.

4.11.1 The case of School A

School A was in the middle of the town with the shops all round. These shops play loud music all the time with big speakers placed outside. This problem of noise would be prominent during the recording of lessons conducted in this school. The concentration was on the teacher hence the recording targeted him despite this interference. The school offered the 2 secondary levels and had two laboratories for students doing Science. The laboratories were not subject-specific but level-specific with equipment, running water, electricity and gas. Level-specific means that the secondary school (see Chapter 1) used one laboratory while the other laboratory was used by the high school.

4.11.2 The case of School B

School B was located near the busy main road from the industrial side to the town centre. Due to this busy road, recording at this school was a problem because the laboratory regularly used was very close to the road. There were two laboratories, one used by secondary learners while the learners from the high school used the other. The laboratories at this school had facilities (water, electricity and gas), basic laboratory equipment and the relevant teaching charts.

4.11.3 The case of School C

School C was situated outside town and offered Science at both secondary levels. The school had one laboratory that was shared by teachers teaching both levels. There was running water, gas and electricity in the laboratory. Equipment was available that could be used to perform most of the science practical or activities. Situated in the village, there was minimum noise around the school while learners were in class.

4.11.4 The case of School D

School D was in an urban area some 7 kilometres from the town centre with the surrounding houses having electricity, water and telephone connections. There were few classrooms. One classroom was converted for administration purposes. The school shares the site with a primary school. There was no barrier between the two schools and learners moved freely all around the compound even when the secondary classes were still going on. This created a problem during the recording. This room was partitioned to provide a space for the principal and secretary's offices, with a bigger sectioned used as a staffroom for teachers. There was neither laboratory nor Science equipment in this school. In each classroom there were many learners who shared small desks, which were closely packed, and made the process of walking around difficult. The space left in front was too small for the teacher to move. Chalkboards were installed, all new, large and clean.

4.11.5 The case of School E

Two other schools were part of the study but were not observed during the three cycles. The first was School E which was close to School C. The Science teachers from the two schools met regularly to deal with preparation of schemes and discussed different content and methodological issues in their established regional activities. Despite the teacher from School E being an active member of these regional activities, she could not participate in this study. The school is one of those that had many learners (about 900) but only one Science laboratory, which was used by the learners from the two levels.

4.11.6 The case of School F

School F participated only in the teaching that took place during the baseline study. This school was situated in the capital town but some 5 kilometres out of its centre. The school offered Science at both levels and had one laboratory, which had electricity, gas and running water and the necessary supply of equipment.

4.12 INTRODUCTION TO CYCLES

In the initial workshop for 20 Science teachers, they discussed the methods that they were using in their schools when teaching Science. They demonstrated this by preparing the lesson plans for different Science topics. Subsequent to the workshop the selected teachers were to be visited in their schools by the researcher who would observe them teaching. The taught lessons were videotaped and audio-taped, looking at their progress. These observations constituted the second set of data of this research project. The researcher and six teachers analysed the video recordings to determine the needed support strategy, and plan the next steps in the project.

As discussed above, action research is made up of different cycles which are in turn made of phases. There are four cycles to this study: the initial cycle, the "Baseline Study" (BLS), and the three cycles. Each of the phases in different cycles will be introduced in the next chapter. The action research process seems to have a number of different strategies in various phases; hence to ensure continuity, each cycle will be illustrated then the data production instrument will be introduced.

The basic constitution of each cycle involved planning, action, observation and reflections. During the BLS, the teachers did not receive any support. In Cycle 1 there was support that was slotted in which made this cycle unique. In the other two cycles, the support was part of the planning phase and not as intense as it was in Cycle 1. Throughout the cycles the actions, planning sessions and reflection sessions were all identical in a sense. They varied in their organisation and structure depending on the focus of each.

In Cycle 2, teachers requested to observe each other and the researcher was responsible for arranging the processes only. Thus, the moves towards independence for the participating

teachers continued, as their confidence and skills grew. Three lessons were conducted and only one teacher was able to observe the other. The others could not carryout this suggestion because of the time needed to travel from one school to the other, even though the research plan provided for transport. The teachers were to move from one school to the other during their free slots. I had to continue observing the lessons since they would not have time to do it even if they wanted to do so. It is in this cycle that one of the teachers could not be observed as planned, because she had a problem with being at school beyond the "normal time". The lesson had to be postponed to a later date. The teacher did not have the opportunity to reflect on this cycle given different school administrative issues, and so a new date was set.

4.13 RESEARCH AS IT UNFOLDED

> What turns everyday life into research is data and what turns ordinary events into data is recording. (Hughes & Williams, 2001: 2)

Table 4.1 below shows the participation of different teachers during the action research, which made up the "baseline study" as an initial cycle. The other three cycles and the last activity being the whole department dissemination workshops. It has to be noted that no formal attendance registers were taken for some of the activities.

Table 4.1. Teachers' participation information

Teacher	Baseline Study	1ST CYCLE	2ND CYCLE	3RD CYCLE	WHOLE DEPARMENT WORKSHOP
School A **Mr. Khaba**	• Workshop • Taught a lesson • Video Stimulated recall session.	All phases.	Did not participate (on study leave).	Did not participate (on study leave).	Did not participate (on study leave).
School B **Mrs. Motloung**	• Workshop • Video Stimulated recall session.	Attended phases but missed some meetings.	Attended phases but missed some meetings.	Attended phases but missed some meetings & interview.	Participated
School C **Mrs. Thabi**	• Workshop only.	All phases.	All phases.	Participated in the planning and did not teach. She was interviewed.	Did not participate.
School D **Mrs. Lebo**	• Workshop • Taught a lesson • Video Stimulated recall session.	All phases.	All phases.	All phases & interviews.	Participated.
School E **Mrs. Dimpho**	• Workshop only.	Attended meetings only and was not observed.	Did not participate.	Did not participate.	Did not participate.
School F **Mrs. Maki**	• Workshop • Taught a lesson.	Did not participate.	Did not participate.	Did not participate.	Did not participate.

The names used for these teachers were codenames and do not portray anything confidential or personal. They are used to protect their identity to avoid any victimisation that might occur given the results of the study.

Mrs Dimpho (School E) and Mrs Maki (School F) could not continue with the study. Mrs Maki like all the others was part of the initial workshop and the lesson observations in the BLS but did not continue after that. Mrs Dimpho was also present in the initial workshop and most of the support meetings that were held in Cycle 1, but was never observed teaching.

Both teachers were interviewed which provided essential data that is part of the analysis. All other teachers attended meetings and discussions and were also observed teaching in their schools.

Table 4.2 presents a comprehensive summary of different types of data generation methods used in this research project.

Table 4.2: Types of Instruments available for each cycle

	METHODS OF DATA COLLECTION
Base line study Workshop (20 participants); Teaching (3 teachers); Evaluation meeting.	Questionnaire; Discussion Journals; Video lessons; End-of-lesson interviews; Lesson journals; Video-stimulated recall journal.
Cycle 1 Support (meetings & a workshop); Teaching (3 teachers).	Meeting plans (agenda); Teachers evaluation (end of support meetings); Workshop material; Research journals; Teachers' produce materials; Video lessons; Lesson journals; End-of-lesson interview.
Cycle 2 3 teachers.	Meeting plans (agenda); Teachers evaluation (end of meetings); Video lessons; Lesson journals; End-of-lesson interview.
Cycle 3 2 teachers.	Meeting plans (agenda); Teacher's evaluation (end of meetings); Lesson journals; End-of-lesson interview.
2 Dissemination Workshop for departments of the three participating schools.	Journal; Discussion notes; Meeting plans (agenda); Research Journal.

Different data generation tools were used. Below are some accounts as to what each entailed and why each was necessary in this research project.

- Questionnaire (Appendix C) The participants were from different schools, different proprietors and different schools, with different administration strategies. The method was mainly intended to determine critical policy issues of the school such as what was going on with its administration, departmental organization, availability of resources and how the schools adopted the Ministry of Education and Training documents that offered guidance on period allocations etc. The action research methodology requires close collaboration between the participants and it was necessary to determine their background and most importantly their biographical information via a questionnaire.

- Lesson journals/Transcriptions (Appendix E) These are the representations of the lessons that were observed, audiotaped and video-recorded, which were to be used as the basis for analysis, group discussions and planning of what would follow. This is presented in narrative form in the thesis, but not in the discussion sessions with the teachers. Only the tape and video recorded captions would be used in the latter.

- End of lesson interview These interviews are in the form of recorded tapes, which were transcribed. Information was used to determine the teacher's self-assessment with reference to the proposed plan made during the planning sessions. They were helpful as they elicited the teacher's comments on how the lesson proceeded and whether it was learner-centred or not, while memory was still fresh. For the purposes of discussion, the lesson tapes were played during meetings and reflective discussions followed. This was important: as some of the lessons were not video-taped, there would be no visual stimulation to recall sessions.

- Video and audiotapes It was planned that the lessons would be videotaped by another person in order to be used in the stimulated review and reflections sessions/meetings. However, only two out of four were videotaped. Both the video and audiotapes were going to provide an indication of what individual participants did in their classrooms. Audiotaping was done in all the lessons conducted in the study. The video camera was hired and the person who provided it was supposed to be informed about the times for the lessons. However, because of events in the schools, lessons were often postponed or cancelled, and the new schedules did not suit the video personnel. The other issue in this videotaping process was that only one cameraman was informed about the study, hence not everyone would be in a position to engage in this activity. Locating a video in a classroom where the focus was on the teachers also seemed problematic because of voice interference from outside the classroom and having to capture only one section of the class at a time.

    - Research journals Research journals were made by participants and/or researchers and are considered to be another useful tool that could provide a record of what happened. This includes the invitations, descriptive encounters with participants, ideas, plans made by the researcher and other reflections. The journal was used as a record of

daily, weekly and monthly occurrences in the research process. Project teachers were requested to keep their research journals and to submit them at the end of every cycle as agreed. A good journal is both a record of events and a record of reflections. It is significant that the teachers did not keep them.

- Meeting plans (agenda): The agenda showed what was discussed during the meetings in different cycles. In the reflection meetings there was no agenda prepared in advance, but teachers' reflections were used to generate one. The different records provided the basis, target and intentions of a particular activity and this necessitated the evaluation of process from the individual to the group. Methodologically this is important, because it is an expression of participation and grounded theory, as well as a demonstration of preparedness to let the project shape itself by not firmly setting down in advance what is to be done in cycles.

- Stimulation recall This is an activity where participants watch the video or listen to the audiotapes recorded during the lesson when they were putting into practice the set cycle plans. Stimulated recall is used to set up informal discussions with the participants on the common issues with which they are engaged (Constable, Cowell, Crawford, Golden, Hartvigsen, Morgan, Mudgett, Parrish, Thomas, Thompson, Turner & Palmquist, 2005). Even though this method is seen as a way of stimulating discussion, in some situations participants could not keep the discussion on track or kept quiet (not participating). The discussion also depended on what was actually captured on video and audiotape, and the recording quality. Sometimes, it was easy to be distracted into trying to hear a particular conversation when in fact that conversation was not particularly significant to the study.

- Discussions Reports The reports were produced by teachers in their groups during the meetings and workshops. They recorded the activities and the responses that teachers provided in some occasions in their groups or individually. Skala, Slater and Adams (2002) recognise group discussions as a rich source of data in qualitative research. They are able to tape down discussions that are going on in groups for better understanding of their thinking, collaborative contributions and process. The groups are unique settings in which dialogue, debate and individual participation are

expected, hence the reports provide relevant information that is needed to answer the set critical questions.

The reports, of course, offer information only on the specific subject that was the focus of the discussions, and even then may not capture the discussion well. To add more flesh to the reports, groups and individuals were requested to present orally before they could be adopted as records, and during the presentation I (and others) took notes. As a group, we made report writing a responsibility of one or another of the teachers. I also kept my own notes and journal, which I could use to support the reports.

- Teachers' materials These are the activities or lesson plans designed during teachers' meetings to demonstrate to each other what they were talking about. The role of the materials they produced is similar to that discussed above. They were important sources of data, as practical representations and demonstrations of the teachers' understanding of LCE.

- Unstructured interviews These interviews are also considered to be useful methods of data collection in qualitative research. Participants tell stories on what interests them, on how their schools are functioning and what they perceive as their role in the performance of the schools (Skala, Slater & Adams, 2002). The person conducting an interview should possess social skills, be motivated, nonjudgmental and trustworthy (Ruane, 2005). Despite being a straight forward process of asking questions and getting answers, it requires a person who is able to ask suitable questions and use an appropriate tone at various points as the discussion progresses. To facilitate truthful responses, the interview should be informal or conversational in nature. There are two sets of interviews that were carried out, end-of-lesson interviews and the interviews of the teachers who did not take part.

  The end-of-lesson interviews provided the recorded summaries of discussions that the observer had with the teacher who was teaching that particular lesson. Information gained was used to determine the teacher's self-assessment with reference to the proposed research plan. This would provide insight into the teacher's thinking, understanding and self-evaluation based on some of the specific happenings in that

lesson. They would be helpful in eliciting the individual teacher's comment on how the lesson went and whether and why it was learner-centred. This was important, as some of the lessons were not video taped.

The second set of interviews were directed at the teachers who did not take part in the study in an endeavour to determine the why they could not take part and what was their understanding of LCE.

Marshall and Rossman (1999) show that interviews, whether structured or unstructured, have different limitations. The results or answers from the interview could be influenced by the setting in which the interview is taking place. To address these issues, interviewees are given the opportunity to select the place where this activity could occur. Those being interviewed can provide false information and may not be willing to be part of the activity, hence the buy-in process that makes the interviewee know the importance of the information that he is about to give could be helpful. The audiotaping of the interviews helped to address some of these concerns about the interviews.

- Observations (Appendix B) Marshall and Rossman (1999) indicate that observation is fundamental in qualitative research as it is able to pick up relevant occurrences as they happen in a real setting. Observations are made in the form of notes which are non-judgemental but provide a rich description of those occasions. The notes would also be used to bridge the gaps between the explanations, understanding and practice and are reviewed at the end of the lesson interview and during the reflections. Initially, a specific document was intended to be used for this purpose, but it was found to be restricting and unfocused: the details and dynamics of particular lessons could not be adequately covered in a general observation schedule.

  The schedule has to recognise the different categories and characteristics of teaching. More often the structured schedules do not reflect the realities of classroom. Hence, a decision of abandoning the schedule was reached here and the observations proceeded without any instrument or checklist. Nevertheless, the schedule assisted in clarifying a theoretical framework for observing the lessons. The observation method requires a great deal of experience and the specific individual should always focus on the

necessary aspects of the research. These issues pose a great challenge to the individual doing the observations.

The documents (lesson journals, lesson transcripts, teacher-produced materials, meeting agendas, meeting reports and research journals) that are discussed above, are generally able to provide valuable information for the understanding of the group interactions, individual participation/involvement and a rich record of activities. They still have challenges in terms of their use, since their interpretation lies fully with the researcher or the person who is analysing them (Marshall & Rossman, 1999). In some cases, the records represent the summaries of thoughts.

4.14 ANALYSIS OF DATA

Data were collected in three domains: teachers' understanding and practices in LCE, processes of collaboration and action research, and teacher change. From there, the study tended towards a grounded theory design, whereby the data generated would guide and shape the theory. Leedy (1997) shows that grounded theory research begins with research questions, which are broad, and therefore allows the researcher more freedom. The researcher is able to interrogate the data deeply, in order to generate theories and solve problems that have not yet been solved.

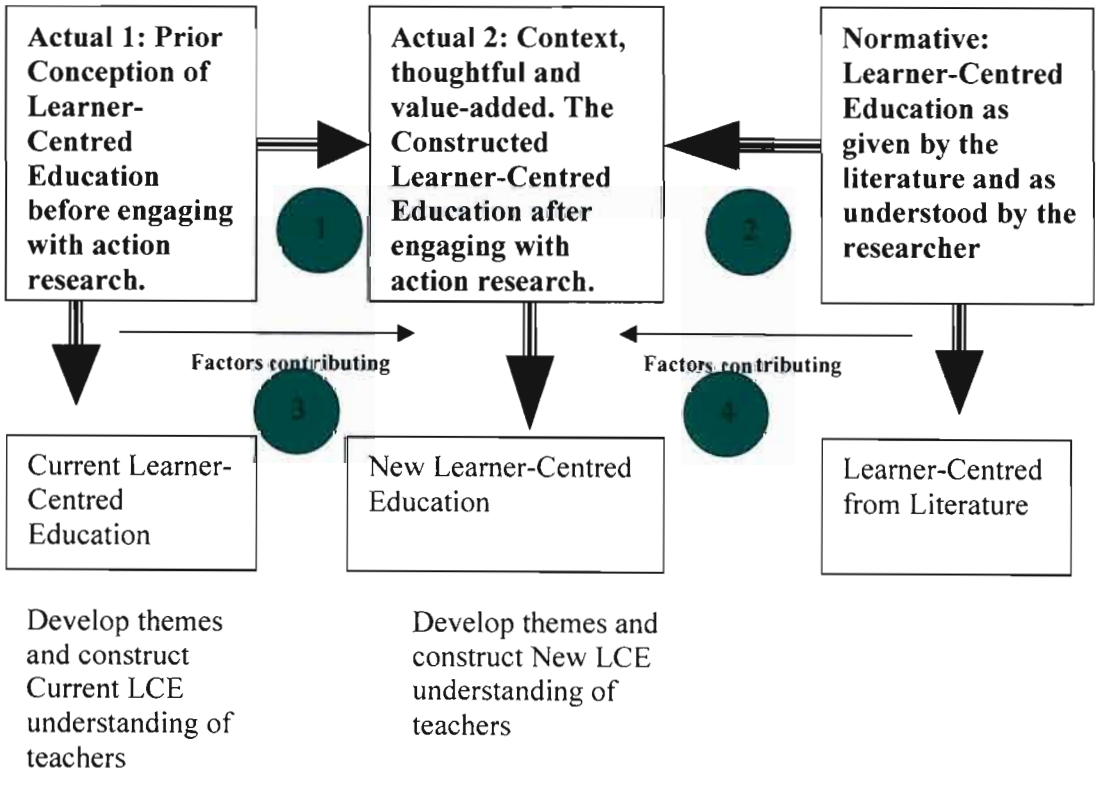
The analysis in the LCE domain is shown schematically in Fig 4.6. The conceptions of LCE in the rectangular boxes are linked together by processes, labelled 1-4.

1. Consistent with the grounded approach, the data on teachers' conceptions of LCE at the start of the project were analysed to yield themes of LCE that were later used when determining changes in conceptions. The analysis will look at their prior understanding, explanation and practice of LCE and how it is changing or not changing as they engage in action research.
2. The learner-centred model that was formulated from the literature was a second input to the change process. In many ways, this is a normative conception, carrying the authority of research and policy. At the same time, however, variations exist which show that this is far from a single conception, so the important 'ideal' here is the one the teachers defined, on the basis of the literature. From this 'ideal' and the teachers' original conception emerges the teachers' 'new LCE'. Throughout the research, the

teachers and I kept open the option that their 'new LCE' would not be a pale imitation of the 'ideal', but a better conception, defined in the context of Lesotho schools and Lesotho life. Thus there were elements of grounded theory in analysing all three conceptions of LCE in Figure 4.6.

3. Beyond the analysis of the different conceptions of LCE, the researcher wanted to understand the individual and group experiences that seemed to give rise to the observed learning, as a result of action research.
4. Lastly, the analysis looked at teacher change in the personal and professional senses that seems to be observed in different activities such as lessons and meetings. The concern here was not only for change, but also motivations for change.

Figure 4.6: The analysis of LCE

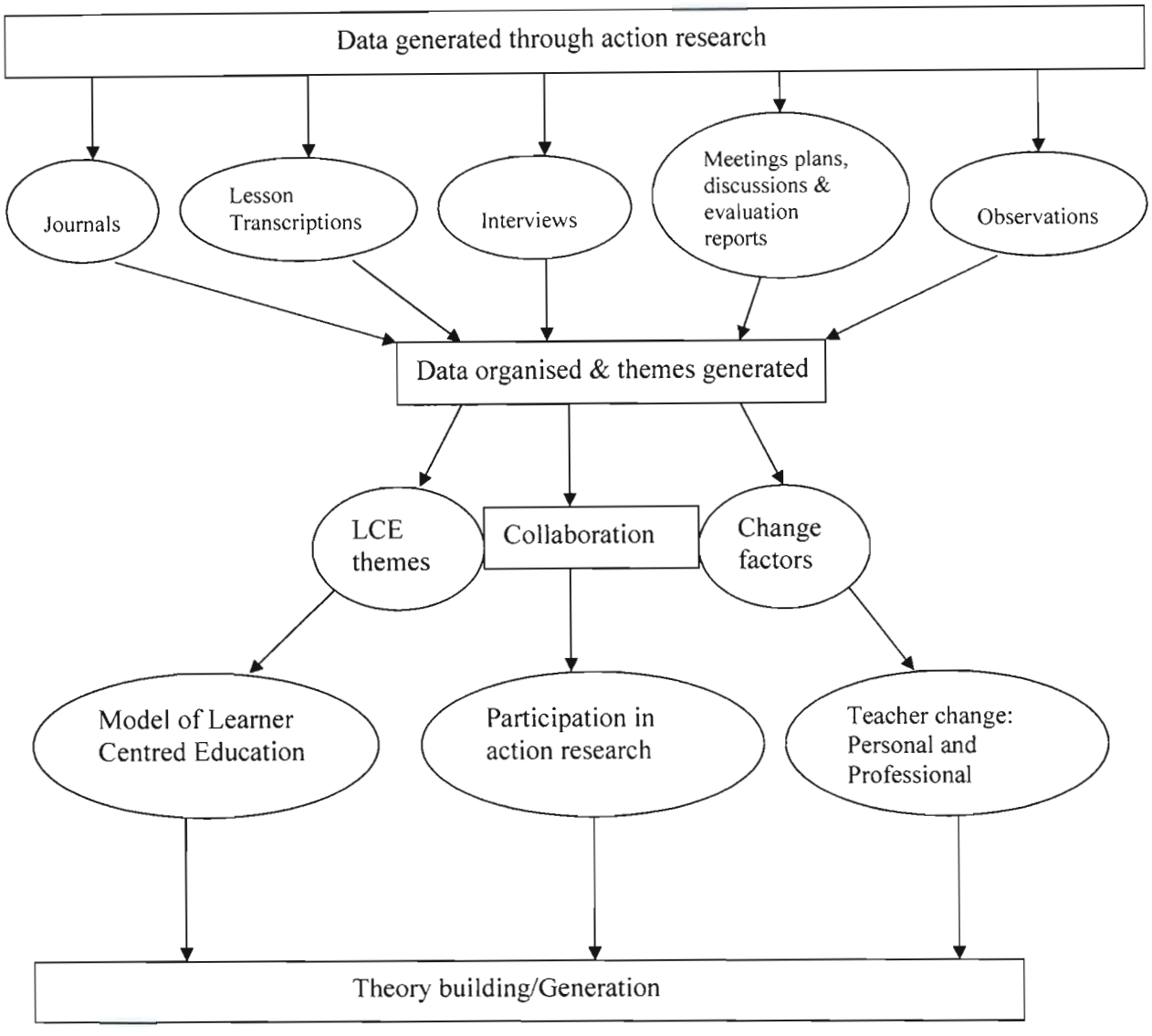


The graphic in Figure 4.7 provides an alternative schematic of the analysis, and the logic of the process. Three levels of analysis were conducted:

1. Initially data from all the sources were organised into emergent themes
2. Themes were classified in three categories, LCE, collaboration and change factors.

3. Lastly, based on the analysis in (2), new categories were established which were a) the model of LCE after action research, b) the participation in action research and c) the teacher change aspects.

Figure 4.7: The diagram representing data collection and analysis



4.15 VALIDITY IN THIS ACTION RESEARCH

When talking about validity in this study there are three aspects that are considered. First, the validity of the instruments in relation to the research purposes, which included teacher development as well as theoretical knowledge. The data were generated in different ways,

which will be used to address the set outcomes. The issues of validity are based on the ability for activities, instruments and methods to provide necessary claims and arguments within the aspects of theoretical knowledge and teacher development. The different levels of data collection as in the BLS where three different data sources were used, provide rich information about teachers' knowledge in the larger group of 20 and later verified with a few during practice. The issue here was that despite being few in number for the rest of the study (from Cycle 1 to 3), they demonstrated that they were in line with what their discussions about LCE were during the workshop for 20.

Second, the validity of the processes and/or of participation in the study is considered. Even though the numbers of participants (from 20 to 6) decreased as a purposeful decision, and later some dropped out (from 6 to 3), this brought up the issue of generalisation of the results. In the smaller number, their engagement and critical involvement with issues of knowledge and practice strengthened. It was also important to maintain freedom to participate, which was not due to management forces or my powers as an inspector. Therefore, freedom to participate at all cycles has been a personal choice, which made the discussion and all other activities worthwhile.

Lastly, there is a need for validity of the representation of the teachers throughout the report. The participants were to read the transcriptions and the analyses, and make comments, which were later be captured. Leedy (1997) calls this "member checking," which is the review of the data sets produced. This would also provide some degree of validity in the arguments brought forward. It is not just a matter of academic work or achieving the results for the study, but more to do with keeping the trust placed in me while engaging with me and allowing me into their classrooms.

4.16 CHALLENGES AND LOGISTICS

The original plan to work intensively with teachers over a two-year period, proved difficult, requiring creativity and flexibility on my part. Challenges to the project came from three directions: the management of schools and the project; conceptions of learning and leadership; and issues of roles, especially while I worked formally as an inspector of schools.

On one occasion the selected day for observing a teacher from one school had to be changed because the night before thieves had broken into the school and taken some assets. The teacher had to take part in the process of reporting to the police. A new date was set, but on that day the teacher did not even use any of the suggested activities that were made available during the planning sessions.

There were other issues that emerged at schools, and the first concerned timetables. In one situation, we arrived at one school for observation and there was no school timetable. Despite schools having been open for three months before the research started, some of the schools in the project had not finalised timetables. The teacher had negotiated a double period and the lesson continued. This posed a great challenge when preparing for classroom observations for the researcher and the video personnel. The recording in the same school was a problem because learners from all other classes were not in class or not being taught due to the lack of a timetable and were moving from one room to another with a lot of noise. It was a problem too for the teachers, in organising their own work, and when they wanted to invite other team members to meetings or to observe classes. Then, even when timetables were finalised, they were often changed, so that planned observations and video-taping had to be rescheduled on short notice (and sometimes could not be done at all).

Another challenge arose from the choice of Form A as the class involved. Form A was selected because its learners had two more years before they sat for the external examination, so there was some freedom in what the class did. However, for this same reason, every year from January to May, this class was used by practising teachers (teacher trainees) from nearby institutes. This was an additional demand on the teachers, the learners and the school administration. In some situations when lesson observations were planned, a different class had to be used.

The choice of six participating teachers at the start of the project seemed adequate and appropriate at the time, especially given their enthusiasm, and the availability of one afternoon a week for the project. However, the demands of the project on teachers and their time proved challenging: the demands of their schools, families and social lives, and changes in meeting times compounded to make it difficult to get all the teachers together and maintain their commitment.

The use of video and audiotapes for 'stimulated recall' proved unsatisfactory. Partly this was because of difficulties in scheduling, so that the video operator could be at the lesson. Partly it was from limitations of the video and audio recordings – both in what they 'saw' and didn't see, and in the technical quality of the sound. There was also a further challenge: the time taken to review them. Most of the lessons observed were one hour 30 minutes, so four teachers together produced 6 hours of audio-tape and 6 hours of video tape. Before our meetings to discuss reflections on the lessons, the teachers had to watch or listen to these tapes, and they did not really have the time, especially given the limitations of the tapes themselves. Thus direct classroom observations proved more effective, where the observing teacher could direct his/her attention, and be an immediate participant in the class.

There is one other issue based on the paradigm in which the researcher and the participants are framed that needs to be noted. It is difficult for a researcher operating in a social constructivism to work with teachers who might not be in the same situation. The difference in framing is one of the greatest challenges in the adoption and usage of LCE principles, which is the main purpose of the study. The difficulty arose not in the purposes of the project and the teachers' wishes to develop their understanding and skills for classroom use, but in facilitating the meetings and reflective sessions with the teachers, where they often wanted me to 'tell them' what to do and how to do it. This proved to be an important part of my own learning as well as theirs. This problem of the role that I had to play in the study and my own learning, was compounded by the fact that I was an inspector of schools. These challenges will be evident in the data collection process and presentation, where these two were shifting and interfering with the processes sometimes during the discussions. In some instances, it was evident that teachers were expecting me to give them instructions and I was also tempted to do that, but this temptation had to be controlled in order for the teachers to take responsibility for their own practices.

As an observer in the lessons conducted, my challenge originated from the role of inspector, as determined by my job description. As an inspector and a regular lesson observer, the focus or scope of my work is normally broad, starting from the general school administration, teachers' planning and policy implementation and learners' participation in both academic and non-academic activities. I had a struggle shifting from this position to a more focused one that is based on the goals of the research project.

Action research is effective when the research itself is initiated by the individual who is going to be a participant. In this study I as an inspector (the outsider) initiates the research in schools, with the aim to see policy practice change as expected by the Ministry but this can create difficulties and some resistance from teachers. I was leading the research project but still maintaining the position and status of my work and the demands of my work. The relationship between the inspector and teachers was highly challenging in situations where at 10:00 in the morning the researcher had to visit a teacher to work on the project and later come back at 14:00 to talk about office work, in different roles and relationships.

The teachers who were participating in this action research were part of a bigger group of the community of teachers in Lesotho, which has been interacting with the office of the inspector. They were not immune to the relation problems and influences that faced them at different levels. The two groups (inspectors and teachers), where they work together, mostly do not see eye to eye in terms of practice and school management. This posed a problem that had to be dealt with by ensuring that the study did not bring in the influences of the inspectorate office but built suitable relationships between the two groups (inspectors and teachers).

4.17 PRE-EMPTING CHAPTER FIVE

The next chapter will present the descriptive data that was generated from the baseline study, the different cycles, the meetings, workshops and the teachers' interviews. The different lessons observed will be presented with special emphasis on those instances that have been identified. There is an account of the interviews of the two teachers who did not take part in the study despite being nominated by their principals and attending the initial workshops and other meetings. The data presentation will follow a structure where Stage 1 will focus on the BLS, Stage 2 on Cycle 1 and Stage 3 on both Cycle 2 and 3. This layout will also be used in Chapter Six.

CHAPTER 5

DATA PRESENTATION

5.1 INTRODUCTION

This chapter presents the data from the initial cycle, named the "Baseline Study" (BLS), through the following three cycles. Each cycle will be introduced, followed by the account of its purpose. The process of data generation will also be presented for the cycles. The results will be discussed depending on each research tool or strategy and the different activities conducted.

5.2 STAGE 1

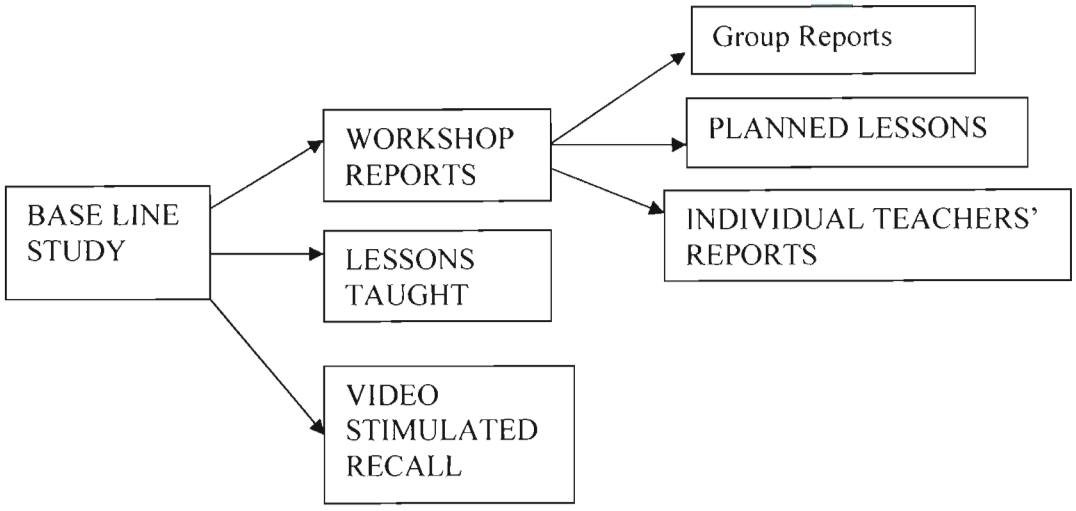
5.2.1 Introduction to the Baseline Study (BLS)

The BLS was intended to establish teachers' understanding, explanation and practice of LCE prior to action research as a way of answering Critical Question 1. This cycle has three areas where data were generated: the initial questionnaire, workshop, the lessons taught and the video-stimulated recall meeting. A workshop was held in order to give teachers the opportunity to communicate and explain their understanding of LCE. There were three main sources of data from the workshop: the group reports, the lessons planned and the questionnaire. The workshop was followed by school observation visits in the participants' schools where they were observed teaching the lessons as they regularly or "normally" do. I observed the lessons and audio and video taped them. Lastly, the six teachers met to watch and listen to the videotapes (video-stimulated recall) and then they discussed the process of teaching that was taking place in each of their lessons.

5.2.2 The process of the Baseline Study (BLS)

The BLS was intended to determine the teachers' conception of LCE from three perspectives: what they say from the workshop, what they do from the lessons conducted and how they explain it in the reflection meetings. The diagram below shows the three different areas of data generation from the BLS.

Figure 5.1: Data sources for BLS



5.2.2.1 The Questionnaire

The results from the questionnaire provided information on the backgrounds of the 20 teachers who attended the workshop. The questionnaire explored their personal background, the school's administration (the Science Department) and the teaching practices that they commonly used at school. There were 11 males and 9 females, with most males between 21 and 34 years of age and females spread between 25 to 40 years. Nineteen of the teachers were qualified to teach Science (with a degree or diploma or certificate with education) at a secondary or high school; one had a Science degree but without a teaching certificate. The average teaching experience was 5 years, with one teacher having been in the profession for 21 years. Most were recently recruited teachers.

From the information that was provided by the teachers, the Science departments in their schools were not formally operating in more than 50% of the schools and in those schools where the departments operated formally, the issues that they dealt with varied with respect to administration and curriculum. A few schools (25%) had formal departmental meetings while others rarely had any meetings.

The schools also varied in their interpretation of the government documents about the teaching of Science. From the government policy documents, Science should be given 6 periods (of 40 minutes) per week. Some schools had three 80 minutes periods. Others

presented all six as single periods, with a few schools allowing one double period per week for practical work. The main contributing factor to the period structure was the availability of laboratories. All schools had at least one multipurpose laboratory for Biology, Chemistry and Physics, shared by all the streams in the school.

Lastly teachers provided some information about their teaching practices. Most of them showed both teacher and learner-centred approaches, indicated with specific examples under each as their current practices. They identified demonstrations, experimentation and lecturing as their basic methods.

5.2.2.2 Workshop purpose

The main purposes of the workshop were to establish the teachers' understandings of government policies and LCE, the teaching practices they used and how they felt the teaching of Science could be improved in order to ensure effective learning. The workshop was designed to engage teachers in discussions and simulated classroom teaching activities to explore their understanding of LCE. Teachers went further to identify the prohibiting factors or the reasons why they teach in the ways they do, including the benefits of various methods.

5.2.2.3 Process of workshop

As explained earlier, the workshop involved 20 teachers, and was conducted over two days. At the start, the participants selected two teachers to facilitate the two days, and completed the questionnaire. Then teachers, working in groups, prepared lessons (for 40 minutes) that they saw as learner-centred. They conducted those lessons with others in the group enacting Form A learners. The records of these activities were submitted at the end of the workshop. The lessons demonstrated concern with content, and the use of structured group work activities. These lessons stimulated discussions on issues related to the roles of the teachers in classrooms, the type of activities offered, the use of different materials in activities and the lesson plan structure.

The teachers then moved to design topic outlines for Form A, giving suggestions for the number of periods per topic and showing the subtopics to be covered. This activity was intended partly as a way of ensuring benefits to all who had come to the workshop (those who

would continue and those who would not), and partly to explore ways in which LCE might be built into the design of a topic, rather than a single lesson. As part of their plans, the teachers indicated the different methods in LCE that could be adopted in order to achieve the required instructional objectives, cover the necessary learning areas and provide necessary evaluation.

5.2.2.4 Workshop results and responses

The teachers, when talking about learner-centred education, raised certain expectations they had of the teacher, the learners and the teacher and learners together in relation to the participation and the progress of the lesson. For example, they felt that in LCE, the teacher should help learners to find things by themselves and ensure that more work towards learning is done by the learners than by the teacher.

Under LCE methods, teachers suggested practical work, demonstrations, questioning, and research or assignments as the methods they were going to use. One group suggested field trips as a way of providing more hands-on and interactive activities. At the same time, most groups noted lecturing as an important way of achieving their objectives within the required time.

After this activity the groups prepared model lessons for Form A Physics topics. For example, one group prepared a lesson on a simple machine using the locally available examples and various strategies of learner involvement.

The workshop discussions indicated some confusion between teaching methods and teaching approaches. The issue here is whether "learner centeredness" is an approach or a method. For example, Imasiku (2000) points out that LCE is an approach towards teaching, while it is likely to incorporate a number of particular methods (techniques), such as brainstorming and projects. Any method can be conducted in a way that promotes or works for learner-centred education. Learner-centred and teacher-centred in one group were considered to be teaching approaches under which specific examples of teaching methods were given. For example, under teacher-centred approaches they gave lecturing and teacher demonstrations as two main examples of methods.

Table 5.1: Explanation of different approaches and methods from the questionnaire

TEACHING APPROACH	**DESCRIPTION GIVEN** (number of teachers who mentioned this approach)
1. Lecture	The teacher does most of the work and gives notes. A teacher tells students the facts. Much talking from the teacher (8).
2. Question and answer	The teacher asks questions and learners respond (2).
3. Demonstration	The teacher is assisted by one learner to do the activity. This is done to show students' experiments that are considered dangerous (dangerous chemicals) or where there are few materials (8).
4. Guided discovery	Students work on their own to learn in the laboratory. Making students discover on their own certain concepts. The teacher supports by probing questions and guides (8).
5. Discussions	Discussing the answers (3).
6. Investigations	When the teacher wants the learners to go beyond what is taught (1).
7. Research	Pupils find materials on their own and conduct a research (2).
8. Practical/experimentation	Investigating what has been taught or is to be taught. Students are given relevant materials and they perform an experiment (4).
9. Learner-centred	The learners do most of the work and activities. Pupils are mostly active and find things out for themselves. Learners are expected to generate the required information but this is difficult in classrooms with more than 45 students (8).
10. Teacher-centred	The teacher talks and does not allow learners to actively participate. That means explanation and demonstration are done by the teacher (2).

5.2.3 School observations

Of the six schools that were part of the study only three could be observed as part of the BLS. The main reason why the other three teachers could not be observed was the schools' commitments to teacher trainees. The following are the descriptive accounts of those lessons conducted in School A, D and F. The lessons described were offered as examples of LCE, subsequent to the workshop.

5.2.3.1 The case of School A

The lesson started with a reminder of what was done previously and then the new concept that was going to be discussed was introduced: electromagnetism. The teacher wanted to do a

demonstration, and wrote a step-by-step procedure on the chalkboard. The equipment that was going to be used was set on the demonstration desk and all learners were requested to come around the desk. One learner was selected to go through the procedure on the board while other learners were to observe what was going to happen. The purpose of the activity was to determine the magnetic field around a current carrying conductor, using magnetic compasses. During the activity, the teacher was standing behind the learner who was doing the demonstration, also observing and reminding the learner of some of the necessary precautions. The learners saw that the magnetic compass needless moved, and moved in different directions. The results were discussed and then the teacher explained what happened with reference to magnetic effects of the current, and the attraction and repulsion of poles of magnets.

The second part of the activity was to determine the magnetic field around a coil, which was an extension of the initial activity. As in the first demonstration, the teacher gave the procedure and a learner was selected to connect the set-up. The magnetic compass needles gave different results, some did not move while others (few) moved in different directions. When asked by the teacher what they expected, the learners said they expected the compass needles to face the same direction in this activity.

The teacher talked about the expected results and requested the learners to sit down and write in their books what they had observed. The teacher went around checking learners as they drew the set-up of the demonstration in their notebooks and showed the results. One of the learners drew the needles facing in different directions. The teacher instructed the learners to show the compasses pointing in the same direction, but they did not agree with that. As he was going around, the teacher noticed that learners were not willing to accept and draw what they did not see happening during the activity even though he told them what was expected. The teacher concluded the lesson by promising that the activity would be done again for learners to be able to observe what was expected. The teacher felt that the lesson was a success, because it achieved the set outcomes. The confusion about the observations and their meaning was seen as a result of the faulty equipment. The lesson was considered as LCE because the learners were engaged in an activity and the interpretation of the demonstration.

5.2.3.2 The case of School D

The teacher greeted all learners, introduced me and the cameraman, and allowed the learners to settle down before starting the lesson. The teacher was standing in front of the class, and occupied this position for the rest of the lesson due to the lack of space anywhere else in the room. The classroom had two-seater desks which were occupied by three or four learners. The teacher talked in a friendly voice to all learners, and took care to turn her face to learners around the classroom. At any point when she asked a question, almost all the learners raised their hands saying "Madam! Madam!" They were eager to answer the question. The seating arrangement did not allow learners to form groups other than those defined by each desk.

The teacher reviewed the previous lesson, which concerned sense organs and especially the ear. The parts of the ear were discussed, based on the knowledge from the previous lesson, and they then proceeded to consider the skin. Learners discussed the functions of the skin and the teacher asked them questions as they were discussing. The next organ to be discussed was the tongue, but this discussion was disrupted and made difficult because it was break time for the adjoining primary school, and noise was coming into the classroom. The learners looked at the functions of the tongue and the different positions of the taste buds. As they were discussing thus, the teacher was writing on the board the points that learners gave, and repeating them as she was writing. Towards the end of the lesson the learners requested to take out their Science textbooks, but only 7 out of a class of 56 had them. So the teacher selected one learner to read from the textbook the section dealing with the tongue. The teacher stopped the reader here and there to explain certain sentences. This took the last ten minutes of the lesson.

The teacher felt that her lesson adopted both teacher-centred and learner-centred approaches. This mixture was a result of the seating arrangement that prevailed in the classroom. She said it was LCE because the learners were given the opportunity to contribute in the discussions of the content, while it had elements of TCE because of the time taken by the teacher talking throughout the lesson. She chose to have a student read for the last part of the lesson in order to reduce her talking time.

5.2.3.3 The case of School F

The lesson was a mixture of topics and activities. It began with review of the microscope and equipment that is used to support vision. Then the concept of time and the stopwatch were introduced, pointing to the importance of using stopwatches and not wrist watches to measure time in Science. The teacher demonstrated how to use the stopwatches, starting from colour coded buttons and their functions. The learners completed some short exercises using a stopwatch. The teacher explained the conversions between minutes, hours and seconds and went further to talk about the conversion between a year and a decade.

The next instrument that was introduced was the triple beam balance, which was not familiar to learners. They also seemed puzzled that it was raised. The teacher demonstrated how it is used, showing the calibrations and the adjustment of the weights and how to add the values given by the different beams. The learners were requested to weigh anything that they wished. The discussion between the teacher and learners went on until the end of the lesson and the learners were then given an assignment, to convert a decade to hours, minutes and seconds. The teacher felt that the lesson was learner-centred in that the learners used equipment to measure time intervals and masses.

5.2.4 Teachers' Discussions of LCE from the initial workshop

Teachers explained that they felt pressure from parents and management to have all learners pass at the end of the year, especially in the external examinations. The performance of a teacher is measured especially by the number of learners who pass the external examinations at the end of the three years for Secondary Level and a further two years for High School Level (see Chapter One). The examinations require that the syllabus has been properly covered, and this puts heavy demands on 'coverage of content' in the time available.

They felt that LCE was too time consuming and the syllabus would not be covered. They explained different ways of losing time in LCE. One was when a teacher had to wait for all learners to reach the same stage before moving to the next part. This was a problem especially in large classes. Some learners would be regularly if not always, left behind. Thus, the basic requirement of LCE, that all learners learn, was an ideal that could not be realised. Other ways in which time was lost was through changes in the organisation of the classroom, and time

taken in discussions etc. There were also resource issues. For learners to be able to handle and use equipment, for example, the school had to ensure that there was enough equipment for big groups, and that it was in proper working order. This was difficult to achieve, because equipment is expensive, and the teachers did not have help in organising or maintaining equipment. A related concern was to do with ensuring safety and order during the classroom activities, especially while classrooms were crowded.

They saw the main roles of the teacher as facilitating and supporting learning through the use of different materials and providing information as required. The question was how best to do this, given existing resources, class sizes and assessment demands. At the same time, they appreciated that LCE seeks to keep all learners involved through activities where learners explore Science in their surroundings and look at its applications in everyday life. They felt that order could be maintained through the careful design of activities. They saw the potential of developing skills through the involvement of the 5 senses. They recognised the contributions that LCE approaches could make to learners' attitudes towards Science, and felt that this could build confidence towards doing Science in the upper classes.

5.2.5 Teachers' Discussions of Lessons during stimulated recall

The teachers' analyses of the three lessons varied. When arguing that the lessons were not LC, they pointed especially to the amount of work the teacher did, compared to the learners. In a learner-centred classroom, they felt, the learner should be at the centre of the learning process and that meant the learner more often than the teacher should be doing the work. On another level they argued for the question and answer method that prevailed in most lessons as a demonstration of LCE: regular interaction between the teacher and the learners was an indication of learner participation and engagement, and provided the teacher with feedback on whether the learners were understanding.

Teachers were concerned about the noise in the three lessons observed and that the responsible teachers were not doing enough towards bringing learners to order. Their concern for noise was not based on any evaluation of whether it occurred "on task" or "off task", but a broad belief that a noisy classroom was not a good classroom.

All teachers who evaluated the lessons looked at the roles of the teacher, but had no particular comments on the methodology adopted, the content and the processes of the lesson. This was perhaps partly because of their knowledge, and partly because they were unsure of how critical to be in this early stage of the project.

5.3 STAGE 2

5.3.1 Introduction and purpose of Cycle 1

Based on the understanding constructed during reflections in BLS, Cycle 1 was intended to develop the principles of LCE, using information from literature and visiting professionals. It would build especially on the idea of caring for learners and learning, and the selection of suitable teaching approaches and context. The group in the planning stages wanted techniques that were not only learner-centred, but would also meet the set outcomes and cover the necessary content. The cycle would draw from constructivist learning theories, pointing to critical inquiry and sharing of power between the teacher and the learners.

5.3.2 The process of Cycle 1

5.3.3 Support phase

In order for the participants to understand LCE and action research during meetings, printed materials were given out and discussed, from journals and books which were related to LCE and action research in education. This phase included also a visit by Prof. Cliff Malcolm (University of Durban-Westville) and Prof. Warren Beasley (University of Queensland, Australia, who at the time was visiting the University of Durban-Westville) to talk with participants about issues relating to LCE in Science. Since the schools were about to close for the winter vacation, only one meeting could be held before the mid-year break. The research process resumed in August 2003.

5.3.4 The first support meetings

This support meeting was held to get an introductory understanding of action research from all the participants (including myself), and to discuss ways through which we could conduct classroom action research. The concept of phases, cycles and collaboration were discussed, focussing mainly on the roles played by the participants. Some time was spent on

understanding and differentiating the phases and cycles, as some teachers were not clear about them even after reading the literature. As the project went on, we would all gain a deeper understanding of the role that the project would play in the practice and understanding of LCE. As one teacher stated later: "The project through its discussions and activities has made me more knowledgeable about LCE and increased the relationships with my colleagues." One advantage they cited was the ability to accept critical comments in a positive way compared to when they first joined the project.

To help us all develop skills in observing and critiquing lessons, short mock lessons were conducted during the meeting and discussed. The discussions concentrated not on content but on issues of observation and critique. The teachers saw from these lessons that it was a challenge to provide a variety of teaching methods that would meet the outcomes, engage all learners, and utilise learners' prior knowledge from earlier lessons and outside school. They realised that observation was complex, and needed some guidelines to be uniform for all in order to maintain the focus. After these lessons we discussed different teaching methods that were used and suggested ways of improving them. Then we sought to bring together the guidelines for observations, ideas about teaching methods and the different aspects and levels of LCE as demonstrated by the literature (see Chapter Two). Throughout, the teachers were alert to constraints on learner-centred approaches arising for example, from the number of learners in their classrooms, the availability of resources and time allocations.

I presented various books, articles and written experiences of other teachers that involved LCE and its principles, such as Halsall (1998) in "Research and School Improvement: Opening doors from the inside". Chapter 5 by Bassey (1998), "Action research for improving educational practice" was discussed in more detail. The chapter looks at the framework for doing action research and explains the phases in an elaborate way that does not merely look at planning, acting, observing and reflection. It also introduces eight steps to do action research which are essential for novices in action research. The teachers read and discussed some of these during the meeting.

Discussions tended to centre on ideas that the teachers identified during their reading, for example "teachers' understanding of learner-centeredness varied and although learners were often involved in group work activities, the lessons remained teacher-centred" (Harris, Mkhomazi, Misser & Sitsha, 2002). The teachers discussed the meaning of this statement and

looked at its implications for their lessons. They showed that group work does not automatically make the lesson LCE, as the interactions between the learners themselves and the teachers are more complex than just sitting in smaller numbers.

As part of the planning, a number of agreements were made during the meeting. Firstly, it was decided that there should be another meeting in which teachers would make plans and discuss their lessons for the Science content set out for the 3rd quarter. Secondly, a plan for the cycle was made in which they were going to work especially on the relationships between teachers and learners. Thirdly, in recognition of the challenges of designing effective LCE lessons, they agreed to make written lesson plans prior to lessons, and spend considerable time on this activity in their schools. Lastly, they agreed to work on the strategies necessary for adoption of LCE despite the working conditions, and record their daily reflections in journals.

5.3.5 The second support meeting

There were three teachers who attended this meeting from the four that were expected. The discussions were lively. They had agreed at the previous meeting to keep journals, but none had. The leadership in these meetings shifted between me and the teachers depending on the activity. To encourage reflection on the action research process, I introduced an evaluation form for teachers to submit at the end of every meeting.

The purpose of the meeting was to explore different ways in which relationships and rapport in classrooms could assist learning, to consider instructional practices that enabled learners to link known and unknown concepts, and relate these more directly to lesson planning and curriculum. The major focus was the relationship between teacher and learners, including knowing learners, providing freedom of participation, and responding to learners' needs in the Science classrooms.

The teachers also wanted to share the issues discussed in our meetings with their departments and schools, and agreed on how they could help other teachers to make the implementation of LCE possible and overcome the problems they might encounter. Agreements were made on the date for the next meeting and when the lessons would be conducted.

5.3.6 The second workshop

This workshop was facilitated by Prof. Cliff Malcolm and Prof. Warren Beasley, who came to Lesotho to work with the teachers.

5.3.6.1 Setting the agenda

At the beginning of the workshop, the teachers were asked what they wanted to gain from the workshop. Their interests included:

i) How to make group work an effective learning process.

ii) How to support learners discussing topics in group settings.

iii) How to build on prior content knowledge to develop the new content.

5.3.6.2 Understandings of LCE

The teachers, as a result of their work in the earlier stages of the project, already had considerable insight into LCE. They were asked to summarise their understanding, and offered the following:

1. LCE involves practical work. In this practical work, learners have to find out for themselves in the classroom.
2. In LCE there should be less talking done by the teacher in class and more work done by learners.
3. Learner can engage in different tasks on the same content or topic.
4. There should be different pathways but all leading to a common goal or outcome.
5. The classroom environment should be conducive to allow learners to share their ideas and discuss them with others.
6. The lesson should value the differences in learners' backgrounds and experiences.
8. There should be sharing of power with learners in class.
9. Learners should take part in deciding the processes to be followed and the topics to be covered.

They were asked what the policy said about LCE and they highlighted the following points:

1) It required them to assist learners with life or survival skills needed in the modern world (e.g. technology, environment).

2) It required teachers to link traditional African knowledge to the new technological world.
3) It required teachers to help learners to be able to learn by doing (discussing + experimenting + making).
4) It required the teacher to be a helper and learners the performers.

5.3.6.3 Constraints on LCE

In the light of what they understood of LCE and their experiences in their classrooms, they were asked to identify factors that they thought prohibited them from implementing LCE:

1. There were few required and necessary teaching materials in their schools.
2. Content coverage was difficult with the new teaching methods. There was a lot of content to be covered per year and not enough time.
3. LCE needed more time for implementation in classrooms. This was partly a problem of time overall, and partly a problem that lessons were given in only 40 minutes periods.
4. The classrooms had many learners, and were often crowded.

During this discussion, teachers emphasised that it was very difficult to deal with LCE with time periods of only 40 minutes: the introduction might take 20 minutes and then the learners might need an hour to work on the activities and report back. Then some 10 minutes would be needed for the conclusions. This amounts to about 90 minutes, or a double period. Such timetabling would lead to new problems, such as learners who missed out because they were absent, or teaching days lost because of public holidays and extra-curricular activities.

5.3.6.4 Power-sharing

The workshop explored approaches to effective group work, and some teaching methods and activities. One aspect of LCE that the teachers found particularly interesting was the idea of "power sharing", and this was taken up in some detail. The strategies teachers advocated for sharing power in the classroom were:

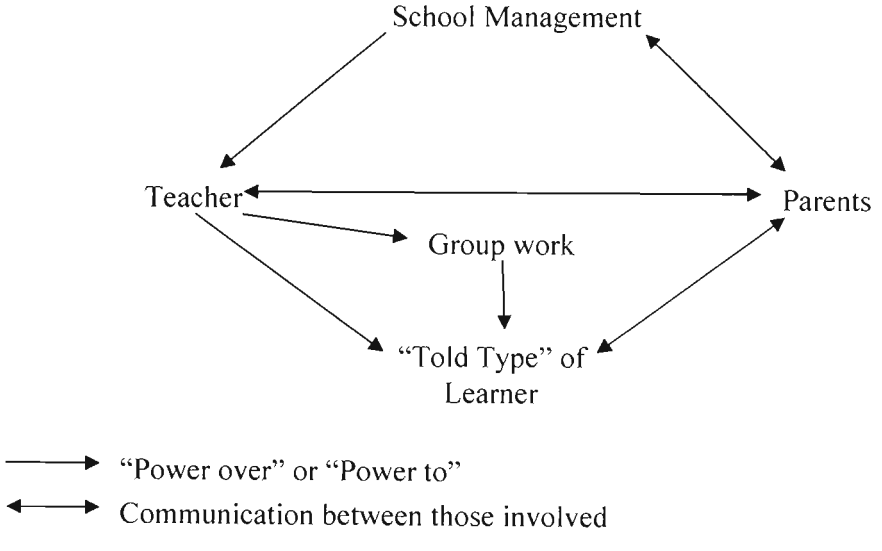
- Learners forming groups of their own choice and allowing open discussion.
- Learners generating and finding resources to answer the task.
- Providing time to generate and discuss solutions.

- Using projects to focus learning, and allowing work to be done in different ways, and at different speeds.

Teachers were aware that classroom management and monitoring were difficult if the teacher is not sharing the control with the learners, especially when dealing with large classes. Different aspects of "power to" learners and "power over" learners were identified in cases of knowledge, techniques used for teaching, the lesson structure and classroom rules, and processes of managing activities. The teachers worked on the activity where they were asked to draw a "Picture" or write a "story" on one aspect of power relevant to learner-centred education. Reports from groups were as follows:

a) Group 1 presented a figure (See figure 5.2) concerning power and communication in the school.

Figure 5.2: Power and communication at school



Group 1 explained that the diagram demonstrates the teachers' conception of power and communication in the school. The single-ended arrow represented 'power over': it showed a hierarchy of power, with the 'told-type' learner having no power (even within a group) and the teacher having power only over learners. Having 'power over' enables the teacher to give

power to the learners, or the school management to give power to the teacher. The double-ended arrows do not portray an issue of power but bring up aspects of communication.

b) Group 2 presented a story of the different needs of different learners.

Group 2 wrote a story of two close friends, one being a bird with a very long beak and the other a dog. The two went out for dinner at a restaurant. The waitress brought two different containers with the same food. The dog was given the food in a bottle with a narrow opening while the bird was given a flat plate. The teachers made the following points. First, how were they going to eat? Secondly, should the dog and the bird be eating the same food? The group explained that the teacher was the waiter, the curriculum the food, and the animals the learners. Different learners require different foods in different ways if they are to have access them.

b) Group 3 presented a story of a girl and a bee in a garden.

Group 3 showed a girl choosing flowers in a garden, and a bee flying from one flower to another. The girl was a learner, the garden was the curriculum, and the bee was the teacher. The teachers said that they were demonstrating that in LCE power has to be given to the learners to choose relevant curriculum. Learners have the ability to go into the garden and select flowers of their own choice. The bees (teachers) fertilize the flowers (curriculum) for learning to take place. In this, the bee has very little power – it does not design the garden, and it has limited influence over the girl's choices, or what she does with the flowers available to her.

c) Group 4 decided to write a letter to parents.

Group 4 drafted a letter to the parents telling them about LCE.

Dear parent
We humbly bring to your awareness that there is a new learning approach whereby the learners have to be fully involved in the learning activities, thus solving problems for themselves, finding things for themselves and recording.
In this case the teacher participation is limited, that's why it appears as though the teacher is doing less work.
As my co-worker I request your cooperation and encouragement to your children.

Yours sincerely...

The teachers explained that parents (and learners) have certain expectations of how learning takes place, and what good teachers do. They felt they needed the cooperation of parents if they were to work in different ways.

After presenting their reports and discussing them, the teachers highlighted that they needed help in particular areas. They wished to get more support on how to use the equipment that they had and how to conduct a learner-centred classroom. They also wanted help on how to make group work effective and how to manage time as they were teaching. Lastly, they raised concerns about evaluation methods, especially when most of the learners were not able to speak English well.

5.3.6.5 Workshop review

Finally, the teachers were asked what they had learned from the workshop. They said they were aware that learners learn by doing and discussing in a LC classroom. They were also aware that there was a need to facilitate learning that involved all senses and to take into account individual differences due to personal experiences. Lastly, they recognized the need to share power during the learning process. Asked to identify the new ideas that they had gained, they chose the ideas of the power sharing in relation to knowledge, learners' abilities to think for themselves, classroom management and control.

5.3.7 The third meeting

In this meeting, the teachers who had attended the workshop shared what they had gained with those who had not attended. The meeting reviewed the issues and ideas mentioned above. The teachers were highly motivated to experiment with and teach in learner-centred ways. Through these meetings and workshops, the teachers' collaboration skills had developed considerably. Further, they shifted from tendencies to "blame the government" and 'the school,' to focus more on issues of learning and achievement. The results were deep and critical discussions concerning LCE, learning and knowledge acquisition. Through sharing their backgrounds and experiences, they dealt with different situations which were identified from lessons, and were highly supportive of each other.

5.3.7.1 Planning phase

Information had been presented to the teachers in the earlier phases. From this emerged a plan:

- Development of rapport, through knowledge of learners and establishing friendly learning environments.
- Selection of teaching methods, guided by the content and its relevance in day-to-day experiences.
- Achieving the set outcomes and covering the required syllabus.

Based on these ideas, lessons were planned, to be conducted by the three teachers in their schools. These lessons were planned individually even though certain aspects concerning the content knowledge were discussed by the group.

The teachers were asked to identify factors that they considered positive or supportive of the implementation of LCE:

- The empowerment of learners makes the learning condition comfortable for learners to effectively learn Science.
- In LCE classrooms learners share ideas more if allowed to do things by themselves and discuss amongst themselves.
- It is easier for learners to incorporate the knowledge they already possess as they use the materials to help them understand the new concepts better.
- If properly administered LCE can change the learners' attitude towards Science and develop learners who are willing to learn.
- Presently at school level sharing of skills and techniques with other teachers is done informally, but with LCE strategies in place this could be done formally.
- The success of LCE at each school depends on the positive attitude that the teachers show to the approach and how they build cooperativeness amongst the learners.

At the same time, they raised concerns:

- Some learners are too lazy to carry out activities, hence they tend to take advantage of LCE and become disruptive and not follow the given instructions.
- In most cases the attitude of learners and parents towards the method is negative and they look only for results at the end of the level.

- LCE needs a lot of planning and requires immense private time from the teacher.
- It is difficult to implement when there are no teaching facilities and many learners in one class.
- The level of English language for learners reaching JC is very low and this makes planning very difficult for them to understand instructions given during activities.

Finally, the teachers wrote comments on the meeting. They felt that the meeting was very helpful, especially in that it extended to new points such as how to make lesson planning easy, and the importance of being able to reflect during and after the lessons. As one of the teachers said, *"We highlighted points of great concern to the teacher."* They commented also on the importance of relationships and the interactions between parties involved in the project.

5.3.8 The lessons from Cycle 1

These were the first lessons taught after the series of meetings, workshops and readings, including the lesson planning and enactments they had done, and the modelling of LCE provided in the workshop by Professors Malcolm and Beasley.

5.3.8.1 The case of School A, Mr. Khaba

This was the first encounter for Mr. Khaba with this group of learners, an arrangement made especially for this project, because Mr. Khaba generally worked with senior classes. The usual class teacher had started the topic and Mr. Khaba continued from where the teacher had stopped. The lesson started with the teacher telling the learners what they were going to do and how interesting that was. There was no lesson plan, typed activities or procedure written on the board for learners. They were requested to work individually without discussion with neighbours during the initial stage of the activity. The activity required them to write down the story of "how magnets are made." After the individual writing, the teacher gave the learners the opportunity to form groups of their choice and most learners did not move, but they turned around and worked with their neighbours. The groups were to discuss the same activity that they did individually. The teacher went around helping them with issues related to that activity. The teacher facilitated the group discussions by probing and posing questions.

The groups then presented their discussion reports and the teacher wrote the statements suggested on the board underlining some words. After the presentations made by all groups, through discussions of highlighted words, three statements were constructed showing different ways of making magnets, guided by the teacher. Learners were provided with magnets and metals to use in an activity that was stated in one of the suggestions. As homework, learners were requested to go and find out the name given to this magnetisation process which they had adopted in their activity. The teacher showed that practical activity was a way of taking the concept further by demonstrating the constructed statement.

5.3.8.2 The case of School B, Mrs. Motloung

The teacher started the lesson by doing a review of the characteristics of living organisms and then indicated that living things can be either animals or plants. Examples of each group were given by learners. The topic to be dealt with was introduced as "Reproduction in Plants" with the main focus on flowering plants. They went on to review reasons why this topic was not done in the past. They had to skip the topic because its turn came in winter when there were no flowers. The teacher started the lesson by asking learners questions comparing the idea of having males and females in animals and adapting this for the plants. To clearly have the concept of male and females in plants, the teacher used common and locally available plants which are known to have specific features that could be recognised as female and male plant structures. During the discussion a number of relevant scientific terms were introduced by learners.

At the end of this introduction the learners were asked to go out and collect flowers to study. Back in the classroom, learners had to cut the flowers into halves ensuring that they did not destroy the small parts. The teacher demonstrated to the learners the different parts that they should look for in their plant using a flower that she was holding; she also referred to a big chart that was on the wall. At the beginning of the process learners were not able to identify these features that the teacher was talking about. She introduced two types of flowers that she was holding as they were going through the identification process. With the support of the teacher, the learners identified the male and female parts that were present in their flowers. The necessary parts in a flower were identified and learners were able to give the names of those parts needed for the process of fertilisation and the gametes involved. While the discussion was going on, the learners and the teacher noticed that one of the learners had

brought in a dagga (cannabis) flower, which she made a comment about: "*He must be the one who has planted dagga here*" and went on with the discussion. People smoke the leaves of this plant and it has been classified as an illegal drug in Lesotho even though it is readily available in many backyards.

5.3.8.3 The case of School C, Mrs Thabi

As the lesson started the teacher brought empty containers of food, real food and empty serving plates. The topic she was going deal with was nutrition and a balanced diet. The teacher asked the learners "What are the things that we can do to live a healthy life?" Some learners came up with the issue of eating a balanced diet and others talked about doing exercises. The teacher concentrated on the balanced diet suggestion and requested learners to explain what it was. The learners were asked probing questions and given the opportunity to answer them. Terms such as proteins, vitamins, water, carbohydrates and roughage were discussed.

An activity was introduced where one person from each group was to go and pick different types of food for their group. Then each group was to discuss the nutritional value of the different foods they had and determine if they constitute a balanced diet. After their discussions, groups presented their analysis. The discussion also included the function or importance of each type of food, whether it was used for bodybuilding or other purposes. From here the learners were requested to identify indigenous plants that could be used to form a balanced diet and to state the nutrients available.

5.3.9 Reflections on the lessons

In their reflections, as in the lesson plans, the teachers concentrated on the classroom management and the conversations between the teacher and the learner. As the lesson outlines above indicate, all the teachers made efforts to initiate conversations among the learners (especially by having the learners bring in their own knowledge), and in their whole class discussions they tried to involve many learners. An example of these whole class discussions was Mrs. Motloung:

T *In animals we have peoples and what kind of peoples do we have?*
S *Male and Females*

T *Do you have male plants and female plants?*
S *No (most said) Yes (few said)*
T *What do you think?*
S *I think there is cross pollination.*
T *So what is it? (Pollination)*
S *Cross... ....*

In their review, teachers noted that implementing LCE was difficult, despite the fact that they had discussed its literature and identified different strategies of implementing LCE. They saw also that some Science topics and theories were more difficult to relate to learners everyday life and experiences than others. Similarly, making use of students' knowledge or following their interests was often difficult. For example, the teachers discussed the issue of the dagga (cannabis) flower, and wondered whether it might have been handled differently and used as the basis for discussions of content and social issues. Similarly they noted that when the learners selected food during the lesson of Mrs Thabi, none of them made a selection that would constitute a balanced diet. Some of the teachers felt that this could have been brought closer to learners' everyday life, linking the foods they like (enjoy), with foods that make up a balanced diet.

The teachers used Mr Khabi's lesson from School A as an example of how to build concepts from individual learners to groups of four learners and then to a whole class. In School B, Mrs Motloung built a new concept by regularly referring and comparing with what learners already knew, in this case mainly from previous school knowledge. A similar thing occurred in School C, where Mrs Thabi extended the knowledge that the learners had due to their daily experiences with food and diet. They looked at this lesson to identify situations where learners initiated discussions, and saw that there were no discussions initiated by learners in the whole class segments, though there were many opportunities in the small group discussions.

The teachers noted two aspects that were common to the three lessons recorded. Firstly, the teachers generally asked questions that were short and structured and learners responded with short answers. Secondly, there was a great deal of time taken by the teacher talking, either introducing a concept or trying to explain a concept. Teachers indicated that these aspects were not in consistent with LCE.

5.4 STAGE 3

5.4.1 Introduction and purpose of Cycle 2

The 2003 school term ended before the study could reach Cycle 2, and hence the study resumed at the beginning of 2004. This resulted in losing one participating teacher (Table 4.1) who left for further studies. In this cycle there were only three teachers who took part. The flow of the phases was similar to that of Cycle 1, except that the support phase of Cycle 2 was fused with the reflection phase of Cycle 1. The cycle started with reflection and planning, then acting (with observation) and lastly, reflection again.

5.4.2 The process of Cycle 2

From their reflections on previous cycles, the teachers decided that there was further need to know the learners' backgrounds and to work on rapport in classrooms. Teachers also highlighted the need to adopt a variety of different teaching methods, and not to rely on group discussions only. Thus, the plan for Cycle 2 was to extend the work of Cycle 1 by dealing with interrelationships, determining and utilising individual background knowledge and increasing the range of pedagogical methodologies that promote power sharing and participation.

5.4.3 Lessons from Cycle 2

5.4.3.1 The case of School B

At the beginning of the lesson voltage and voltmeter were introduced and then cells were used to check voltage using the voltmeter. The teacher asked the learners to check the voltage of cells that were given with a voltmeter and made them aware of the figure written on the cells. In this process of measuring, the unit of voltage was introduced. They went further to discuss the scales on the voltmeter and how to read the scale. The teacher used the cell and a bulb to make a complete simple circuit. The bulb produced light. This provided an example of energy. Different types of energy were introduced, such as chemical and electrical energy. The teacher told the learners to go outside and observe what the solar engine does when put on the sun. The operation of the steam engine, which was done in the previous lesson, and the solar engine, were used to add more types of energy, such as heat and light energy.

The teacher introduced the issue of "making" energy and discussed it with the learners, which later brought up the idea that energy cannot be destroyed. There were other learners who were not keen to agree with this idea that "energy cannot be destroyed." The teacher facilitated the discussion to determine whether they could make their own energy or destroy it using the question- and-answer method with the whole class. The teacher concluded the lesson by presenting and making reasonable the principle of energy conservation. Finally, the teacher facilitated a lesson review, asking learners what they had learned from the day's lesson. The learners indicated that they had learned how to "make" their own energy from cow dung and the teacher looked surprised because they had not talked about that at all during that particular lesson. While they were talking the bell rang and the lesson stopped.

5.4.3.2 The case of School C

The lesson started with the teacher informing the learners that they were going to deal with bonding and requested one of them to draw the structure of an atom. The structure was labelled and learners were again asked to explain an atom. In order to answer the question, the learners referred to positive and negative electric charges. The class went further to discuss things that caused attraction, such as electric charges. Then an activity on electrostatic induction was done, which involved the learners rubbing their pens on their hair and then using the pens to attract small pieces of paper. The results from the activity were discussed, with ideas of electronic shells and addition or removal of electrons emphasised. This led to the concept of atomic number, and the distinction (in electronic structure) between metals and non-metals. During the discussion, examples of metals and non-metals were given viz sodium and chlorine. The two examples were used to analyse the bonding that occurs when they are mixed. The teacher in this process discussed the sharing and losing of electrons, starting from the idea of shells and electron occupation. Lastly, the teacher indicated that the type of bonding between sodium and chlorine is called ionic bonding. In the next lesson the class would consider covalent bonding.

5.4.3.3 The case of School D

The lesson was a continuation of the previous lesson, which had ended before the groups could give reports of what they were discussing. The teacher gave each group 10 minutes to present and the presentations were on different groups of arthropods, such as insects,

arachnids and crustaceans. Each group of learners was to give two examples of each group and identify their characteristics. During the presentation, the teacher asked questions to seek clarification in certain areas and repeated most of what was said by presenters. All groups were given the chance to present even though they were repeating the information (examples and characteristics) given by other groups, in different words here and there. The presentations of all groups took the whole period.

5.4.4 Introduction to and purpose of Cycle 3

In April 2004, Cycle 3 started and involved three teachers from Schools B, C and D. Only two (from School B and D) were able to take part in teaching while the teacher from School C participated only in the planning sessions (refer to Table 4.1). The planning session was held on a Sunday and the teacher from School B was not present because of family problems. The acting and observation phase in this cycle had the researcher and one member of the department observing the teacher when implementing and practising the suggested strategies that were given during the planning phase. The member of the department was not part of the planning session but only joined to observe. The group decided that the final reflection phase should be converted into a departmental workshop for the school in which the teacher shared with other members of the Science Department the experiences of taking part in the study and the understanding of LCE.

5.4.5 The process of Cycle 3

In this cycle teachers wanted to conduct the lessons to demonstrate their new understanding of LCE and the teaching that it represents. Therefore they helped each other plan individual lessons that are LC, designed activities and offered to one teacher the equipment necessary for the achievement of the learning outcome that he wanted to address. This was the first time in the study that the teachers wanted to address a problem of lack of resources by borrowing from others. They offered this help to her as a means of determining if the lack of resources actually contributed towards not meeting the requirements of LCE. The participants conducted lessons in the presence of one colleague because they felt that they would like to share with their colleagues the experiences gained from the study. At the end of the lesson, departmental workshops were held where the participating teacher worked with other teachers to explore LCE generally, its implications and challenges.

The individual teacher was asked to plan the workshop with my support. However, even though I was there to help them, none needed or asked for my help. The issue of conducting the departmental workshop was introduced as a way of sharing and disseminating the information and research experiences to other Science teachers in the participating schools. In School B, a teacher from another department contributed to planning the workshop while other teachers from different departments wanted to attend but could not because of daily school activities.

During the planning of this particular cycle, teachers worked together to design lessons on the specific content and pedagogy that each would handle. They anticipated challenges in content and methodology, and made suggestions on how to deal with these. My role changed purposely in this cycle, so that the teachers worked very much by themselves. I did not provide information nor probe with questions during this meeting.

5.4.6 Lessons from Cycle 3

5.4.6.1 The case of School B, Mrs Motloung

The lesson started with the review of the characteristics of living things, where learners state them and the teacher wrote them on the chalkboard. When they had finished listing them, learners were requested to select one characteristic that they would like to deal with on that day. They selected reproduction. The majority of learners agreed to deal with the mentioned topic except for a few who selected feeding. They had to vote to determine what they were going to discuss on that day and reproduction had a larger number of learners than the other topic. The learners had reasons for selecting the topic. When asked what they wanted to know about reproduction, some said "nothing" while others said "life cycle." The discussion continued to look at the different gametes necessary for reproduction and types of fertilisation. The teacher coordinated the discussion and learners were requested to describe some concepts here and there.

To introduce the concept "life cycle," an example of one learner was made, where the teacher followed the different stages of that learner, starting from birth to the stage of marriage and having children. The learners were then requested to draw the life cycle of a housefly, fish, bird and locust. As she was going around to see what the groups were doing, the teacher

observed that some of the groups were struggling with the drawings of the mentioned insects even though she expected them to draw a word diagram to show the stages. This was clarified to them. During the presentation and discussions, reference was made to the use of these organisms at certain stages in games that they played during childhood. The lesson was more question and answer with the teacher mostly repeating the answers from learners. At the end of the lesson, learners asked questions to clarify some concepts that they did not understand in the process of development of those organisms.

5.4.6.2 The case of School D, Mrs Lebo

Again, the details of logistic difficulties were distracting: there were things going on in the school that interfered with the lesson as planned, and hence with the dynamics of the lesson. For example, when the lesson started, learners from other classes were going up and down outside, making a lot of noise, and at one moment some were standing in the doorway watching. The door was open and the teacher stopped them: "Do not come in". Also, we expected at least one teacher on the staff to be there as agreed, but there was no one. Later, as the lesson was already going on, one teacher came in after the participating teacher went to the staff room to fetch her. The other teacher who came to observe did not bring pen or paper to write on.

The lesson started with learners forming groups of four and recapping what was done in the previous lesson. They presented their reports, which showed that they had been dealing with the concept of work and its units. The introduction of machines was made and they were requested to give two examples of traditional machines and two examples of modern machines. The teacher checked what groups were doing, mainly the front section because the desks were closely packed, not allowing her to go between them to check those groups at the back of the classroom. As she was going around, she explained the task to some groups and asked questions to others.

The groups presented different examples and they were instructed to present from where they were because the groups at the back could not reach the front of the classroom. The teacher repeated after the presenter and later followed with questions directed to the group and sometimes to the whole class. The modern and traditional machines were discussed and one learner requested an explanation of a bulldozer (it was an example given by a certain group

during the presentation). The bulldozer was not explained but the Sesotho name of this machine was given.

5.4.7 Departmental workshops

5.4.7.1 The case of School B, Mrs Motloung

The workshop was planned fully by the teacher with the help of one colleague who was not part of the study. The colleague was not teaching Science but English Language. In this meeting there were 8 teachers and the researcher.

The other members of the department were requested to add more topics to be discussed. The reason for the workshop was to share the experiences of action research and LCE. The participants started discussing the factors that seemed to prohibit them from doing LCE in class and the positive factors about it. This activity was intended to have teachers give positive and negative factors, which could help in the understanding of what they perceived as LCE. Mrs Motloung designed an evaluation sheet that was to be filled in by the teachers at the end.

As they started discussing the factors, one of the teachers expressed a concern: *"There seem to be more on the negative side than on the positive side."* The numbers in the brackets shows the number of teachers who stated a specific point on their written documents collected at the end of the workshop.

- Over crowded classrooms makes it difficult to implement LCE (4/7).
- Lack of resources such as books, photocopier, computers to produce support materials. Some also included the lack of equipment in their laboratories (6/7).
- The syllabus content is long. LCE is time-consuming. There is pressure to finish the syllabus. Teachers tend to cover the syllabus for the sake of examination but leave learners with no understanding of what had been discussed (6/7).
- Lack of preparation for teachers. More time for preparation is needed but the teachers do not have it due to heavy personal teaching loads per week (6/7).
- Lesson plan not easy to use at certain times of the day (e.g. after lunch, some prefer to lecture since learners felt sleepy).
- Type of learner in one class (mixed ability that varies very much) (4/7).

- The teacher has to depend on what the learners are contributing (3/7).
- Lack of understanding from the teachers (3/7).
- Learners have poor communication skills (3/7).

During the discussions in the workshop, one of the teachers said:

> It also takes me back to whether I understand LCE clear. Because the LCE if it was properly implemented it will mean each learner has to go at his or her own pace. You do have to consider the time factor. When I plan for it, I have to plan for fast learners, medium learners and slow learners, so that each one of them goes at his or her own pace...The word examination seems to frustrate us.

At this particular time when they were talking about the policy and the government most teachers were looking at me, with a look that suggested they wished I would say something, but the participating teacher addressed their concerns through reference to the literature and drawing from her past experiences. During the presentations made by other teachers, the participating teacher was not talking, only recording what they were saying.

"*Dealing with the positive can bring up more negatives*" one teacher said but another responded alternatively that "... *you can even change some of the negatives and make them positives.*"

Teachers in this workshop went further to give the following as processes, requirements and benefits in a LC classroom:

- Pupils discuss things themselves.
- It ensures deep learning and creativeness.
- Availability of teaching aids.
- Less thinking on the side of the teacher.
- When introducing a topic there should be teaching aids. It reduces abstraction.
- Level of understanding that the learners come with from primary (need for teacher to check and know the prior knowledge of his or her class).
- LCE ensures that learners interact with each other.
- It takes care of slow learners since they will learn from others.
- In helps learners acquire a spirit of independence.

- It provides the basis for developing a positive attitude towards Science.
- There were also suggestions of things like a "take home practical" on certain topics.
- Again they suggested that afternoon lessons should be well planned with discussion, presentation etc.

A suggestion was made that there was a need for a workshop to equip teachers with the necessary skills for the proper implementation of LCE. At the end of the discussion one teacher said "*We have not discussed the issue of the time factor,*" which was followed by teachers saying:

> The syllabus for JC is too long. Who is responsible for changing it? It has to be changed to suit the recommended approach... If the curriculum is like this, is it possible to change the method of assessment currently used?

They highlighted again the following points about LC from the lesson that was taught that day:

- Questioning methods in class.
- The participation of most students.
- Prior knowledge use/utilisation (there were some who knew something but not everything despite the fact that the class was made up of learners from different schools who are repeating the same level).
- Group work (they grouped themselves).
- The type of introduction (it has to be selected carefully).
- They agreed that there was too much repetition from the teacher.

When asked for comment on interactions in class, the teachers demonstrated different levels of interactions:

1) Interaction between learners and the teacher:

- Learners responding.
- Asking appropriate questions.
- Sharing the power of class management with them.
- Bridging the gap between learners and the teacher (LC is not easy for an unfriendly teacher).

2) Interaction between learners themselves.

- Creating the necessary environment for discussions in groups and during the class.
- Allowing a free grouping system.
- No laughing when someone was giving answer (generally the classroom culture that is instilled through the agreed rules).
- Monitoring their communication during the independent activities.

At the end of the meeting they agreed that the teacher contributed in large measure towards the failure to adopt learner-centred education in their classrooms.

5.4.7.2 The case of School D, Mrs Lebo

The workshop was supposed to be held immediately after the lesson conducted and involved all the Science teachers. This could not start immediately given problems of venue. Later, after sorting out the problem, the workshop started. There were 4 teachers who attended the workshop. One was the participant, two were new teachers, and the last one was an old member of staff.

According to the plan, which was made while they were together as participants, the individual participating teacher was expected to make a workshop plan and facilitate it. The discussion initially would be based on the observations of the teacher who was at her lesson, through views and comments. Then the discussion would proceed to the teachers' understanding of LCE and its principles.

A report from the teacher who was observing was given to start the discussions for the workshop. The teachers discussed LCE but most of the contributions were from the participating teacher. She highlighted the advantages and disadvantages of LCE with particular reference to the lesson she conducted. She was trying to use the lesson that she conducted on that day as an example, and later was supported from the other teacher who came in late. The discussion was not structured and could hardly start due to the brief report and comments that were provided by the teacher who was observing the lesson.

5.5 INTERVIEWS WITH THREE TEACHERS WHO CONTINUED UNTIL THE END

One purpose of the interviews was to find out what were the teachers' aim(s) of participating in the study, and why they continued when others withdrew. The second purpose was to determine the teachers' understanding of LCE after being involved in the study for some time. Lastly, the interview intended to determine the achievements that they could recognise from participating in the study.

5.5.1 The case of School B, Mrs Motloung

The principal appointed me from all other Science teachers who are teaching Science in my school, not because I am confident with Physics but because she based herself on the aims of the study. Hence my participation in the study was to achieve two things: 1) understanding and knowledge of LCE with its principles and 2) understanding and further knowledge of Physics concepts which is not my speciality.

My interests actually originate from my analysis of the type of learners that we have in our school. The majority of them are not passing both the local tests and external examination even after being taught and we thought they understood what we taught them. From my little understanding of LCE that I received from the MOET workshops, LCE education was just about hands-on. I thought if I could know more about LCE this could help learners to learn properly in our classrooms.

At the beginning of the study, based on our analysis of the lesson that we conducted, generally, we were not able to fully adopt LCE in all our lessons during teaching. We could not fully adopt because of the system's pressures where we are expected to cover the syllabus which is set for each year. The time available for teaching that set syllabus does not allow the pace that LCE would require which is guided by the learners. On the other hand, I feel there is a mismatch between the teaching and the examination because the effectiveness of the teaching does not have any impact on the performance of the examinations at the end of the year. Therefore we teach only to meet the examination requirements of completing the set syllabus, not considering the effectiveness of the teaching considered.

It has to be clear that there are other methods that we can still use to have learners passing the examinations, which are not following the principles of LCE. The teacher-centred teaching is one approach that does not go together with LCE, and which is dominated by rote learning, still maintains that learners would pass at the end of the year in Lesotho. But anyway, my understanding has changed since I know that LCE has to deal with learning environments, types of methods and meeting the objectives of schooling. With this view, "hands-on" is just a small portion of the learning environment that is said to be LC.

Despite being aware that other approaches could be of help to my learners to pass the examination, I continued participating. There were reasons why I continue in the study even though I encountered many challenges due to the adoption of different styles in teaching and facilitating learning. Initially I was about to give up the teaching profession due to frustrations that I had, not because of teaching in this particular school but due to being a teacher in general. Being in the study I felt that this was the opportunity to change my attitude towards the profession and continue with teaching but in a different way. The activities that we dealt with, the discussions that we had, the support that others provided, the network that was formed and the process of the study all made me enjoy teaching more that I did in the past.

This was not the first time that I was engaged in in-service activities but the structure of this made the difference, because in other in-service activities the facilitators are there for a day or two and after that we are on our own. Access to support after that is very difficult and some times the challenges that you meet in schools totally differ from the assumptions that were made during the preparation of such workshops. Fine, I had other things that prevented me from fully participating, but whenever we were together I benefited a lot such that even here at school I have started working with other teachers during the lesson planning, conducting lessons and analysis of lessons conducted.

The study actually made me see my teaching from a different angle of being bound by the policy requirements to that of enjoying what I am doing and utilisation of more skills from fellow teachers. I did not plan my lessons in the past but now I understand the necessity of having a written plan and selecting specific activities for each lesson. The selection has to involve the specific topic and the challenge that would engage learners. Lack of planning

could be observed in earlier lessons which were highly traditional in that they were teacher-centred and I talked more with "poor" type of questions often directed to learners.

To go deeper into my participation in the study, I can state 3 reasons:

- *It was a way of keeping myself busy and covering up some of my frustrations. Due to different things that I encountered as a teacher, I had previously made the decision that I must leave the profession but now hey, I am ok.*
- *I was feeling empowered and hence I changed my attitude towards the teaching profession. We directed the activities, even the school-based workshop, I planned and conducted it. This made me have more confidence in myself.*
- *I was anticipating that I will be able to deal with my Physics content knowledge as we met with others during the discussions/sharing of ideas, but we were not forced to stick to Physics only. This reduced some of the frustrations that I would have encountered as the study continued.*

The role that the researcher played was more towards encouraging and also bringing us together even in situations where we were not participating as agreed. He contributed a lot during the discussions that were done and provided us with the necessary information at all times where there was a need.

My participation was based on meeting the systems' needs originally but I ended up following my own personal and professional goals. The interest in the practice means we want learners to pass but their passing could be achieved with the use of teacher-centred and other methods which are not part of LCE. If I do what the system requires my learners would always be left behind in syllabus coverage and I would not be able to cover the required content for the examination. Lastly, the time given for Science in schools is not enough, that is, 6 periods per week and this is the challenge that we did not explore enough in this study.

5.5.2 The case of School C, Mrs Thabi

My principal told me that he has decided that I should take part in an in-service activity. I did not have anything in mind since very little information was provided to me about the activity but after the initial workshop I started developing some interest in the activities planned for future. I felt like it was time for me to register for a postgraduate degree because I could

observe certain areas that would require improvements in my teaching and content knowledge even without being told about them.

During the study, I felt again that it was helping me to understand LCE more. My main interest has been to change my teaching approach, which was dominated by me standing in front of the learners giving them things to do or "step-by-step" instructions to follow. This would include the ways of utilising the teaching resources such as textbooks and others. I recognised in this activity from both practice and literature that my past methods of teaching did not widen the scope of knowledge of the learners. The use of their previous knowledge and the new knowledge during learning turned to be more exciting. This is one of the aspects of LCE that I discovered by being part of the study.

The time for the study was too short despite having taken almost one and half years. The learners were used to traditional teaching where the teacher would be teaching/lecturing and then giving them the notes. The learners were taught before the study started and they were used to that traditional teaching method and the introduction of the study required them to change their own ways of learning. Other subjects in our schools were teaching in the same traditional way and did not use LCE principles in their teaching, hence this also created confused learners and posed a challenge to me. LCE required them to participate in the lessons through discussions with other learners and then with the teacher. There was a struggle for them to share and participate in such discussions. In the lessons that we conducted there has been an observable lack of participation from learners even when we gave them the opportunity to discuss issues openly.

LCE is a teaching approach which gives the learners more chance to individually or as a group work towards attaining necessary knowledge construction. It works towards building an individual who is critical and able to think independently versus TC, where the teacher is regularly making conclusions for learners and providing them with the final conclusion that is not open to challenge. In LCE there is an increased participation in the conduction of the activity, its processes, discussions of the results and then the construction of the conclusion.

The researcher has notably played different roles in the study. Whatever we did in classrooms originated from our discussions. Even if we missed the point of what we agreed to do, he would continue with the lesson observations and not tell us to go back to what was planned.

That is, in any moment he never said "I expected you to do this and that" while recognising the change in lessons or activities. We had the power to do what we wanted and decided how we did it. In the discussions he did not control but we did everything and he would provide information that would help us make suitable plans for the achievement of LCE. I can highlight one example. During the beginning of the study where we had a workshop in which more often we expected him to contribute in the discussions as we are used to this in past workshops. But the way that workshop was conducted made it clear that we had to expect a different stand point from the researcher in this case.

I can identify one teacher whom I think has grown considerably during the study its Mr Khaba. The methodology that he used in the BSL was highly traditional but there was a drastic change in his second lesson. Probably this was due to the fact that he made use of the literature and discussions from meetings and workshops. I cannot go into details to describe the type of the lesson that he conducted after the support activities.

Me as a person, I have changed since my teaching gives more work to the learners in different ways throughout the set activities. There is a reduced workload for the teacher during the lesson while trying to give learners enough time for the interactions. This is due to my new understanding of LC classrooms.

Turning the focus to the type of in-service training I think we should encourage other teacher trainers to use it because it provides the specific support that individuals need in their schools and it is not a general type of support. During the workshop type of in-service that is normally used, we do simulated teaching with teachers taking the roles of learners but this does not give or portray the realities of the learners in classrooms. The teacher support method should be used throughout the country in all the subjects.

5.5.3 The case of School D, Mrs Lebo

I was appointed from my school and requested to take part in this study. The study helped me to change my teaching and for the first time last year we had an increase in the number of learners who have passed JC Science examinations. The study was intended to focus on our understanding of LCE in which were agreed that the teacher had to assume the role of a facilitator in the lesson. Learners did most of the work as they dealt with the activities, made

observations and discussed the results to formulate the conclusions. This shows that our view of LCE focused on the management of classrooms, methodologies and meeting the national expectations.

The researcher visited our classrooms to observe us but did not give comments that I expected from an inspector. He would just ask clarification in certain areas but most importantly, he would ask me if I thought my lesson was learner-centred or not and why did I think it was. The other role that he played was taking part in the discussions in the reflection sessions. He would provide information to help us understand a concept and was able to make necessary plans for the cycle.

Mr. Khaba changed in methodology of teaching and was able to socialise and even discuss academic issues when we meet along the street. It was not the first time we were together in an in-service training but after that we never come together or have the opportunity to meet as a smaller group to share ideas.

I am a very shy person to talk or even allow other teachers into my lessons but this study made it possible for me feel comfortable to have them in my study. The way the observations were conducted and the reflections that came after really made me comfortable to be part of that group.

5.6 INTERVIEWS WITH TEACHERS WHO PARTICIPATED AT THE BEGINNING

There were two teachers from School E and F who did not participate in the study but interviewed for their side of the story. The purpose of the interview was to determine why they could not take part in the study and to identify the role of their colleagues in that decision. Both teachers had no problem with the interviews and were present on the scheduled dates.

5.6.1 The case of School E

After any workshop that one of us attended, a report to the department has to be given to all others members in a meeting set-up. We meet regularly, that is, at least twice in a quarter

with the allowance of emergency meetings whenever necessary. The school usually takes part in the regional Science meetings because these meetings contribute a lot to the present performance of our school. In these regional meetings we normally sit together to plan, scheme and prepare the common tests that we give our students. The results are compared for all schools and learners ranked. From last year the activity gave our students a challenge and competition of some sort. The students from our school performed better than they used to do. In my 20 years of continuous teaching this activity has demonstrated a positive impact on our learners.

I need to do something about the performance of my school. It is true that students pass in large numbers in junior secondary but we no longer have the good credits that we used to have, for instance, we no longer have the As, the Bs and the Cs, only the Ds, but students pass in large numbers. I think this is brought by the new syllabus and another main problem is that not all students could buy books; they only rely on the lesson notes and not all are having the notebooks to write such notes because of poverty. They are using one exercise book for all subjects. There is a big problem, since more than half of the students are poor, they delay payment of their school fees and never buy the needed learning support material.

Like I have just said, the new syllabus is very difficult to deal with. Some of the topics that appear even in Form A are not easy to teach at this level. In this situation the regional meetings are helping, in some instances we work together if there is a topic that I think I won't be able to pass the message across to the learners in the right way, I ask another teacher to do it for me next time.

As a department we observe each other and after the observation we sit down to discuss things with the concerned teacher. If there is an idea that one of us would like to suggest to be used in order to have the students gain more understanding of a certain concept, we discuss that with the teacher. After the discussion we normally follow up to see if that has been of help or not. The team teaching that we usually do is only during the theory lessons, not in practical sessions.

Normally we do a lot of theory because from the six lessons per week given, we only have one practical slot (double period). This is a problem with the new syllabus since all streams are

using the only laboratory that we have. So the new syllabus has also affected the way we do things because it requires more practical work.

I have been aware of the study that was done with Science teachers around and I was invited to take part. I have gained a lot of experience from the study even though many a time lately I was not able to participate because of my problems. Earlier, before talking part in the study, I was not aware of how to bring this idea of learner-centred approach into each and every lesson. It was very difficult from the beginning to adopt this approach. But the workshop and the sessions where we sat together to discuss things and some topics... I thought that really it can do a lot because students have to do things themselves and get some help here and there. Now I can help them. For some of the experiments we thought they need some equipment from the laboratory, but we have now recognised that we can improvise or use what we already have.

Ok, all I am saying is that a learner-centred approach requires students to find different concepts for themselves or discover them. Learner-centred education indicates that learner-centred is not only in the classroom situation. Again we should go deeper and find out more about the child, that is, what is the problem with the child. Like I indicated some of them are finding it difficult to buy books or have the proper uniform so we have gone out of our way as teachers and we have provided uniforms for them. There is something that I have identified as outstanding about learner-centred education. I have realised that the students understand the topics better when dealt with using this approach in class.

5.6.2 The case of School F

I am aware of the study that was conducted by the group of Science teachers. The information about the study was given during the workshop which we attended in January 2003. I did give an oral report to my department but it was in an informal discussion. If a workshop on JC Science teachers is held, the teacher who attended the workshop will informally meet with others but not the whole department as such. This report back is done only if there are certain things that will apply to other classes. After the January (2003) workshop I did the same, I gave the report even though I did not show them the materials given there.

I can identify factors that I think are affecting the performance of the school in general. Firstly, the intake. We get children from Phalafala Primary School and from other schools. Our school normally admits 3rd classes and few 2nd classes, which are about 3- 5 out of the 150-160 and most of these students are rejects of other schools. Even though we are aware that we take this type of learner, our department has never sat down to work on a strategy of dealing with this problem at school level. Generally, the department is not working together even though as individual teachers there are certain things that we do.

We do not observe each other but we do team teaching. The team teaching is done during practical work and in the theory lesson. From my point of view, team teaching is not the only thing that we do. We as teachers, when we have a problem, we talk about it at anytime during the day. Even just before going to class you can ask them, 'How can I do this?'. We find strategies of how to deal with it. It is just unfortunate that we do not have the administration that could bring us together, including the head of the department (HOD). I cannot remember any time where the HOD brought us together with the aim of discussing our issues. If I am not mistaken even for this year (2004) there has never been a Science departmental meeting (that is end of April 2004).

I have been involved in Science teaching for 12 years and I have never gone for further training in this period. Despite all these problems that I can identify, I am presently satisfied with my performance in class even though I am not actually satisfied with the performance of our school in Science. In class my teaching is mainly controlled by the topic that I am dealing with. If it is an experiment, we come to the laboratory or we take the equipment to the classroom; even those things that require explanation in class I can still talk to my colleagues about them.

Ok, coming to the research project, I was expected to implement the learner-centred approach in my teaching and I was expected to teach at the same speed as other teachers. This was my view after the first workshop where the research study was introduced. If we put aside what I cited as the teaching pace, I did not see any other benefit of the study. I had a problem myself because when we scheme together and prepare lesson plans we are restricting the participating teachers on the methods to use when teaching. In my work and with my experience, I am a person who feels like doing what she wants. In this study I was expected to be at the same level with others at the same time. This thing really made feel I

was not fitting in. Anyway that has past. I can only share with you my understanding of learner-centred education. In this approach the learner has to know things by doing, finding or sometimes searching with the guidance of the teacher but most importantly, doing things himself without being told.

The interviews bring up issues in action research participation, different attributes of motivation, the teachers demands, personal priorities in accepting support or taking part in support activities and types of benefits in knowledge construction, "collaborative networking" with others and change at different levels.

5.7 CONCLUDING REMARKS

For those who did not participate their interviews reflected that their schools were not in any way different from the other school settings, as revealed in the questionnaire earlier. This was not the reason for not participating, hence they put forward an issue relating to participation. Firstly, there is support available in regional structures but the contribution to her knowledge and practice development made by the project was recognised. There are different demands that teachers face, such as collaboration at school, management styles and social factors of learners, which affect the adoption of LCE. For example, learners in a class cannot even copy activities done due to the lack of necessary resources.

Those who participated brought forward different issues:

- The type of knowledge and understanding they had about the project.
- Personal, professional and system's interest and motivation in the project.
- Their constructed idea of LCE from the experience from participating in action research.
- The network and collaboration that was been brought about by being part of the project for a long period.
- The requirement from the system to meet certain demands (syllabus coverage, time allocation, examination etc.).

5.8 PRE-EMPTING CHAPTERS SIX AND SEVEN

The next two chapters will provide the data analysis generated by the six teachers who took part either fully or partially in the action research. Chapter Six will present the discussion based on the thematic analysis adopted and provide a deeper understanding of different aspects of the data. Chapter Seven will look at issues of participation from my side and from the perspective of each participant.

CHAPTER 6

LCE PRIOR TO AND AFTER ACTION RESEARCH

6.1 INTRODUCTION

This chapter looks at the data to establish changes in teachers' understanding and uses of LCE in the course of the action research. It draws on data especially at three stages: the initial stage (BLS), the end of Cycle 1 and the end of Cycle 3. Thus the chapter responds to the first and second critical questions:

- What is the initial understanding (thinking), practice (teaching) and explanation (say) of Science teachers about Learner-Centred Education?

- How does their understanding (thinking), practice (teaching) and explanation (say) about Learner-Centred Education change or not change over time as they engage with action research?

Thematic analysis is used to construct the Science teacher's understanding (thinking), practice (teaching) and explanation (say) of Learner-Centred Education in Science classrooms at three different three stages. The themes that emerged from the data are:

Teachers' participation in LCE

- classroom management
- facilitation

Classroom activities in LC classrooms

- predominant activities
- linking new content to learners' existing knowledge
- meeting learners' daily experiences

Learners' participation in LC lessons

- hands-on activities
- observing, recording and discussing results

Benefits of learning using LCE

- ensuring better learning

- developing skills

Constraints and conditions for the adoption of LCE

- Time
- number of learners
- lack of resources
- teachers' competence

Power and expectations in LCE classrooms

Competing demands and assumptions

The first stage, during the BLS, represents the teacher's knowledge at the start of the study. The second stage, at the end of Cycle 1, was chosen because it followed a period of intense exploration of literature and current practices, supported by workshops and experimentation. The third stage, at the end of Cycle 3, was chosen because it represented the formal end to the project.

6.2 STAGE 1: UNDERSTANDING AND PRACTICE DURING THE BLS

During the initial workshop in the BLS, in discussions and in the lessons the teachers planned and presented to each other, they showed they were generally aware of LCE policies and approaches. They suggested as LCE methods, practical work, demonstrations, questions and answer, research or assignments, and activities where learners could explore Science in their surroundings and look at its applications in everyday life. They saw these methods as providing more hands-on interaction, giving learners more opportunities to contribute to discussions of the content of the lesson. They recognized as a basic requirement of LCE that all learners learn, and hence that LCE required methods where all learners would be involved. However, they felt that such expectations were idealistic, especially in large classes: no matter what activities and time allowances were made, some learners would be regularly if not always left behind. In this they felt pressure from parents and management to have all learners passing at the end of the year, especially in the external examinations. This required engaging all learners, but it also required covering the syllabus. Most groups gave lecturing as a way of achieving their objectives within the required time, but often seemed confused about teaching methods and teaching approaches, and uncertain whether there was any place for methods such as lecturing within an LCE approach.

In the BLS, teachers were requested to reflect on their current teaching practices in schools. From their reflections, two main categories emerged: what they are expected to do in an LCE classroom and what learners are expected to do. They followed these discussions into activity design, and considered the benefits of LCE, constraints, conditions of implementation, questions of authority, expectations and competing demands.

6.2.1 Teachers' participation in LC lesson

In this category, the teachers highlighted the participation of the teacher in order to achieve the set objectives or learning outcomes. For this, the teacher had to ensure that the classroom was properly managed, and hence had to have power over discussions, control over learners and the ability to ensure order. Safety was also a consideration. The teachers felt that basic management, characterised by order, goal clarity, a teaching plan, a climate of intellectual engagement, clear rules and provision of resources was the starting point for 'facilitating learning' in any classroom. Similarly, they felt that monitoring learning and ensuring that all learners were on track, was important for LCE. Overall, it was the teacher's role to select teaching methods and ensure that all of the learners acquired the expected information. These findings are considered in more detail below.

6.2.1.1 Classroom management:

To achieve LCE, the teacher has to maintain order and ensure that all learners are taking part in the lesson and that "*learners are on the track.*" One indicator of order is reduced noise in class. For example, when watching the video of one teacher's attempts at LCE, another said: *"There seems to be a lot of noise in the lesson made by students and the teacher did not take control."* Another teacher added: *"There was poor management: students were making a lot of noise and the teacher said nothing to stop the behaviour of the students especially during activity 2 (where they were finding the mass of objects).*" In this specific situation, the learners were debating in their groups about which object to put on the scale as required by the given activity. The teachers, in their concern for the noise, ignored the content and activity in which the "noise" was made. The criticism that the teacher in the video has "*said nothing*" about the noise indicates that the management of noise was the teacher's responsibility.

However, even though the videoed lessons were criticised for high noise levels and little order, the teachers felt the lessons were LC. This was mainly because of the level of engagement of learners, and the inclusion of hands-on activities or demonstrations.

T *Hey what is going on? Eh all right, hold on today, actually what we are going to do is the topic called electromagnetism.*

T *What is going on?*

S *(Too much noise and not clear).*

T *Here is the wire. Can you do that? Keep quiet!*

Mr. Khaba was giving the learners instructions for a specific activity. He had no handout, so he described what was going to be done step-by-step as he wrote it on the board for learners to copy. Meanwhile, there was a kind of consultation between the teacher and the learners, in which he mostly called on a small group, to the extent that most learners were not part of the discussion and talked about other matters.

Teachers watching Mrs. Motloung's teaching similarly identified the needs for classroom management, order and reduced noise. One segment involved the teacher conducting a question-answer session with the whole class, where learners often responded in chorus. This was seen as 'noise.' Yet, handled properly, the chorus response is a kind of participation that helps the classroom work as 'a community' to which everyone belongs, and can assist with engagement.

When watching the video lessons, the teachers were unanimous that safety was the teacher's responsibility, to be taken care of when planning lessons and during implementation. They pointed to a lesson that used cells in electrical experiments rather than the alternating current that was also available as an example of ensuring safety.

6.2.1.2 Facilitating learning

Of course, the teachers saw everything they did as a means of facilitating learning, from basic management and lesson planning through lectures, activities and questioning. The focus in the BLS, including the demonstration lessons that were videoed, was to facilitate learning that was LC. As noted earlier, the teachers in the introductory workshop had pointed to the goal of having every learner learn, through the use of hands-on activities, discussions, and relating

Science to their lives and experiences. The analyses below are drawn not so much from these discussions, but from the demonstration lessons the teachers conducted. From their lessons, their theories about learning and LCE can be inferred (all the teachers were attempting to demonstrate LCE).

The teachers identified 'doing experiments' as an LC method. In this, they felt the teacher's role was to facilitate the learning by ensuring that the experiment was done effectively, which was achieved by the students following a set procedure or recipe (step-by-step). This means the activity was shaped by the teacher, but learners were responsible for following the procedure, and could still work at different paces, and get help from each other. When resources and time did not allow all students to have access to equipment, demonstrations provided a fall-back position.

The activity and the procedure were normally introduced and written on the chalkboard by the teacher. This was partly because resources were not available to produce handouts. While the teacher wrote, the students copied down the steps, as a way of ensuring order and so they would have notes about what had been done. For the demonstration, Mr. Khaba, for example, set the equipment on the teacher's desk and all learners stood around and observed one learner following the procedure, which involved the behaviour of compass needles near an electric current. The teacher checked if all learners had seen the reaction of the needles, and for those who had not, the activity was repeated. He was aware that students standing near the table obstructed others at the back. He saw it as his responsibility to ensure that all learners observed the demonstration and got the required results.

Mrs Maki's class also used equipment, mostly for measuring. The lesson started by considering measuring instruments that were familiar to the learners and then went on to unfamiliar equipment. She facilitated the activities by asking questions, seeking to lift the standard of intellectual engagement through involvement of all learners, and employing concepts of reinforcement and reward, as the class thought through what was to be done with the equipment.

Group discussions were used by all the teachers, especially whole-class discussions, which were teacher led. In lessons where small groups were used, the teachers facilitated by going around to see what learners were doing (though in one class this was prohibited by the seating

arrangements: the desks were too closely packed with many learners at each desk). These small group discussions were followed by presentations to the whole class. The class discussions seldom involved debate between learners, but were more a form of reporting to the teacher. The teacher then brought the "discussion" together in a summary by directing learners to the "correct ideas" and reaching the "expected outcomes". Other interactions between learners sometimes took place, but were not brought into discussions in which the teacher was involved. So, in the whole class question-answer sessions, the agenda was managed by the teacher and almost all questions came from the teacher.

Generally in the lessons the teachers talked most. For example, here is a single uninterrupted talk by Mr. Khaba. Although it is long, it also illustrates his wish to keep everyone involved, and to be clear:

T *So the effects that we are going to find out when we pass an electric current in a wire here. There is something that you are going to do. Let us first find out those things that you are going to use. Since you are now experimenting, I am just going to tell you those things and you are going to use (pointing): 1) wire, 2) cells and 3) magnetic compass. Ok, these are the things you are going to use. Now, what are you going to do with these things that we have put here? Now eh, you are going to make a hole at the centre of these cardboards then later on you will ...can you please be quiet! ...you are going to pass this wire here and make sure that it does that vertically on that thing. Make sure you enter this wire here and connect it to the cells or before you do that... stop writing for a while!...before you do that to the cells, what are you going to do is that you will put the magnetic compasses around the wire here. Then connect the wire to the cells there, then later on you are going to be able to observe what is happening. When you connect this wire to the cell, here that is what will actually happen. Then after having...you are going to try and check why we had that kind of behaviour there all right? Now we are saying we make a hole on the cardboard then you put the wire in the hole. Eh then after that you put the magnetic compasses...Then connect the wire to the cells...eh is there any volunteer that can come here and do the very same thing that I said should be done? Yes, any volunteer?*

Another strategy of facilitation that the teachers used was to 'build on students' knowledge,' especially by reviewing what was done in the previous lesson. Such reviews did not encourage discussion between learners but centred on the teacher's questions:

T *Ok today, remember we have been working with the parallel cells and parallel voltages. You remember that?*

S *Yes, teacher.*

T *Eh, today it is going to be interesting. Remember I said eh.. Using electricity you could be able to make a magnet? Remember that? So actually today the topic that we are going to do is related to that...*

6.2.2 Classroom activities

The teacher has to make the decision on the method to be used when specific Science content is to be done. The choice of activity depends on content as well as purpose, number of learners and learning theories. The selection of teaching method also depends on resources, factors such as the availability of equipment, time needed for the set activity, books and materials. The teachers were aware of these factors and catered for them seeking at least to avoid negative impact. An example was where all learners stood around and watched one learner following the procedure. This method was adopted due to lack of equipment and concern for safety.

6.2.2.1 Predominant methods

The lessons the teachers designed had activities in the form of practical work, demonstration, and question and answer, all of which seemed to involve learners. Demonstration, discovery and questioning were dominant among methods mentioned by teachers in the initial workshop. Despite the confusion in those discussions between "approaches" and "methods", the majority of the teachers felt that learner-centred methods were methods that they knew. They indicated that any LC method should involve all learners in its progress.

6.2.2.2 Linking new content knowledge with prior content knowledge

The teachers were aware of the idea of using 'prior knowledge' in their lessons and expected that in the course of the action research they would learn ways of incorporating prior knowledge into the development of new concepts. In their demonstration lessons, however, previous content was sometimes reviewed that had very little relevance to the new information to be learned: it was more about reviewing earlier lessons than setting up the current lesson. An example was Mrs Maki's class:

T: *What do we use the microscope for?*

S: *To look at small things.*

T: *To look at small things. Right. There are some things that we cannot... There are some other points of information that we cannot get using our sense organs, we need more instruments such as the Ultrasound, telescopes and binoculars. Let us look into our laboratories, what do we use to measure time? Yes (pointing at one learner).*

This introduction reminds the students of earlier work with microscopes, and extends to some other instruments that support the eye, but it makes no connection with the issue of measuring time that would be dealt with. In reviewing the lesson, the introductory talk was recognised by teachers to be more about bringing up what was covered in the previous lesson than building the current lesson.

"Prior content knowledge" referred to knowledge gained in the previous lessons or learners' daily encounters in class. Mr. Khaba made references to students' uses of electricity at the beginning of his lesson, but there was no link to the content of the day, which concerned electromagnetism, and no attempt to review, for example, ideas on current that might have been built on to establish the new content. The other teachers similarly raised past learning at the beginning of their lessons, without linking it to the content of the day. Again, in reviewing the videos, the teachers recognized the necessity of using previous subject content during the introduction of a new lesson, and its role in the knowledge construction. Their failure to do so might have been a lack of skill, or perhaps of awareness, which the videos brought to their attention.

6.2.3 Learners' Participation in the LC classroom

6.2.3.1 Hands-on experiences

During early discussions, the teachers argued that in LCE, learners should participate and involve all the different senses (listen, taste, touch, see and smell) to find or discover things for themselves. This was part of the argument for the students doing experiments together and handling equipment, which is based on touch, seeing and talking/listening. They felt that not all senses could or need be used in a given activity, but most of them should be used. During their demonstration lessons, all of the teachers gave learners the opportunity to handle equipment and observe, even during demonstrations.

> *Then connect the wire to the cells (long pause)...ok eh, you can ... eh is there any volunteer that can come here and do the very same thing that I said should be done. Yes, any volunteer?*

Mrs. Maki's lesson did not only involve touching, but enabled learners to operate equipment.

6.2.3.2 Observing, recording and discussing

During the initial workshop, and in their demonstration lessons, the teachers placed importance on learners making observations, and recording and discussing the results in a small group, with neighbours or with the whole class. Learners were able to communicate what they had done or thought, and share with members of the group and the whole class. The teachers saw that individuals and groups had some freedom to work in different ways and use different skills.

T *All right, is there anything that you have observed?*

S *No.*

T *Ok, can you please add more compasses?*

S *Only one.*

T *Has it moved?*

S *Only one moved.*

T *All right, from that observation here what we are doing is that there is something that actually happened. Can you do it again?*

S *Yes, teacher.*

T *Actually only one is moving.*

S *Vertically.*

The lesson showed some degree of collaboration between the teacher and the students, but with the learners given little opportunity to think and find an explanation for their observations. This was the degree of LCE that was observed.

6.2.4 LCE Benefits to learning

The initial workshop discussions and the critiques of each other's lessons, established certain points that teachers agreed as benefits of LCE. The teachers showed insight into and agreement about which activities would 'work' and the benefits that a particular method could bring. The benefits they saw in LCE methods were deeper learning, skills development, and a more positive attitude to Science and skills in management. The teachers linked these ideas, using logic more or less, as follows. Firstly, from deeper involvement through activities and interactions with equipment (laboratory and other), students would better understand Science concepts. At the same time, they would learn to be more critical and able to take responsibility for their learning. Secondly, the teachers argued that LCE could play an important role in the development of positive attitudes towards Science. Most learners, they claimed, do not like Science and a solution could be found in LCE. Its methods and principles tended to bring in the interests of learners and helped them to explore and challenge their daily encounters, inspiring them to learn more. Thirdly, if a lesson is properly planned and well thought out, it can link the Science content with its daily applications and make use of learners' surroundings as a context for that content. These different aspects could all work together in cycles that improved learners' attitudes towards Science while also building their knowledge.

One of the strong points of LCE, teachers said, is that learned concepts will be retained by the learner, which indicates a deeper understanding of concepts. The teachers raised the idea of deep learning in their explanations of LCE and in their belief in experiments as a way to achieve LCE. They tended to explain deep learning as being able to use learning in different contexts. As they put it, learners would be aware of Science in their surroundings and how Science could be used to solve problems or support activities in their daily experiences.

As noted earlier, the teachers believed strongly in involving different senses during learning. They also saw LCE as an approach in which learners are "expected to generate the required information" as they do the activities design for that purpose. This process develops skills such as observing, communicating and negotiating or discussing the results with other learners and the teacher. Although the teachers hinted at learners developing higher order thinking skills, they did not develop these arguments.

6.2.5 Constraints and conditions

The teachers were aware of the benefits that particular methods have in teaching certain content. They said:

> *...a combination of these two methods (LCE and TCE) ensures attainment of effective teaching and learning. A combination also ensures that the syllabus is completed within the given time.*

There are two significant points in this statement; one is the interchangeable use of 'approach' and 'methods'. The other is the acknowledgement that compromises have to be made in terms of time and coverage. Teachers did not consider it worthwhile to pursue one outcome/concept/theory for a long time because many students would become bored while others were still struggling.

6.2.5.1 Time

For proper implementation of LCE, the teachers were concerned that adequate time was not available nor was it properly organised. Like Glover & Thomas (1999), they argued that 40 minute periods are too short to allow the necessary interactions and engagements of LCE. They were concerned also at the time given for the whole syllabus coverage. They opted for TC approaches because that saves time. The issue of LCE being time consuming was a general concern for all teachers.

6.2.5.2 Number of learners in a classroom

Most of the classes had large numbers of learners, often squashed into a small number of desks. LCE is "*difficult in large classes, some of the learners are left ignorant*".

6.2.5.3 Lack of resources

The number of learners also contributed to issues of access to equipment for practical work, and the provision of worksheets and materials. Of the 20 schools that were represented in the BLS, 15 schools had only one laboratory for the whole school. One school had none, three had two laboratories and one had three laboratories. Where there was only one laboratory, it was a multi-purpose laboratory used for Biology, Chemistry, Physics and Science. This means that the 'hands on,' methods which the teachers saw as basic to LCE, generally has to be in the classroom outside.

More equipment is required for working in smaller groups, and this has implications for costs of purchasing equipment, maintaining it, storing and managing it. Teachers pointed especially to expendable and brittle equipment, such as batteries and glassware. For successful LCE, the quantities of laboratory equipment have to increase.

Schools also do not have laboratory technicians. The preparation of laboratory activities, checking and ensuring that equipment is functioning, storage and supply, all fall to the teachers. At the same time, teachers see laboratory work and hands-on activities as important, and try to use both LC and TC methods, depending on the situation.

6.2.5.4 Teachers' competence

Teachers raised issues of competence in two areas: content knowledge and professional knowledge. Even when equipment is available, the teachers have to be confident about how to use it: *"Teachers are not adequately prepared or there is lack of knowledge on how to use the equipment"*. They also have to know how to repair it, because there are no repair facilities (and perhaps no money), where this is done. The aspect of content knowledge is crucial, especially when students are asking many questions and bringing in ideas from beyond the classroom itself: *"How do you facilitate learning something that you do not know?"*

6.2.6 Power and expectations

The use of learners in demonstration experiments in the BLS showed one way of sharing the responsibility of conducting the lesson and giving the teacher more opportunities to observe and guide learning. Even when only one learner was involved in doing the practical, other learners identified with that learner, and knew that their turn would come. All of the teachers used question-answer methods during their lessons, and sometimes small group discussions. Even though the teachers did not identify these aspects as "power sharing", they used methods that shared the power to some extent. At the same time, as noted earlier, they believed strongly that it was the teacher's role to ensure good management, keep order, and have a plan that learners had to follow. They saw themselves as responsible for the classroom management and the learning.

6.2.7 Competing demands and assumptions

The teachers explained that as well as the many demands on their attention in schools, with time and resources always contentious issues, there are also assumptions that constrain what they do. For example, it is assumed that good teaching is demonstrated by a greater number of learners passing external examinations, and this means that covering the syllabus and working hard on the kinds of question that are set in examinations is important. They also felt that learners who were successful in rote learning could do well in the examinations, hence discouraging deep learning and relating Science knowledge to other knowledge and experiences. Whether through rote learning or not, passing examinations was the major goal. Here, the teachers felt that LCE could help in two ways. First, it could help with remembering: *"Concepts treated in this (TC) manner are easily forgotten."* Second, it could help the teacher to identify and work with students who were having difficulties.

Linked to this are assumptions about what teachers and learners do. For example, in School A, the classroom was set with one-learner desks arranged in rows and columns, with every learner at his or her own desk. Arguably, this strengthened an individualistic way of doing things. When the learners were requested to discuss as groups, they did not move the desks or shift from their seats, but opted for working with neighbouring learners. The school culture and norms, and even its rules, can be constraints.

6.3 STAGE 2: UNDERSTANDING AND PRACTICES AT THE END OF CYCLE 1

Stage 2 refers to Cycle 1 of the action research, the cycle immediately following the BLS. I identify it as a 'stage' because it was a period in which learning (from articles, meetings, experimentation and workshops) was high, and teachers' thinking, practice and saying about LCE changed greatly. In a planning workshop at the start of the cycle, teachers set their agenda as "learning more about LCE... reducing the time they take talking during their lesson and improving their utilisation of prior knowledge." In this cycle, their earlier concerns for the "benefits" of LCE and the constraints on its implementation gave way to wanting to learn new techniques and apply them in their lessons.

In the presentation below, I follow the same headings that were used in presenting Stage 1, where I draw on data from discussions, workshops, lessons, reflections on teaching, and critiquing each other's teaching.

6.3.1 Teachers' participation in the LC lesson

The teachers moved considerably from concern with order, safety, and ensuring that learners were 'on the track', to establishing a caring environment for learning. Here they were borrowing from Malcolm and Keane (2001), who proposed three levels of LCE: caring for learners and learning, providing LC pedagogies, and giving learners opportunities to influence curriculum content and outcomes. During the cycle, the result was that the basic management roles were deepened in quality and scope, from order and control towards higher quality learning settings and interactions.

6.3.1.1 Classroom management

The teachers were less concerned about 'noise': groups made "noise" as they worked through different activities, but the teachers realised that this could be productive and not unproductive. On one occasion, during a support meeting, they talked about learners taking advantage of the LC classroom and becoming playful, but this was now seen as something to be managed, not a basis for avoiding LCE.

The teachers were more inclined than in Stage 1 to write what learners were saying on the board during question-answer and reporting segments, sometimes strategically highlighting or emphasising certain words and ideas given by the learners, and helping the learners to see how certain concepts were necessary to meet the set outcomes. They also did this with groups. In one lesson, for example, one group of learners came up with ideas about how to make metals in different shapes, and another suggested a method of how to magnetise metals. During group reports, the teachers often repeated what the group presenter had said, even if it was not written on the board, as a way of ensuring that all learners heard what the presenter was saying and captured it. In some cases where presenters did not communicate effectively, the teacher requested other members to help. In these instances, others in the group usually volunteered to help, as they recognised that their colleague was having problems in presenting the group's views. As well as building group cooperation and support, the technique made groups comfortable with presenting because there would be support for any individual as required. It also enabled the group reports to become a more valued part of the whole lesson.

6.3.1.2 Facilitating learning

As mentioned earlier, for Cycle 1 the teachers chose to give particular attention to caring for learners and learning conditions. From their reading, and as part of their planning, they looked at methods that could improve rapport between the teacher and learners, and between learners themselves. One strategy for this was to make greater use of learners' names. Even when not calling learners by names, the teachers worked to build rapport and encourage discussions that were lively, asking questions and selecting different learners to answer them, so that the learners worked hard to come up with points of discussion. Part of this effort was to ask for different kinds of information. For example, in one lesson, the teacher called four learners by names, asking two to tell their experiences of growing up in the fields. The learners' stories were used as real life experience for others who did not know.

6.3.2 Classroom activities

The greatest shift from the methods used in stage 1 was towards more participatory activities. The lessons on flowers, how magnets are made and food, all demonstrated more and more varied interactions between the teacher and learners, and between learners. An example from one lesson was when individuals were asked first to write down their own ideas, in the next

stage, share and discuss them in groups of four which will later be used to stimulate open discussion to the whole class. This was a variation on 1-3-6 consensus (Malcolm, 1998), which worked as 1-4-45 consensus in this case. The groups of four took individual ideas to work on in critical ways, and consolidated them to one point to make to the whole class. Then the whole class formulated a few statements that could be tested through practical work. The teacher did not give a ready-made procedure for the practical work, only the question that the learners were expected to answer. Where the group work activities were not clear to the learners, the teachers recognised that and went to individual groups to clarify the task.

6.3.2.1 Linking new content knowledge with prior content knowledge

Mrs Motloung linked reproduction in flowering plants to learners' knowledge of reproduction in animals. The learners compared flowers they had collected, and identified parts performing particular functions in reproduction, based on similar parts in animal reproduction. The other teachers also attempted to use learners' prior knowledge, but only to introduce the new concept, proceeding to go in-depth with the new concept without linking it to old ones.

6.3.2.2 Including learners' daily experiences and interests

Allowing learners to choose what they would like to deal with in class was one way of meeting their interests. For example, one teacher invited students to choose flowering plants from the school ground to use in her lesson on reproduction, and this worked well in the lesson. However, one learner brought a dagga flower. This raised two issues. Firstly, what learners would like to do or understand might not be the same as what the teacher has in mind. The teacher had not been aware that there were dagga plants on the school premises. She acknowledged the flower, but made no further reference to it: in the class discussions, the characteristics of flowering plants were made generally, with students observing and comparing the plants they had brought. If the learner with the dagga flower had thought its introduction would lead to a discussion on uses of this plant as a drug, and its effects on humans, it didn't happen. Secondly, it is possible that the learner was testing the teacher, to see what she would do with an 'illegal plant' in the classroom. In this case, the teacher's response was probably the safe one: to 'notice' it, but not make any serious comment. She and the other teachers were unsure of how to deal with issues such as this – whether the ideas the

learners introduced might distract or redirect the class from the planned content and goals, and what to do when learners raised interests that might be controversial.

In other classes too, teachers sought examples from the learners as part of the lesson, on topics of flowering plants, hydro power, and foods. The lesson on foods and their containers attracted the attention of learners, not only drawing on their daily interests, but also creating a lesson in which all learners were participating and lively. Like the teachers in the other lessons, this teacher went beyond the learners' existing knowledge, by making them aware of the nutritional value of different vegetables.

6.3.3 Learners' Participation in the LC lesson

It is clear from the earlier reports that the learners' participation changed dramatically in comparison with stage 1. The learners enjoyed participating, and found the discussions interesting. For example, this extract from Mr Khaba's class shows that students were willing to contribute, and showed confidence in themselves. Despite presenting a more scientific statement during the whole group discussions, they original started with the following discussion:

One Learner	*Magnets are made using certain chemicals such as iron and steel.*
Another learner	*How? What are those chemicals?*
First Learner	*I don't know them.*

As well as participating in group and whole class discussions to reach consensus, the learners were given less rigid guidance on practical activities than had been the case in stage 1. As noted earlier, in one lesson learners collected flowers which they cut into halves, without destroying the smaller parts inside, so that they could compare different flowers and learn about the functions of different parts. In the lesson on foods, the learners selected food items to consider in their groups, and as a group, learned about the nutrients that were available in each food. Just the act of collection was important to the learners: they saw it as an indication of their involvement. This was extended further in the whole group discussions.

6.3.4 Constraints and conditions

In this cycle the teachers expressed no concerns about constraints and conditions: their focus was on interactions in the classroom and teaching techniques that were somewhat new to them. The lessons were completed within the time planned and generally reached the teacher's expectations. None of the lessons sought to use laboratory equipment, but instead used materials such as flowers and foods that were generally available. This was so even for lessons held in the formal laboratory.

6.3.5 Power and expectations

During the workshop provided by external facilitators quite late in the cycle, the issue of power sharing as a new aspect of LCE, or at least a new way of thinking about LCE, was raised. The teachers recognized the workshop process itself as an example of LCE approaches, and ways in which power, responsibility and inputs might be shared. For example, they were given opportunities – for the whole programme and in particular segments – to decide what to talk about and where emphasis should be. In this, the workshop demonstrated level three of LCE (Malcolm and Keane, 2001), where the participants not only engaged in LCE pedagogies, but influenced the development of the content and the outcomes available. They saw too that this can result in greater ownership of the learning process and deeper engagement (Malcolm & Keane, 2001; Harris et al., 2002; Brodie et al., 2002).

When issues of power and communication were put forward during the workshop, the teachers responded with a number of interesting insights into their schools and LCE. These were presented in Chapter Five. One group produced a diagram showing flows of power and communication in the school, highlighting especially the (limited) power of the teacher except in interaction with learners, and minute power of the 'told-type child'. This "told-type child" in relation to the teacher, or as part of a group, has little power, other than via parents, who could indeed exert pressure on the teacher to meet their expectations of 'telling'. A second group independently focused on the power of parents, and drafted a letter to explain the 'new' teaching methods, and request support. A third group produced a metaphor in which the curriculum was a garden, the learner was a girl picking flowers, and the teacher was a bee, hovering. The bee has no power over the type of the flowers, the design of the garden or the weather, but it can pollinate, and it can sting the child if it chooses. The fourth group

produced a picture of a dog and a bird, where the waiter served food in containers that the bird and dog could not access. They explained that different learners have different needs and abilities. Each learner is unique in the way he/she would like to be taught (containers of food) and the curriculum/syllabus (food) he needs/wants. The teacher (waiter) in this situation has to assess the learners and provide them with suitable food in suitable containers. Their metaphor had the added aspect that "food gives life", as knowledge and good teaching do.

Teachers pointed out that the teacher is essentially the waiter, not the cook. Or, shifting the metaphor, perhaps the bird and dog represent the teachers, the food is the policy, and the schools (and school management) are the containers. Perhaps the teacher is expected to be the "told-type child." The teachers recognised the need for collaboration not only between teachers and learners, but between policy makers, teachers, school management and parents.

Taken together, the teachers' posters show deep insights into schools and LCE. The bees poster showed that teachers were aware that learners know what they like and why they like it; the bird and dog poster showed awareness that different children need different things, presented in different ways; all four posters suggested that teachers felt they had very little power except that over students, like the waiter or the bee, and that they have to tread carefully between parents, policies and school managers. Giving learners choices (as in the bee poster) or fitting curriculum and teaching to individuals (as in the bird and dog poster), constitute a further shift in power away from teachers.

The four posters demonstrate three things from the teachers' point of view: 1) lack of power to practise LCE as they know it, due to the expectations of parents, school managers and the education system (including syllabuses, exams, timetables, resources and the norms of schools), 2) the demands on them to perform in particular ways, 3) their knowledge of the rationales for learner-centred education and participative approaches. These insights were well beyond their understandings in stage 1 and the BLS.

6.3.6 Competing demands and assumptions

As the posters show, teachers face competing demands in situations where they are limited in what they can do: they can't change the examination system, for example, or the fact that parents (and everyone) tend to judge schools, teachers, and learners by examination results.

So, for example, the letter to parents "humbly" wishes to inform them about new methods and request patience and support.

In follow-up, the teachers talked about the need for closer collaboration at the system level, at the school level, and at the classroom level. For example, they argued that parents should be "co-workers" in the learning process, just as teachers and learners needed to be co-workers in the classroom, and parents, learners and policy-makers might be co-workers in the design of policy. However, their immediate concern in the domain in which they did have influence, was classroom practice. In the poster of a 'letter to parents', the teachers purposefully decided not to write the letter to the Ministry of Education, the principal or the school board; in a sense they saw parents as their closest partners. So teachers saw themselves as caught in a trap made by the policy designers and the education system, especially when it asks for LCE in situations where it is not readily accommodated.

6.4 STAGE 3: UNDERSTANDING AND PRACTICES AT THE END OF CYCLE 3

Stage 3 consisted of two cycles of the action research, Cycle 2 and Cycle 3. The changes for the teachers through this stage were not so much in their understanding or skills as in their confidence. They were more confident to try things with their learners, and to run workshops with other teachers. They recognized that LCE was an approach more than a set of methods, and an ideal more than a recipe. On the one hand they saw it as 'more difficult' than they had expected, and on the other hand they saw that there was no 'right answer' in the design of lessons, which provided scope for their imagination.

6.4.1 Teachers' participation in the LC lesson

Connected with their growth in confidence, teachers showed considerable change in aspects of rapport in the classroom, not only in the classroom environment they were able to establish, but also in their interactions with individuals and groups of learners. This increased rapport was only partly about using names. For example, Mrs Lebo called 15 learners by their names during a Cycle 2 lesson, but none in Cycle 3. However, she did use terms of address that were friendly and respectful. Mrs Motloung, in contrast, displayed great increase in using students' names, from eight names in the beginning cycle to 18 in Cycle 3. Some of the teachers used a technique of repeating learners' names, where the learners were requested to

explain what they meant, and then given the opportunity to talk without interruptions. The learners in these two classes were relaxed and comfortable when presenting and answering questions.

In the reflection meetings in Stage 3, the teachers agreed with one another that they should allow learners' time to answer the question asked, and should avoid asking more than one question at once. The lessons in stage 3 showed different methods of facilitation from earlier stages, especially because teachers had reduced their talking time during whole-class segments. They balanced their talk with learners, as shown below.

T *Ok, another group.*

S *Spade!*

T *Spade. Ok, let us write it (writing it on the board).*

S *Spear.*

T *Spear, is it a machine that help to make work easier and simple? Another one, please. Yes?*

S *Wedge.*

T *Wedge, (repeated it as she is wrote it on the board), what is it in Sesotho?*

S *"Selepe".*

T *"Selepe", is not an axe?*

S *Oh yes!*

T *Which are the modern machines?*

S *Spade.*

T *Spade was mention earlier.*

S *Wheelbarrow.*

T *Wheelbarrow, ok. This group.*

S *Computer.*

T *Compute ok! This group?*

S *Tractor.*

T *The tractor. The group behind you (pointing to one group).*

S *Digging fork.*

6.4.2 Classroom activities

6.4.2.1 Linking new content knowledge with prior content knowledge

For lessons in Cycles 2 and 3, the teachers tried to use the learners' background knowledge as part of the lesson. An example was Mrs Moutlong's lesson, again on reproduction (as in Cycle 1), but this time with a different class, and on insects. The learners' ideas and interests were much more critical to the development of the lesson than in the similar lesson in stage 2. This time, she gave them options about which characteristic of living things they would study. When they chose reproduction, she suggested three examples of a frog, fish and a bird. When they needed help with the concept of life cycle, she used the human life cycle (building from the example of one learner's family) as a model. She depended on the learners, as groups, to know the different stages in the life of particular insects, but pushed them to use and learn vocabulary that was common for all insects.

6.4.2.2 Meeting learners' daily experiences and interest

The activities that were used to bring in the learners' interests varied from having them talk about the Science content to talking about personal experiences. Mrs. Lebo's lesson above is an example. Another concerned locally-used tools. Among the many that were listed, one was a bulldozer, but this was not discussed as part of the lesson. Towards the end of the lesson, one learner requested an explanation. The teacher did not answer herself, but turned the question to the class. A learner offered not an explanation in English, but the name in the mother-tongue language, and the teacher accepted this strategy as the right one.

S *Madam, what is a bulldozer?*

T *She is asking what is a bulldozer.*

S *"Khofu".*

T *"Khofu e etsa hore mosebetsi o be bobebe".*

Another example was when a learner introduced knowledge that he had, perhaps seeking to have the topic taken up in detail. It concerned the possibility of using cow dung as a source of energy.

T *What did he say about energy? He is wasting our time (he did not say anything). That is all?*

S *That I can make my own energy.*

T *But there is a problem of making your own energy. What kind of energy are you going to make for yourself?*

S *Gas.*

T *Which gas? From what are you going to make that gas?*

S *Cow dung.*

The teachers also recognized that different topics have different potential for building on learners' knowledge and experience. In Cycle 2, for example, they noted a lesson on atomic bonding, where possibilities of using learners' 'everyday knowledge' were much lower than in lessons of flowering plants or foods or tools.

6.4.3 Learners' participation in the LC classroom

In stage 2, and more so in stage 3, the teachers shifted their ideas of 'hands-on' from laboratory work with Science equipment to using a range of materials. In one lesson in cycle 3, as the teachers noted, the 'hands-on' in the lesson was not direct experience with sources of knowledge at all, but recollected experience, as the learners constructed maps of the life cycles of insects.

Building on stage 2, teachers in stage 3 expected learners to take part in group discussions, and gave them tasks that forced them to share their views. These tasks flowed smoothly and effectively, with the learners happy to discuss, come up with examples and ask questions. The teachers also worked to use learners' ideas as part of the lesson. In only one instance in cycle 3 was the role of learners restricted to group discussions and presentations, without attempts to build and expand on their ideas.

6.4.4 Constraints and conditions

As noted earlier, during the externally facilitated workshop in stage 2, the teachers had found the consideration of power (in the education system, the school and the classroom) a new way of thinking, and a useful one. Even as they articulated the limitations of their own power, they found the discussion liberating, alerting them to what can be changed and what cannot be changed (at least not easily). They responded to this in stage 3, in two ways. First, they were more inclined to accept constraints as something to work around or with, rather than feeling

helpless about them. Second, they made more attempts to distribute power within their classrooms. Thus, issues of constraints and conditions in schools only came up as part of planning specific lessons. In Cycle 3, Mrs Lebo did not have any equipment to demonstrate the simple machines. She came up with an alternative, to collect equipment from the neighbouring school. This turned out not to be possible because of administrative work required. She then made a revised plan, to have the learners talk about simple machines they knew well.

The issue of the number of learners in a classroom remained: room size, desks, and equipment were all inadequate for LCE. Even so, the teachers all sought methods that would involve learners more deeply in working together and with the teacher, doing activities individually, in small groups and as a whole class.

6.4.5 Power and expectations

As noted earlier, the teachers in Cycles 2 and 3 increased their focus on power sharing, through greater use of learners' ideas, 'trusting the learners' to plan and conduct activities, and using tasks that pushed learners to think about the content and contribute to the development of the lessons. The lesson on life cycles was an example of democratic planning, where the learners chose the aspect that they wanted to study (reproduction and life cycles), and then brought into discussion their own knowledge of the life cycles of certain insects. The teacher in this class was aware that learners might choose a different topic from what she was ready for, and indicated she did not have a ready-made plan to cater for some of the interests that might come up. At the same time, she knew that the learners understood this lesson as a continuation of earlier ones on the general topic of living things, and was confident that they would stay more or less within the bounds of the syllabus.

T *How many are saying they reproduce?*

S *Whole house, (some said) Whole class.*

T *It is like the whole class would like us to talk about reproduction.*

S *Yes (all).*

T *That is what we are going to talk about today. You have chosen this topic now but I have chosen it yesterday. So, reproduction. Why do you want us to talk about reproduction? Why did you say you would like us to deal with how living things reproduce? Can you tell me your reasons? Yes?*

S *Because I want to know how they reproduce.*

T *Does it mean you do not know?*

S *Yes madam. (one said) I want to know more.*

T *You want to know more?*

S *Yes*

T *What do you know? What is that you know? "Ha kere" you are saying you want to know more. Can you tell me what is it that you know at the moment? Falimehang? Do you know anything about reproduction?*

Through stage 3, more effectively than the earlier stages, teachers used groups as part of reviewing previous lessons and developing the current lesson. The teachers perceived that power sharing, catering more to individuals, and engaging more learners more deeply could all be achieved through group work.

6.4.6 Competing demands and assumptions

The pressures of competing demands, for each teacher, and for those teachers who had been engaged to 'help' in one way or another, intruded into stage 3 as they had in the earlier stages. Thus, as before, classes were rescheduled, resources that were organised were suddenly not available, and so on. But by stage 3, all of us were perhaps more accepting that people had busy lives, and plans simply had to be changed as necessary to accommodate shifting priorities.

6.5 WORKSHOPS FOR OTHER TEACHERS

As described in Chapter Five, the teachers during stage 3 decided that, as part of the project, they would conduct workshops on LCE for other teachers in their schools. These plans came to fruition in two schools, Schools B and D. This decision shows the confidence that the teachers had in what they had learned, and more: they sought to run the workshops in ways that modelled LCE, giving teachers who had observed their lessons, and participants in the workshops, considerable freedom to raise issues, express ideas, and discuss concerns. For example, Mrs Motloung in School B began by inviting participants to add topics to the agenda, and then asked them to say what they thought were the features of LCE, and list its

advantages and disadvantages. Mrs Lebo in School D began by having the teacher who had observed her lesson report on it. As it turned out, this report was too brief to be a springboard for the session, which left Mrs Lebo having to take the lead herself, but her plan nevertheless demonstrated her preparedness to take risks with passing the lead to others. In both workshops, the teachers showed considerable insight into meanings of LCE (consistent with the descriptions above), the constraints on it, and the ways that creative solutions might be sought. It showed too that their experience during the action research had enabled them to anticipate the positives and negatives that participants would raise, and build on them in productive ways.

6.6 FINAL INTERVIEWS

In the interviews at the end of the project, the participating teachers talked about the ways in which their understandings of LCE and the constraints in schools, combined to shape their final positions. Extracts from their interviews provide an indication of the ways their knowledge and practice changed. The extracts show that different teachers changed differently, but also that some teachers were more articulate than others about the changes they had experienced, which were largely group processes of discussion, joint planning and reflection.

Mrs Motloung:

> *I thought if I could know more about LCE this could help learners to learn properly in our classrooms.*

> *LCE has to deal with learning environments, types of methods and meeting the objectives of schooling. In this view, "hands-on" is just a small portion of the learning environment that is said to be LC.*

> *The study actually made me see my teaching from a different angle of being bound by the policy requirements to that of enjoying what I am doing and utilisation of more skills from fellow teachers.*

I did not plan my lessons in the past but now I understand the necessity of having a written plan and selected specific activities for each lesson. The selection has to involve the specific topic and challenge that would engage learners.

Mrs Thabi:

I recognised in this activity from both practice and literature that my past methods of teaching did not widen the scope of knowledge of the learners. The use of their previous knowledge and the new knowledge during learning turned out to be more exciting. This is one of the aspects of LCE that I discovered by being part of the study.

LCE is a teaching approach which gives the learners more chance to individually or as a group work towards attaining necessary knowledge construction. It works towards building an individual who is critical and able to think independently versus TC, where the teacher is regularly making conclusion for learners and providing them with the final conclusion that are not open for challenges. In LCE there is an increased participation in the conduct of the activity, its processes, discussions of the results and then the construction of the conclusion.

My teaching gives more work to the learners in different ways throughout the set activities.

And though Mr Khaba could not participate fully in Stage 3, the changes in his teaching from stage 1 to stage 2 were noted by Mrs Thabi and Mrs Lebo:

I can identify one teacher who I think has grown considerably during the study- it's Mr Khaba. The methodology that he used in the BSL has been highly traditional but there was drastic change in his second lesson. Probably this was due to the fact that he made use of the literature and discussions from meetings and workshops. (Mrs Thabi)

Mr. Khaba changed in methodology of teaching and was able to socialise and even discuss academic issues when we met along the streets. (Mrs Lebo)

6.7 LCE MODELS

In this section, I present the models of LCE that the teachers, as a group, held in each of stages 1, 2 and 3. From the beginning, the teachers were cautious about the 'ideal LCE' as presented in the literature, and well aware of the constraints and expectations that surrounded them and their classes. The ways in which they critiqued LCE changed markedly during the project, from concerns that it would interfere with order, syllabus coverage and examination results in stage 1 to imaginative criticism and searches for effective compromises in stage 3. At no stage did they simply accept some authoritative view of LCE and seek to implement it faithfully. The effect was that they used their knowledge of schools and traditional teaching and their expanding knowledge of LCE to try to find a version of 'quality education' that involved some combination of LCE and traditional approaches, to create a solution that they felt was appropriate in Lesotho. My purpose in this section is to present that solution, showing how it derived from the teachers' experience during the research project.

The teachers' understanding, as I am presenting it, is based on their actions in classrooms, their discussions as part of the planning and reflection meetings, and how they explained LCE in their practice and through their research. Neither what teachers say nor what they do fully represents their understanding, especially while they are experienced teachers, highly skilled in perceiving learners' moods and responses, and making classroom decisions 'intuitively.' In this, I am aware of the difficulties of capturing in print, for example, the ways that learners were participating and contributing, or the confidence in thinking and experimentation that were emerging. To report that 'the learners were participating more deeply,' or 'the teachers had gained in confidence' is only to hint at the knowledge and understanding of LCE that was operating. To this must be added the fact that, throughout the project, over a period of two years, the teachers were mostly 'on the run', fitting the project into busy lives, having to make unexpected last minute adjustments because of particular demands and conditions in schools. The lessons the teachers presented were not highly rehearsed lessons, but part of school life. Within these limits, their explanations and classroom practices portray to some extent their understanding. For example, Lake (1995) argues that teachers' understanding is associated with the type of teaching they practice. Waters-Adams and Nias (2003) claim that, while teachers may not fully describe and explain their understanding, through their practice they portray significantly both tacit and espoused understanding. Therefore, in my analysis, teachers' explanations and practices are utilized. I am also aware that, while the group

planning and reflection sessions resulted in sharing of understanding, there is not 'one understanding' for the group, nor even for an individual teacher. As McCombs (2000: 6) observes "...'learner centeredness' is in the 'eyes of the beholder' and varies...".

Finally, the ways in which teachers' understanding changed over the course of the research project reflected to some extent the plans they made for successive cycles. The teachers used a number of research papers and books as part of the research, but three proved to be influential: the paper by Malcolm and Keane (2001), which suggested three levels of LCE, and two books by Malcolm (Malcolm 1998 and 1999), which offered practical advice on LCE teaching methods, group work, and so on. Also critical was the externally facilitated workshop in stage 2, where the teachers analysed teaching and schools from the perspective of power-sharing. Thus stage 1 represented the teachers' initial conception of LCE; stage 2 focussed on the idea of 'caring for learners and the learning situation' (level 1), which extended into LCE pedagogies (level 2), and stage 3 moved further into giving learners a say in setting outcomes and content as well as influencing the pedagogical development of the lesson (level 3, as reflected by Malcolm and Keane, 2001).

6.7.1 Stage 1 LCE model

At the start of the project, the teachers' main interest was to have more learners do better in examinations. They were aware of LCE principles and methods, and saw them as a way to achieve better learning, especially through "hands-on" laboratory work, learners finding things for themselves, working in groups, and linking content in the classroom to everyday life. The major requirement for the teachers was to engage more learners more deeply in the content of the lessons. They also recognised LCE as having the potential to develop a positive attitude towards Science, and a range of skills.

While the teachers were broadly aware of constructivist learning theories and helping learners to construct knowledge, they saw themselves as needing to structure the learning sequence and control classroom interactions in ways that would lead learners to 'right answers'. Order, safety, control, and a lesson plan were pre-requisites for learning, and the basis of 'facilitation.' Effective classroom management included control of the lesson's development, the discussions and tasks, and ensuring progress for individuals and the class overall. Facilitating learning is not only about tasks and presentations and discussions in the

classroom, but also about authority, order, safety and control over the learners, and assumptions concerning what learners can do or can be allowed to do. Vakilisa (1998) notes that classroom management does not encompass only the teacher's content knowledge and presentation, but also strategies for motivating learning and maintaining order in the process. Kasanda and Ndunda (2005) also point to ways that LCE goes beyond what the TC classroom entails, with different relationships between teacher and learners and different assumptions about learning and participation.

To the teachers in stage 1, the presence of "noise" in a classroom demonstrated a lack of classroom control and management, and interference in communication. To them, noise reduced the prospect that any learner was learning. Neither did they distinguish between noise, order and control: if there was order in class there would be no "noise"; if there was "noise", there would be no order. After watching videos of each other's lessons, the teachers had difficulty getting beyond the presence of noise to look at what the learners were actually doing, or even the source of the noise.

Although there was confusion between LCE approaches and methods, teachers were well aware of the value of selecting the teaching methods to be used, according to content, the situation at hand, and likely effectiveness. The difficulty in confusing a general approach with particular methods arose especially from the conviction that, at least all the time, the teacher needed to present ideas, summarise ideas, and lecture, and they feared that LCE did not make room for such methods. At the same time, they greatly valued the use of practical work (including demonstrations) and asking probing questions during whole class question-answer sessions, in order to encourage engagement and monitor progress. However, they recognized from the videos that during those discussions, they talked too much, and often gave learners little time or room to express ideas or ask questions (a finding similar to that of Modisenyane et al., 2003).

The teachers indicated that any of the LCE methods adopted should involve and engage learners in its progress, as "the learners were given the opportunity to contribute to the discussions." The processes the teachers used ranged from having learners discuss ideas with their neighbours, in small groups, hands-on laboratory work, to whole class demonstrations with equipment, and whole class discussions. An idea that was important to the teachers was that learners should use different senses (all five of them) as part of finding things for

themselves. Thus, practical activities were important where learners could handle equipment, make observations, record and discuss the results. The teachers saw this also as learners taking responsibility for their own learning (Harris et al., 2002).

Especially when facing the constraints and limitations in their schools, the teachers argued that a combination of LC and TC methods was required, to ensure attainment of syllabus coverage and to save time. In their large classes, the considered goals of every learner learning in his own way and own pace was impossible: there would always be some learners who were slower than the others, and compromises were necessary between the needs of different individuals, and the needs of the whole group. Moreover, they pointed out that it is not easy to adapt LCE where there is not enough equipment, space or time. LCE is an expensive approach because more practical equipment/material has to be bought; more laboratories are needed, and the work involved in preparation and maintenance of equipment takes the teacher away from other responsibilities. The teachers conceded that lack of competency and time for preparing for laboratory activities, using and fixing equipment led them sometimes to not using the equipment they had. Chisholm et al. (2000) similarly identified lack of resources and lack of teacher training as factors that affected teachers' adoption of LCE approaches in South Africa.

In summary, the teachers were aware of the principles and different aspects of LCE before the action research started, though their levels of understanding and use varied. Their conception of LCE was based on engaging more learners more fully, but in a framework of order and safety, time, resources and the demands of examinations, where they felt it was critical that they held closely to the control and flow of the learning. In practice, they saw techniques such as practical activities, group work and question-answer approaches primarily as ways of achieving deeper engagement and hence more effective learning. Therefore LCE was mostly a collection of teaching methods, where the teacher was the authority for the knowledge, the management of learning, the sequencing of ideas, and the monitoring of progress.

6.7.2 Stage 2 LCE model

When changes in practices are promoted in a school curriculum, teachers adapt them based on their knowledge and interpretations, settings at schools, and how the changes fit within the existing school context, beliefs and cultures (Halai, 2004). In stage 2, the teachers' actions,

explanations and understanding of LCE demonstrated major changes in their understanding, personal and professional interests, and focus of concern. During stage 2, these changes were guided by the literature which they discussed in their support meetings, and by experimentation in their classrooms, critical reflection and joint planning.

During stage 2, the teachers saw much more clearly that all learners have to learn in their own ways, and that they have different interests and needs. This was evident especially in the posters they developed about the dog and bird, and the garden, and to a considerable extent in their classrooms. It required that the teachers give learners more power and responsibility in engaging with the learning, contributing their ideas and bringing in their knowledge from other experiences. It involved shifts not only in their faith in learners and different approaches to classroom management, but shifts in their view of learning, from an emphasis on knowledge transmission to a more social constructivist view, where the teachers recognized the roles that all those around the learner (the teacher, the parents, the resources, the activities and the policy itself), played in knowledge acquisition and active participation in learning. They no longer expressed concerns about 'noise' and 'control', and were comfortable with the idea that the teacher should present information, and guide the classroom processes quite closely. These adaptations supported the acquisition and construction of knowledge, the development of different skills and deeper relationships in the classroom situation (Pololi & Frankel, 2005). They were 'rewarded' by the learners' responses, the abilities the learners showed to take responsibility and contribute, and the teachers' perceptions that more effective learning was taking place. Like the teachers in Majara's (1998) study, these teachers demonstrated they were still in charge of the general management and planning of their classes, but had moved beyond concentrating on control to promoting critical participation of learners through support, the design of activities, and strengthening the relationships between the teacher and learners.

They saw also that LCE, in spite of greater participation and 'freedom', nevertheless had its own kind of order, and required more attention, not less, for lesson preparation and planning. The teachers worked on the conditions of learning in their classrooms in ways that addressed issues of care, for example, by knowing all learners and calling them by their names (Vakalisa, 1998); listening to learners, using their ideas and responding to their questions. In some instances, the teachers encouraged mother-tongue use to recount experiences, and to help with conceptual understanding. In most of the lessons, there were times when learners

challenged the decisions made either by the teacher or their group, and this was not seen as disrespectful or threatening.

The activities that the teachers designed in stage 2 were not step-by-step recipes as they tended to be in stage 1, but challenged learners to think about goals and processes, and come to agreement within groups. These activities increased participation and flexibility in the lessons (Smyth, 2005), affecting not only the activities themselves, but the general climate of participation and respect in the classroom. To some extent, the teachers were 'taking risks' in these kinds of experimentation (Minton, 1998). However, arguably, the risks were not great: the teachers were highly experienced, and well respected by their learners as well as their peers.

Modisenyane et al. (2003) point to the importance of incorporating learners' prior content knowledge into the construction of new knowledge. In this study, teachers similarly experimented with using the learners' prior knowledge and experiences to build the lessons. Whereas in stage 1, the teachers had restricted their reference to prior knowledge to a review of the last lesson (regardless of its direct relevance), in stage 2 they drew on and used prior knowledge, not only as part of introducing the lesson, but at points in its development. The learners were able to share their knowledge, experiences and interests in small groups and as a whole class. Part of this was a wish to connect the activities in the classroom to the everyday experiences of the learner (Kasanda & Ndunda, 2005). This aspect was much more highly developed during stage 2.

With their deeper understanding of LCE as it emerged during stage 2, the teachers saw LCE more clearly as a major shift in the nature of teaching, management and power distribution in the school – an approach, rather than a collection of methods. The teachers recognised the need for communication with parents as part of the change, as shown in the letter to the parents to explain the new approach and invite support. From the perspectives of policy, systemic requirements, schools, parents and classrooms, the teachers showed they were now quite aware of what was happening from the design and implementation of the Science syllabus, and the expectations of parents and others. Their analyses of the flow of power and communication that they showed in their posters were important. There was a uniform feeling in the group about the power that different participants in education had, especially the small amounts of power of teachers, except over learners in their classrooms, and the details of

teaching they provided. (In stage 3, they built on this, seeing more clearly the power they did have in lesson planning and in influencing their peers, and the advantages of giving some power to their learners.) They were broadly aware that, in their participation in the research programme, they had a major influence over its learning outcomes, shaping the agenda themselves, drawing on their own experiences and needs, as well as influencing over the learning process. To the extent that the research programme was a model of LCE, this raised issues of how much learners in school should influence the content of lessons and not only the teaching methods. In general, the teachers did not wish to go this far – mostly out of concern for covering the syllabus and preparing for exams – but they made some moves that allowed the learners to influence what was to be learned as well as how. For example, in one lesson learners were allowed to select the characteristic of living organisms (mainly plants). Overall, the teachers came to see power not as absolute (whether in policy, the system, the principal, parents, teachers or learners), but as part of the relationship between all, which meant that power could be negotiated.

With this understanding, constraints, conditions, assumptions and competing demands had a different significance from those in stage 1. While the constraints needed attention at all levels of the system (see also Modisenyane et al., 2003; Mohr, 1986; Onwu, 1998), there were possibilities, and they could be liberating. Constraints, conditions, competing demands, expectations and assumptions were not talked about as much in stage 2, but still operated to affect teaching. The effects were not only from the 'obvious' conditions of large classes and few resources, but also interruptions to teaching, a noisy throng just over the school fence, the rescheduling of classes, and so on.

6.7.3 Stage 3 LCE model

While the teachers' achievements during stage 2 might be considered as little more than opening forays into LCE, their experiences were sufficient to illuminate their understanding of LCE and affirm their own abilities to think and work in new ways. Thus, they moved quickly to an interest in adapting LCE critically and creatively to the conditions in which they worked. They recognised that LCE as an approach, which is based on listening to learners, incorporating learners' experiences, developing challenging activities, adopting relevant teaching methods, utilising and creating contexts, and building from learners' prior knowledge requires believing in themselves and the capabilities of each learner.

In their critique and refocusing of LCE, they no longer saw it as a collection of methods, but a whole approach, and one in which creativity and compromises were required:

> *Because the LCE if it was properly implemented it will mean, each learner have to go at his or her own pace. You do have to consider the time factor. When I plan for it, I have to plan for fast learners, medium learners and slow learners, so that each one of them goes at his or her own pace.*

There were further changes, compared to stage 2 in the way they organized their classrooms and the type of instructional methods they adopted, in particular by strengthening group work and making greater use of learners' contributions (Esteve, 2000; Apple Learning Professional Development Research, 2002). The discussions in groups, and the groups' presentations were more critical and thoughtful. Important points were captured on the board and used by the whole class. The teachers created an environment that demonstrated care for all learners, concern for learning, and support for different ways of learning (Esteve, 2000). This increased the learners' commitment to the lesson and resulted in deeper learning, an objective that the teachers had proposed at the beginning of the research project.

The teachers' workshops and demonstration lessons showed not only their confidence and abilities, but their preparedness to break common boundaries, for example, by inviting colleagues into their classes, and, in one school, by involving teachers from other subjects. They showed also their desire to change their school's individualistic approaches, and to influence other teachers' practices. At the same time, they maintained their own commitments to the research team, and working across schools. Angelides, Evangelou and Leigh (2005) emphasize the roles of collaboration of teachers from different schools in teacher development.

6.8 A MODEL OF LCE FOR LESOTHO

The teachers who opted into this project and maintained their commitment and involvement over the two year period of the project were already skilled and experienced teachers when they began. During the project, they worked thoughtfully and creatively, as a group and individually, with policies, research literature, published teaching methods, and their own experimentation and reflection. Thus, they provide a somewhat unique and special resource in

Lesotho. Out of their experience, they formed, albeit in embryonic state, a version of quality education and LCE that can guide policy development and teacher support in Lesotho. In this section, I outline the features of the model they derived eventually.

The teachers' primary concerns were to have as many learners as possible learn effectively in their classrooms. Effective learning had to be seen mainly in terms of syllabus coverage and examinations results, but extended to other outcomes, such as positive attitudes to Science, development of a variety of thinking skills, practical skills and social skills, and seeing relationships between the 'Science' they learned in school and their lives beyond school.

To this end, LCE could be considered as a collection of teaching methods, such as hands-on activities, projects, group work, question-answer and discussions, that helped more learners engage the lessons more deeply. But LCE was better considered as an approach to learning, centred on participation (for all learners) and power-sharing, responding to learners' needs and interests as individuals and as groups. This changed the nature of authority and power in the classroom, and created a classroom climate quite different from a traditional, teacher-centred classroom.

The hierarchy of 'levels of learner-centeredness' (Malcolm & Keane, 2001) was found to be a helpful idea underpinning for the model. At level one, 'caring for learners and learning' is largely about the relationships that characterise the classroom: knowing the learners individually and through the groups to which they belong, believing in their capacity to learn and wanting them to learn. These relationships are "expressed" and "negotiated" through verbal and non-verbal actions and interactions with others (Robertson, 1996). Brodie, Lelliott and Devis (2002) cite Surgue's claim that the most significant aspect of LCE that teachers can demonstrate is in interpersonal relationships. Teddlie and Meza (1999) make similar arguments.

They saw too that having different ways of learning operate in the classroom tends to make learning itself an object for discussion, as learners see how others learn and experiment themselves. In similar vein, the teachers saw that many of the common LC pedagogies could support outcomes beyond 'learning Science', such as critical thinking, problem solving, communicating and working with others.

While advocating LCE approaches, the teachers firstly saw a complete individualisation of teaching and learning, whereby, for example, every learner achieved a certain level of knowledge. There would always be some learners who were slower than others, and to 'wait' for them would be to prevent the rest of the class from learning. Second, they distinguished between what might be called the flow of learning and the flow of teaching. During whole-class presentations and discussions, they were quite aware that some learners would be 'left out', even when the teacher used question-answer methods with skill. Attending carefully to individual learners who were struggling would cut across the flow and logic of the lesson for the class overall, interfering with participation and engagement. Thus, they had to manage the "flow of teaching" in ways that monitored the whole class, including many individuals, but without diverting or stopping the flow. The flow of learning thus belonged to the whole class, and perhaps most of the learners, but not every learner. Teachers had to attain and sustain a balance, not just between fast learners and slow learners, but between a dynamic that was flowing and one that was not.

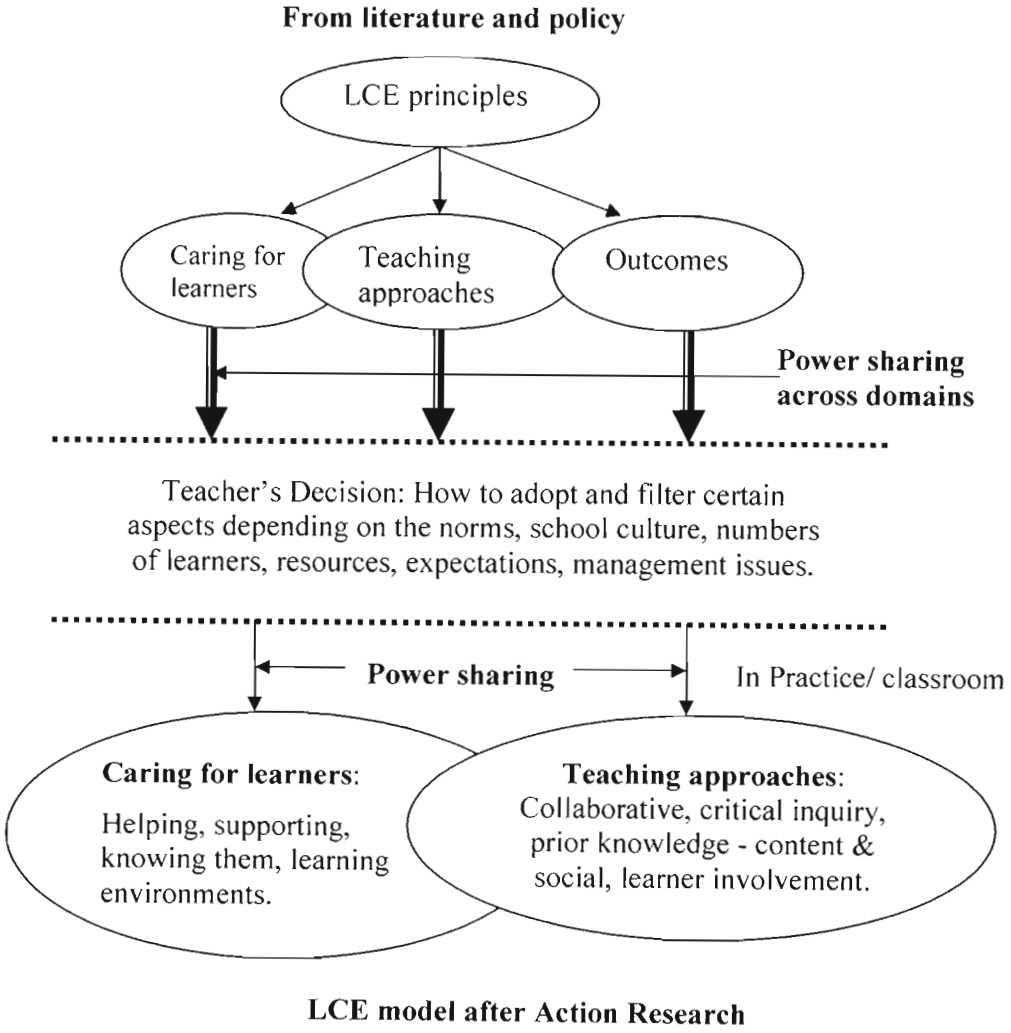
Similarly, they had to balance content coverage and participative methods such as group work and creative activities, especially given constraints of resources and time. This required teachers to make presentations, summaries, lectures and demonstrations. Such presentations could be done in ways that are compatible with LCE as an approach, when they acknowledge diversity and promote participation, challenge, inclusion and common goals.

While the teachers understood the reasons for level 3 of learner-centeredness, where learners participate in the selection of content and influence the outcomes to be addressed (Malcolm & Keane, 2001), they saw limited possibilities for this. Given the importance that the system, parents, schools and learners place on examination results, and the consequences of poor results (for learners, teachers and schools), the model of LCE had to make examination results a priority. This required the teachers to emphasize the kinds of outcomes that examinations can measure, and give time in class to practice and prepare for such questions. At the same time, they understood the rationale for and value of level 3, as indicated especially in their metaphors of the bird and dog (where the bird and dog require different foods, as well as different ways of eating), and the garden (where the learner chooses flowers she wants). They also allowed level 3 to operate to some extent in their classes, giving learners some freedom to choose topics and examples, and allowing them to influence the development of the lessons through their own interests and experiences. In the action research project, the teachers were

well aware that they had major control of the agenda as well as the processes of learning, and that this was an expression of level 3.

The model of LCE that emerged as achievable is represented in Figure 6.1. This figure shows two models of LCE: one given by literature (ideal LCE) and one that is "practical or doable". The capacity for learners to influence the outcomes available (Malcolm & Keane, 2001; Brodie et al., 2002) is not a significant part of the model. This is mainly because of the demands of syllabus coverage and examinations, within policies that also advocate LCE.

Figure 6.1: The model of LCE that emerged



The teachers, in this model, recognised a distinction between LCE and learners' engagement in classrooms. A good lecturer, for example, could succeed in engaging most or all of the learners, but this would not make the process learner-centred. They viewed LCE's main interest as bringing into the lessons learners' backgrounds, interests, learning styles and beliefs, and building learning through participation in a variety of ways. This would also increase engagement. While it would go beyond learning that was particular to examinations, it could include such learning. The learners could enjoy learning one concept in different ways, sometimes through a practical setting, at other times through a cultural setting and so on, but still reaching more or less the same outcome. Thus the "flow of learning" and the "flow of teaching" could be brought together. This meant that, while teachers had limited power (in relation to the syllabus and the examination requirements), they also had significant power in the design of lessons and as leaders in classroom processes. An effective way to use that power was to distribute it to learners.

The teachers' commitment to "learner-centred approaches" in classrooms does not mean that all the designed activities are "learner-centred methods". For these teachers, the choice of teaching method depends not only on resources and time, but the content of the lesson. For example, a lesson on "atomic bonding" has much less scope for drawing on learners' beliefs and experiences than one on foods or reproduction in plants, but it can be a topic in which the learners' are deeply interested. Thus, once again, the teachers demonstrated that an "effective education" does not have to match "ideal LCE", as it is commonly promoted in the literature. The teachers understood these complexities from the beginning and made their own judgements on how to adopt LCE principles. They were guided by their knowledge of what is possible in view of situational factors (such as policy, school, classroom, community, learners, teacher, resources etc.), and what is changeable (in the short term at least). So too, while they generally supported and strived for constructivist approaches to learning, they decided that presentations, lectures and summaries could and should be accommodated in that framework.

The teachers' preference to modify 'ideal LCE' for their own practice was not due to lack of understanding of LCE, constructivist learning, the conditions in schools, or existing power relations in the education system, schools and classrooms. Nor was it due to their lack of skills (or, at least, their confidence they had the skills at a basic level). As part of their own learning during the action research, including their reflections on the literature and the

learning and experimentation in their classrooms, they had lived level 3 LCE, and social constructivist approaches to learning. Their final choices and 'recommendations', rather, were based on a new knowledge of LCE combined with knowledge of schools and the education system with their competing expectations as well as requirements, and judgements about changes that are possible in the short term in Lesotho.

CHAPTER 7

PARTICIPATION AND CHANGE IN ACTION RESEARCH

7.1 INTRODUCTION

The chapter considers the teachers' experiences that gave rise to their learning during this project. It looks at those who participated fully and partially, and those who did not continue beyond the initial workshop. It considers the interactions of their experiences and motivations, and examines in some detail the processes of change for these teachers. Thus the chapter responds to critical question 3: *"Why do the teachers change or not change?"* The question is taken up in the context of Lesotho, and leads to suggestions for improved support of teachers' professional development there.

7.2 A REVIEW OF THE PROCESS

The action research process used in this study, as it was planned and occured, is described in detail in Chapter Four. The project began with a 'baseline study' (BLS), comprising a two-day workshop with prospective participants, observations of classroom practices that were then used as inputs to critical discussion in relation to LCE, and discussion and planning sessions. This was followed by three cycles of action research (reflecting, planning, experimenting, reviewing), each involving the development and presentation of lessons by the participants and review of the lessons. The cycles were supported by workshops and meetings in which participants worked with various research papers and support materials, including an externally facilitated whole-day workshop during Cycle 1. As part of Cycle 3, at the end of the project, the participants resolved to lead workshops in their schools.

The project, through the BLS and the three cycles, was demanding for me as well as teachers: there were many meetings, almost all of them after school or during weekends; there were 'performance pressures' to design LCE lessons and present them to observers (including using the video cameras and audio-tape recorders); there were follow-up meetings where the lessons (and the teachers) were critiqued; there were administrative arrangements that had to

be made and remade within schools (where priorities and timetables sometimes shifted at the last moment) and with others (such as camera operators, participants from other schools, and myself); and there were always deadlines and tasks that had been agreed on at meetings but which proved difficult to meet. Added to these were the family and community commitments that we all had, and changes in employment conditions and priorities that arose in the course of the two years of the project. The effects were that, of 20 participants in the introductory workshop, six were selected (and agreed) to commit to the project, of which two dropped out early in the process, and one (Mr Khaba) left, to go on study leave at the end of Cycle 1. Given that the major period of learning and experimentation, occurred during Cycle 1, there were four teachers contributing closely during the major phases of the project. Mrs Motloung, Mrs Lebo and Mrs Thabi, completed all the cycles.

None of us had anticipated at the outset the demands of the project. Nor had we anticipated the complexities of the action research process, or of my own role, where I not only facilitated the process, but wanted to collect data: a research-facilitator while I was an Inspector of Schools.

The literature on action research recommends cycles of planning-action-observation-reflection, each marked by the achievement of particular goals. Within cycles there are phases or steps of planning, action, observation and reflection (Dick, 2000b; Hopkins, 1993; Elliot, 1991; Hatten et al., 1997). In practice, the process was never this tidy. Firstly, the goals of a cycle were often revised during a cycle, and in any case were never 'reached' in definitive or absolute ways: experiences in early cycles were revisited as appropriate, and judgements made then were revised. The same applied to plans. For example, agreements made early in the project that the teachers would keep journals proved unworkable. Similarly, the idea of video-taping all lessons was abandoned, because of the intrusion and limitations of the camera (the camera operator had to choose what to capture in the midst of complex classroom interactions), and because of the time involved in replaying tapes. "Live observers", who led the critiques at the follow-up sessions, proved more useful to the teachers, though I depended also on audio-tape recordings. In this same situation, the idea of using the observation schedule was stopped because it restricted the observer and did not allow flexibility during the process. So too, processes of reflection and planning became mixed with each other, often as part of the action.

In practice there were cycles within cycles (McCombs & Vakili, 2005). For example, each of the cycles involved teaching LCE lessons. But the design and implementation of a lesson involved all of reflection, planning, acting, observing and reflecting. So did a particular activity or segment within a lesson (Woolhouse, 2005). Some of these 'mini-cycles' had major effect in the project. For example, Mr Khaba, in his lesson on how to make magnets, had not anticipated that learners would have so many ideas, or be able to take responsibility so readily. He revised his plans, expectations and style of interaction, and developed these approaches in other lessons. As Carr and Kemmis (1986:186) observe, while the cycles and phases apply in a general way (the major cycles could still be identified in this research), the process is characterised as much by 'moments' of reflection, planning, observation and action as it is by 'phases'.

Individually or as a group, teachers made plans based on their reflections and experimented the activities they designed in their own time but which were made or structured to be in line with the group objectives and aspirations in the project. The interactions between planning, acting, observing and reflecting as individuals and as a group, met the objectives set which constituted major cycles and minor cycles that were not distinct. This made participation in action research more involved and intricate. These phases are not separable and are fulfilled hand-in-hand in action research, which makes its unfolding more complex. The teachers' collaboration, participation and my facilitation turned these complications into learning experiences and motivated us to explore more.

Another example of 'cycles within cycles', of a different kind, is represented by the second support workshop (externally facilitated). This workshop sought to model LCE and the action research process. The day began with the teachers reflecting on their understanding of LCE (reflection phase) and what they wanted to have on the agenda. There followed a series of activities (actions), which led to reflections and suggestions. Then, during the day, the agenda was revised (in particular to home-in on issues of power and power-distribution) to meet the participants' needs, even as they clarified their needs.

The second aspect of complexity arose from the confusion of my own roles, confusions that were relevant to the teachers, the achievements of the project, and the research. I faced conflict between the demands of the project and the demands of the research, and between my

established role as an Inspector of Schools and my role in the project as facilitator/researcher. The two conflicts overlapped and interfered with each other.

Being an inspector was a threat to the study and the study also was a threat to my position as an inspector. I had been broadly aware of this from the beginning, and so had the teachers. We had expected that I could simply 'change hats' and everyone would see which hat I was wearing. It was not that simple. The roles and behaviours of an inspector have been socially constructed and so changing or mixing them also involve social processes and time. The confusion was great at the beginning, for me and the teachers. I made school visits sometimes for achievement of inspector's roles, while on other occasions it would be for the project. As an 'inspector', the expectation (for the teachers and the Ministry of Education, and hence for me) was that I would sit in classes, evaluate and report. As a researcher, my job was to observe the classroom as data, to understand what the teacher and learners were doing in their efforts to demonstrate LCE. Woolhouse (2005) recommends that, for successful change through action research, titles and ranks should be set aside during the research project. While we tried to follow this recommendation, and teachers became quite skilled at deciding which role I was in, the interaction of roles was unavoidable. One of its effects was that I rethought my role as an inspector, and became more sympathetic to what teachers were trying to do, and more of a 'facilitator of teachers' learning', even as an inspector. The role of being a fault finder and policy monitor changed to a supporter who collaborates with teachers to implement policy.

The second conflict was between my role as facilitator of the project and my role as researcher. As facilitator, my role was to organise the project, model LCE and power-sharing (at all three levels in Malcolm & Keane's model, 2001), and promote the achievement of agreed outcomes. The requirements for 'good data', including deep probing of teachers' ideas and their justifications for their claims and the maintenance of good records, often cut across the dynamics of planning and 'learning' together in our focus on goal achievement. This is like the teacher's dilemma in LCE, where demands of 'assessment' and recording can threaten the flow of a lesson and the achievement of a lesson: it is one thing to be attuned to the learning in a complex classroom, and another to cater to data collection about individuals, whether for 'assessment' or 'research'.

This conflict of 'keeping records' versus facilitating and activating the processes of learning, were compounded by my 'authority' as an inspector, and even my authority as a researcher. Whether viewing me as inspector or researcher, the teachers tended to expect that I 'had all the answers' where LCE, research and lesson design were concerned. On the other hand, I was well aware that I did not have 'the answers', and, furthermore, given my commitments to power-sharing and drawing on the teachers' experience and expertise as part of the research, I did not wish to impose my own knowledge and values on others. The teachers took time to understand and accept that I was genuine in this: I was not the 'expert' that they might have assumed. However, this threatened their assumptions and expectations concerning 'an inspector' and a 'PhD student', and threatened, in a sense, my reputation, as well as the achievements of the project.

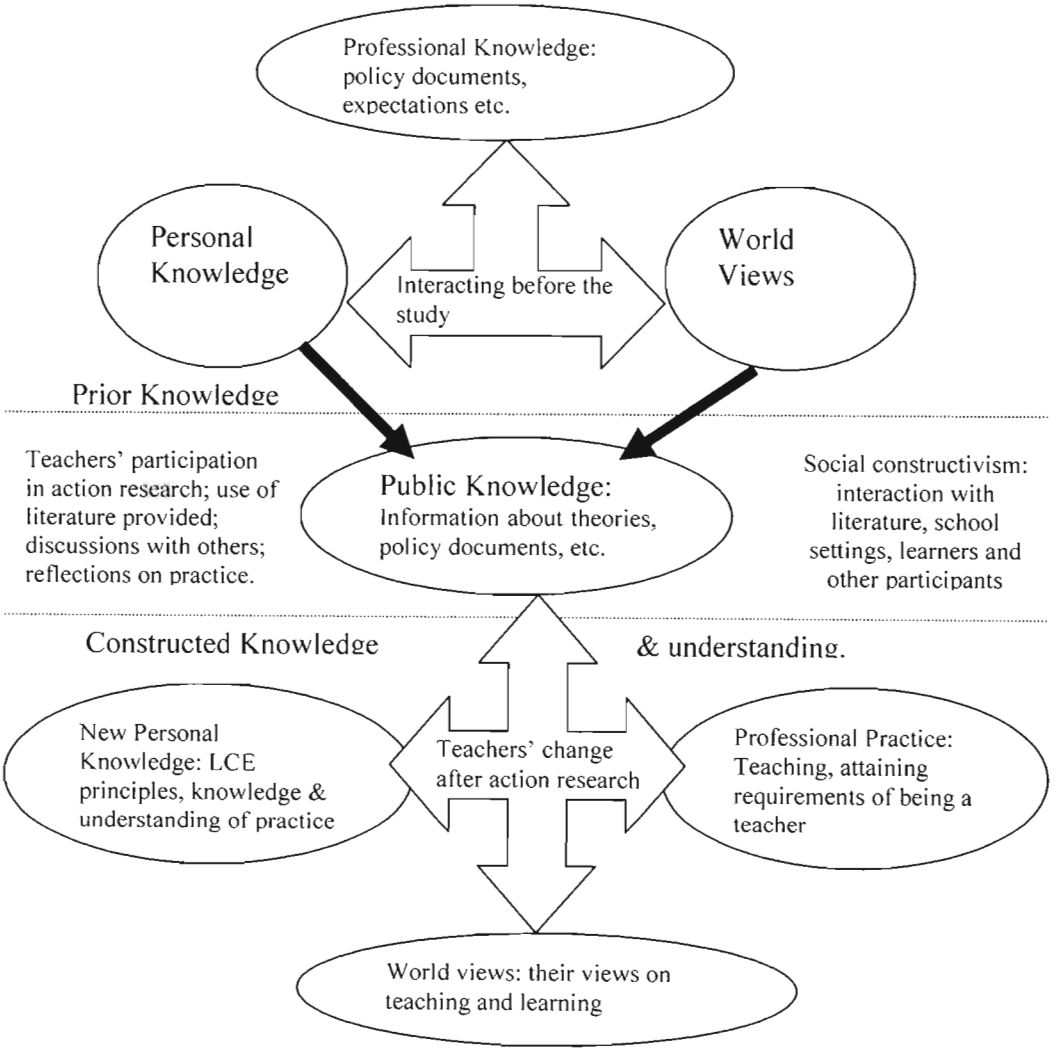
As it turned out, between all of us, we found our way. The main evidence of this is that the four teachers who were strongly committed to the project at the beginning remained strongly committed (including Mr Khaba, whose award of study leave took him out of the project at the end of Cycle 1). They would not have stayed if they had found the relationships and progress unsatisfactory. One effect for me though, was that sometimes I did not question the teachers as deeply as I might have, or probe and record their thinking. I am also aware that, had I probed and questioned more deeply, and demanded more complete records, I might have upset the project, or even destroyed it.

7.3 TEACHER CHANGE

Changes in teachers' personal knowledge can be considered through theories of social constructivism. Fenning (2004) and Illman (1998), for example, suggest that the personal meaning-making process, in the face of new information, is based on interactions of that information with prior personal knowledge, worldviews and experiences. Figure 7.1 represents these ideas for the teachers in this study. They had their initial understanding of LCE, demonstrated in the BLS, and their individual worldviews, which constituted their personal knowledge before the study. Through their involvement in the action research, they contributed their personal knowledge to the group (which became public knowledge) and engaged with literature, each other, and experimentation, leading to new personal knowledge (including worldview) and new professional practices. At all stages through the project, they sought to integrate knowledge, values and practices by reflecting on their explanations, their

experiences in classrooms, and their justifications for their actions. They refined their skills in critical inquiry, demonstrated especially in the project meetings. In the later meetings, their confidence in themselves and others was higher, and so was their knowledge, so they reflected on issues differently and "inquired" more through questioning and suggesting solutions and explanations (Lomax, 1991). Part of this growth was their preparedness to take their knowledge to a wider public, by conducting workshops at their schools. A similar effect was observed by Atwell (1986): teachers' participation in research not only changed them personally but changed their status in their working situations.

Figure 7.1: Teacher change



Mrs Motloung's new knowledge and practices enabled her to revive her interest in teaching:

> *Due to different things that I encountered as a teacher, I had previously made the decision that I leave the profession. But now, hey, I am ok.*

She had felt frustrated by the different demands from parents, ministry, school's administration and learners, but the project helped her:

> *I was feeling empowered and hence I changed my attitude towards the teaching profession.*

She considered the collaboration she experienced in the project to be rewarding, and an important reason for her revived interest in teaching. On one occasion, the teachers had observed that "*use of LCE can change the attitudes of learners towards the subject*". The same was true for the teachers.

The changes in teachers' professional knowledge are documented in Chapter Six. Beyond the changes in activities and techniques, there were qualitative changes in their classrooms, in relationships, rapport and interactions between teacher and learners, between learners and with materials. The teachers' understanding and view of teaching itself changed. Auger and Wideman (2000) recognise action research as having the capability to advance teachers in their practice based on theory and self. The teachers also felt that the changes had measurable effects on learners:

> *The study helped me to change my teaching and for the first time last year we had an increase in the number of learners who have passed the JC examinations.*

As part of collaboration in the project, the teachers were able to decide what they wanted to learn, as well as how they wanted to learn. This was not only at the start of the project, but during it. They set the agenda, and they changed it along the way. The teachers had misgivings about having learners operate at Level 3 LCE (influencing content and outcomes), but they welcomed the opportunity to work at Level 3 themselves. As Mrs Motloung explained: "*my [initial] participation in the study was to achieve .... understanding and further knowledge of Physics concepts which is not my speciality.*" However, during the study her attention turned much more to processes of learning and the design of teaching. Some of

the shifts in the agenda arose from shifts in the teachers' primary concerns, consistent with the Concerns-Based Adoption Model. At the start, they were greatly concerned about order and control, and the constraints that would make LCE difficult to implement. By the end of Cycle 1, their concerns had shifted to issues of power and using learners' ideas in lesson development, and by the end of Cycle 3, to conducting workshops for other teachers.

I explained earlier that the project was very demanding in terms of time and energy, but it was also true that the teachers were making those demands. From the view of the schools, all teachers take part in the daily running of the school, including administrative roles, teaching roles, chores and meetings. Even though the teachers had the support of their schools, they were still expected to be active at school. Yet, in this context, the teachers, decided to visit each other to observe each other teach, rather than use video or audio tapes. This required arrangements at both ends, and travel between schools, but this is what the teachers wanted. They were highly motivated, individually and as a group, to go on with the study, managing as well the demands of their schools and social life.

7.3.1 Mapping the changes

The teachers and I observed and analysed each others' lessons in each of the cycles, and, combined with the information from discussions in the group and interviews I conducted, they showed progress from BLS, through each of Cycles 1, 2 and 3, in all three levels of LCE. It is important to realise that the project extended over nearly two years, and, while only one lesson per cycle (a demonstration lesson) was analysed, the teachers experimented with, and reflected on, various other techniques and approaches in other lessons too.

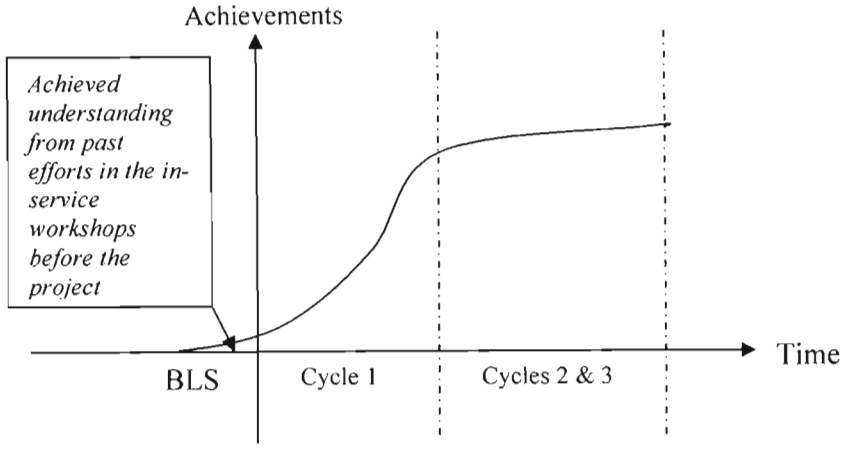
The data suggest that the teachers' progress was not 'uniform.' Cycle 1 showed dramatic changes in methodologies, classroom relationships and interactions. But the later cycles changed less (or more subtly), as the teachers consolidated their ideas and approaches. It was partly their own recognition of this stabilisation that encouraged them to run workshops in their schools. Figure 7.2 attempts to represent the changes graphically. The graph is in line with the Concerns-Based Adoption Model (CBAM) which holds that teachers go through a sequence of stages, defined by particular concerns (Loucks-Horsley, 2001). The CBAM is made of **awareness, information, personal, management, consequences, collaboration** and **refocusing** as stages in change process (Hall & Hord, 2001; National Academy for Science,

2001; Sweeny, 2003). In Cycle 1 the teachers were concerned mainly with awareness, information, personal adequacy, management and consequences.

The awareness at the initial stage entailed the search for a clear understanding of what LCE and action research was (*awareness*). Their struggle of understanding LCE, approaches, methods and the processes of action research constituted this stage. The understanding of LCE and action research was achieved through support efforts such as readings, discussions, processes in meetings and workshops (*information*). The meetings and workshops further developed their understanding through analysing LCE principles focusing mainly on how it was going to impact on them, their learners and their schools (*personal*). The participants then planned for implementing the acquired knowledge and understanding of LCE principles, which focused on the changes in practice that would be used to organize the innovation better (*management*). Basically, they were working towards making use of LCE principles within their prevailing situations. The classrooms became places where the plans were put into practice. The participants implemented their plans, observed the processes and reviewed them where necessary (*consequences*).

In Cycles 2 and 3, teachers' concerns were mainly on *refocusing* and *adaptation,* which saw the emergence of the model presented in Chapter Six. The engagement in these stages resulted in established patterns of use that were tested, refined and evaluated through group discussions and help (*collaboration*) during the reflection and planning meetings. In the constructivist mould they were aware that some teaching skills could be acquired or achieved if collaboratively practised in the real setting and supported by their experiences. Reaching the final stage of *refocusing* directed teachers towards seeking more effective alternatives to the established use of LCE principles. Some satisfaction was reached by then.

Figure 7.2: The representation of change through the cycles



The extent of changes in Cycle 1 can be attributed to a number of factors. First, the agenda was designed in part to work systematically through the CBAM stages: from an initial focus on awareness and information, the teachers were allowed (as part of the process) to express personal concerns and fears about management, and consider possible consequences (positive and negative) of LCE. Through discussions and cooperation, the teachers developed trust in one another, making collaboration and refocusing stronger. Once they reached the refocusing stage, they put aside concerns for personal adequacy, management and constraints, and turned their attention to creating an LCE environment and experimenting with teaching methods, interaction styles and power distribution. This set them up for stages of *refocusing* and *adaptation.*

Secondly, Cycle 1 was a period of extensive input. The teachers read and discussed research articles on LCE and constructivism, books on teaching methods, and articles explaining action research. The externally facilitated workshop was timed to occur shortly after that reading had been done, so it was able to work with issues and ideas quite deeply (as shown in the posters the teachers produced). From that base, the teachers worked together to plan demonstration lessons and reflect on them, marking the end of Cycle 1.

Third, there was the structure of the action research process itself, which the teachers recognized as a model of LCE, and an example of project-based learning. It brought together project goals (changed teaching practices) and learning goals (especially knowledge of LCE),

which they valued and saw as relevant to their schools and professional interests. As Mrs Thabi put it,

> It provides the specific support that individuals need in their schools; it is not a general type of support.

The teachers understood the change processes that were built into the project and recognised them. They could see how readings, experimentation, reflection, critique and feedback were supposed to work together, and how power-sharing and the three levels of LCE could operate.

Fourth, the processes of collaboration, including the freedom the teachers had to direct the goals and processes and the ways they could learn from and with each other, were conducive to social constructivist approaches to their own learning and provided personal support. Moreover, the teachers opened their classrooms for others to see what was happening, and also opened themselves to criticism and suggestion.

These explanations are consistent with literature on teacher change in action research (e.g. Fulton and Torney-Purta, 1999), and taking advantage of support mechanisms (Cusworth and Dickson, 1994).

7.4 MOTIVATION

Notwithstanding the attributes of the project described above, the research points especially to individual and group motivations. The teachers chose to join the project knowing that it would be a long-term commitment, and an additional activity to their daily school duties. There were no 'external pressures' (after the first meeting) beyond their loyalties to the project and the group and this increased their motivation. Lam (2005) shows that teachers felt that they had control over their instructional practices and collaboration became more motivated. They joined the project in part because of requests from their school principals, but the schools exerted no further pressure. They chose to 'stay in' the project, even when it was impossible for them to attend some sessions and meetings or complete particular tasks. The initiatives were from them: if anyone in the group had opted to leave, others would have accepted that, as they did for two of the participants who left.

It would appear that these teachers saw the project as an opportunity in four ways: 1) it fit their interests in learner-centred education, interests that went beyond policy requirements to doing better for their learners; 2) it offered professional development that might have career advantages; 3) it fit their daily school and social commitments, and 4) they wanted to see themselves as innovative and effective teachers. This is represented schematically in Fig 7.3. For every teacher, these four aspects were part of their motivation.

In every case, the teachers acknowledged school motivations, especially the need to have their students learn and do well in exams (Horng, Hong, Chanlin, Chang & Chu, 2005). For the initial meeting, all the participants were 'sent' by their principals. Professional motivations arose similarly: the teachers wanted to teach better, and they wanted to be 'up-to-date' in their knowledge and practice. They were aware of LCE policies and the claims for them, and they knew about LCE from professional readings and conversations. Hence they knew of the consonance between the policy and the research literature, of system requirements and professional knowledge. They demonstrated some knowledge of LCE in the first meetings, when they talked about their understandings of LCE and the kinds of teaching methods that would express it, but also demonstrated that their knowledge was not well developed.

Fig 7.3. Different motivations

Another aspect of their professional interest was in working with other professionals, especially as part of the project team (Horng et al., 2005). Career interests proved to be relevant: three of the participants are now engaged in formal studies, and one had a

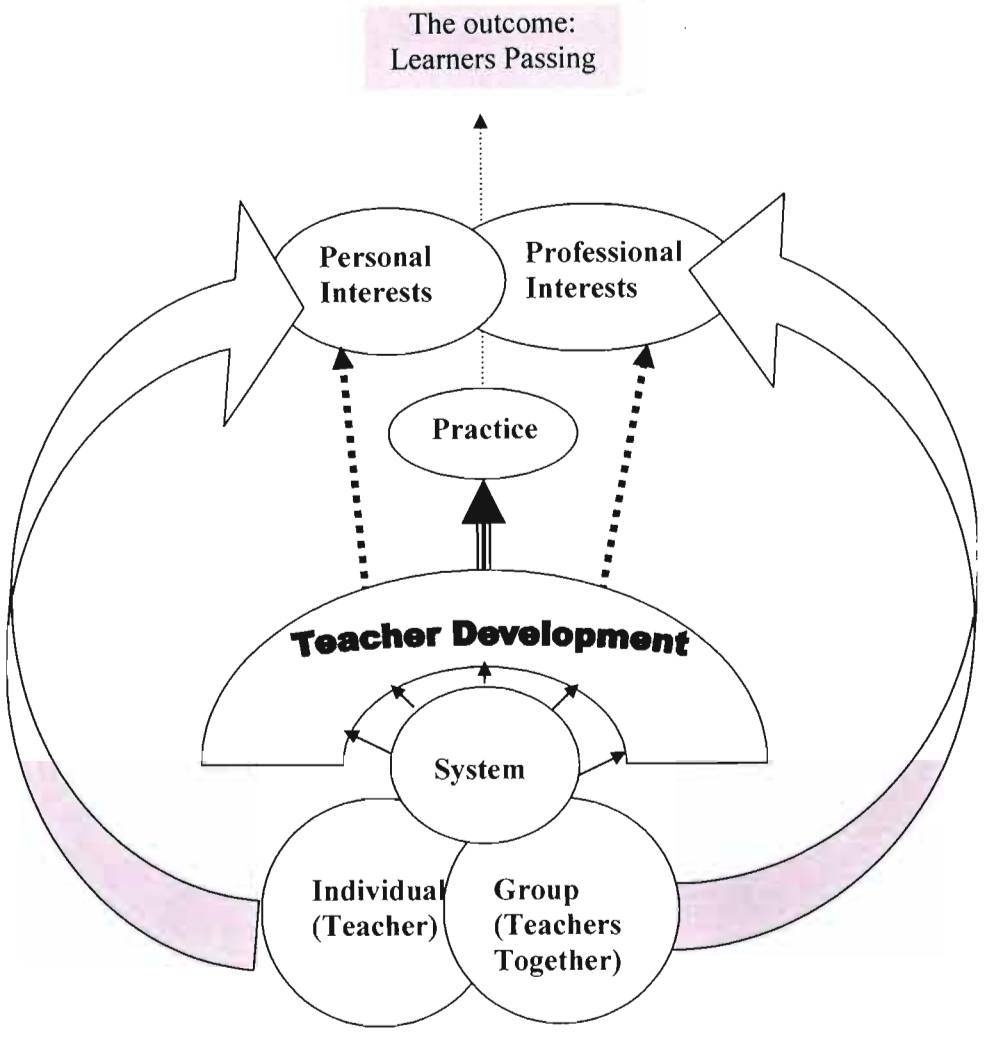
promotion. To a large extent, these possibilities arose during the project, more than before it. Interactive with all of these motivations were personal interests and commitments, observed similarly by Monk and Kwong (1999). The latter went further to show that for adults, motivation is due to personal growth, educational aspiration and occupational development.

For Mrs Motloung, for example, the project was a way out of her frustrations and job dissatisfaction, and also a way to 'keep herself busy.' For all of the teachers, it was a personal wish to learn. As Mrs Thabi observed, as the project continued, it became a personal interest, and this in many ways became the dominant motivation. Thus, the primary rewards of involvement were a sense of achievement and the respect and pleasure they had from their achievements (indicated especially in their classrooms, and their interactions within the group). Career opportunities, in many ways, flowed from this.

The way that the various interests came together is suggested in Fig 7.4. At the top is the real concern that the teachers had for their learners, especially in relation to examination results. They wanted to teach more effectively. Individual interests, group interests and system interests overlapped to some extent, and this area of overlap was grasped in the project. Further, by its collaborative style, it enabled common interests to be worked out, and also for them to be renegotiated during the project. Thus, the teacher development programme not only responded to their initial interests, but shaped their interests, especially while it was centred on practice and the specific conditions in which the teachers worked. The effect was that professional and personal interests came together, reinforcing one another, and allowing the teachers, individually and as a group, to better respond to their learners, and improve learners' achievements.

Changing from one practice to another is not just a matter of facilities, resources and time. The teachers in this study changed their beliefs, knowledge and practices. The choice of the participating teachers to continue beyond the initial project meeting created a self-selected group, whose shared commitment reinforced and shaped individual commitments (Somech, 2005). At individual levels, the teachers adjusted their lives and gathered the necessary support to meet their commitments. Their support went beyond learners and the school to include families, other participants in the project, readings, workshop facilitators, and even policies.

Figure 7.4: The teachers' utilisation of professional development



7.5 CONCLUSION

In a sense, the teachers in the study developed their understanding of LCE as part of the action research process. The development of knowledge and understanding of the three levels of LCE was evident and they were able to utilise only two levels in classroom situation with the last demonstrated in their own learning process. The development of this understanding and knowledge resulted from support from different sources.

From the discussions in this chapter, I would like to offer below a suggestion about teachers' engagement in professional development in Lesotho. The teachers were provided with support by other participants, from literature, from me and from visiting facilitators, but were able to adopt LCE in the way they wanted (as demonstrated in Chapter Six). The issues of constraints which prohibited them from the adoption of LCE principles, vanished from their discussion during the study and even where they came up, the options provided were not utilised (e.g. alternative methods of teaching certain concepts and the type of equipment to be used).

The system used in-service programmes as the only staff development activity which they had power and control in terms of the selection of those who would participate. However, teachers used their participation differently to attain personal and professional goals. I therefore propose that teachers' participation in staff development programmes is not due to interest in development of practice or the fulfilment of the system's requirements but due to the desire to attain both personal and professional goals. This was observed for those who challenged the situational and personal factors that prohibited change.

The teachers recognised that they had power on practice/teaching in classroom but not any other issues pertaining to school administration, policy design and implementation. Being in this situation they redirected their interest on the things they had power on/ over: attainment of personal and professional interests.

Therefore this suggests that teacher development in Lesotho through in-service programmes should provide the opportunity for support (from school, policy makers and other professionals) and allowance for self-directed interactions between teachers at school level and neighbouring schools for such programmes to be successful in practice. The workshop-type of in-service could still be used as demonstrated in this project, but with more intense collaboration and support established within each school and with other participating schools.

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APPENDIX A

THE ETHICAL CLEARANCE:

University of
Durban-Westville

PRIVATE BAG X54001 DURBAN
4000 SOUTH AFRICA
TELEGRAMS: 'UDWEST'
TELEX: 6-23228 SA
FAX: (031)204-4383
☎ (031)204-4111

RESEARCH ADMINISTRATION
TEL: (031)204 4068
FAX: (031)204 4893

ALL CORRESPONDENCE TO BE ADDRESSED
TO: THE HEAD – RESEARCH ADMINISTRATION

11 JUNE 2003

MR. BM. KHOBOLI
EDUCATIONAL STUDIES

Dear Mr. Khoboli

APPLICATION FOR ETHICAL CLEARANCE – "TEACHING PRACTICES OF SCIENCE TEACHERS IN SECONDARY AND HIGH SCHOOLS OF LESOTHO"

With reference to my letter dated 7 March 2003, I wish to confirm that the conditions stated in my letter have been met and that your project has now been granted ethical clearance:

Your clearance number is **03039A**

Thank you

Yours faithfully

.....
MS. PHUMELELE XIMBA
(for) HEAD: RESEARCH ADMINISTRATION

PS: The following general condition is applicable to all projects that have been granted ethical clearance:

THE RELEVANT AUTHORITIES SHOULD BE CONTACTED IN ORDER TO OBTAIN THE NECESSARY APPROVAL SHOULD THE RESEARCH INVOLVE UTILIZATION OF SPACE AND/OR FACILITIES AT OTHER INSTITUTIONS/ORGANISATIONS. WHERE QUESTIONNAIRES ARE USED IN THE PROJECT, THE RESEARCHER SHOULD ENSURE THAT THE QUESTIONNAIRE INCLUDES A SECTION AT THE END WHICH SHOULD BE COMPLETED BY THE PARTICIPANT (PRIOR TO THE COMPLETION OF THE QUESTIONNAIRE) INDICATING THAT HE/SHE WAS INFORMED OF THE NATURE AND PURPOSE OF THE PROJECT AND THAT THE INFORMATION GIVEN WILL BE KEPT CONFIDENTIAL.

cc. Director of School
cc. Supervisor

APPENDIX B
OBSERVATION SCHEDULE:

SCHOOL:_____ **DATE:**_____

FORM/ CLASS:_____ **TEACHER:** _____

SUBJECT: _____ **TITLE/ TOPIC:**_____

OBSERVATION STARTING TIME: _____ **END TIME:**_____

1. Layout of the class (draw a diagram of where children are seated).

2. Take note of the posters and images on walls. What are they about? What messages do they convey? Are there any made by learners?

_____

_____

3. How well is the classroom resourced? Write short notes on the resources and state of the room.

_____

_____

SECTION A				
1. Does the teacher greet? Comment:.....	All learners	Most learners	Few learners	None
2. Does the teacher tell the learners how the lesson will be conducted?	YES. Explain.....		NO. Explain.....	
3. Does the teacher give the objectives of the lesson?	All objectives clearly explained	Some clearly explained	Objectives given but not explained	No objectives
4. Who decided on the process to be followed by the lesson?	Teacher How?.....		Learners How?.....	Both..How?..... .....
SECTION B				
1. Does the teacher demonstrate / teach during the lesson?	Most Times	Sometimes	Rarely	Never
2. Does the teacher create an environment which enables individual learners to work on their own and seek assistance where necessary?	Most Times	Sometimes	Rarely	Never
3. Is there any reflection of power sharing as practised by the teacher during the lesson?	Comments:.....			
4.Are there specific moments where the teacher had a problem with power sharing?	Positive way: Comment:		Negative way: Comment:	

5. Does the activities selected link the concept with other subjects?	All the Times	Sometimes	Rarely	Never
6. Does the lesson incorporate learners' daily experiences?	All the Times	Sometimes	Rarely	Never
7. Does the teacher appear to encourage or take an interest in children who are struggling during group work or discussion or reporting back?	All the Times	Most of the times	Some of the times	Rarely
8. Does the teacher offer support or redirect learners during activities?	Most times	Sometimes	Rarely	Never
9. Describe the role of the teacher during discussions?	....			
10. Are there learners who appear to participate poorly in the class? Is the teacher aware of them?	Comments:.....			
SECTION C				
1. What is the nature of the classroom climate? Out of control.....	Tense	Some what tense	Somewhat relaxed	Relaxed & learners seem to enjoy it
2. Do children move about freely?	Between groups	Within the group	Rarely	Not at all
3. Is there commotion, during discussions, teaching or reporting back?	Yes or No	Comments:.....		
SECTION D				
1. Do learners sit in groups selected / formed by them?	Most of the Times	Some of the times	Rarely	Not at all
2. Do learners sit in any of these groups?	Boys only	Girls only	Girls and boys	One sex being more than the other
3. What degree of interaction is there between children?	Much interaction	Some interaction	Little interaction	No interaction
4. Does the interaction take place around classroom work?	Most of the Times	Some of the times	Rarely	Not at all
5. Does interaction take place around non classroom interest(e.g. chatting)?	Most of the Times	Some of the times	Rarely	Not at all

4. **OPEN- ENDED NOTE**

In this section write down whatever strikes you about arrangements in the classroom, events and non-events, remembered pieces of dialogue, which indicate how learner-learner and learner- teacher relate to each other.

_____

_____

_____

_____

APPENDIX C

THE QUESTIONNAIRE FOR BASELINE STUDY:
RESEARCH QUESTIONNAIRE

LESOTHO SECONDARY AND HIGH SCHOOLS

Dear Science Teachers,
I am currently undertaking Doctoral Studies in Education with University of Durban Westville. The purpose of my study is to find the teaching practices used by science teachers in schools. The information provided here will only be used for this research and I, Benedict Khoboli guarantee confidentiality and no public divulging of information.

Thank You.
In this questionnaire where a box is given please tick or cross the appropriate box and where a space is given please give the details. If the space provided is not enough please use a separate sheet of paper.

A. PERSONAL DETAILS

1. Gender:

Male	
Female	

2. Age:

21 to 24		25 to 29	
30 to 34		35 to 39	
40 to 44		45 to 49	
50 to 54		55 and above	

3. Qualifications

	YEAR	QUALIFICATION	MAJOR SUBJECTS
3.1			
3.2			
3.3			
3.4			

4. Teaching Experience
4.1 How many years have you been teaching? ___
4.2 How many years have you been teaching physics?_____
4.3 Which levels have taught physics? _____
4.4 Which classes are you teaching physics now? __
4.5 How many periods per week do you have? ___
* ***PLEASE ATTACH THE CURRENT PERSONAL TIMETABLE***

B. SCHOOL INFORMATION

1. Name of the school: _____
2. How many periods are given to science per week at JC level? _____
3. a) How many are used to teach physics? _____
   b) How many are used to teach biology? _____
   c) How many are used to teach chemistry? ____
4. Who is the HOD at you school? _____
5. How many are you in your department? ___
6. Are you working as team in your school?

YES	
NO	

   6.1 If yes list the activities that you do together.
   6.2 If no explain why?
7. How many science laboratories are available at your school? _____
8. Other member of the department, are they always using it?

C. TEACHING INFORMATION

1. Which teaching approaches are you regularly using in the science classes?
2. Why are you using this approach?
3. Can you describe the teaching approach that you are using? _____
4. Which other teaching approaches are you familiar with, apart from the one mentioned in 1.

SECTION	TEACHING APPROACH	DESCRIPTION
4.1		
4.2		
4.3		
4.5		
4.6		

5. Do you prepare your lessons?

YES	
NO	

5.1 If yes please attach four copies of different topics in physics.
5.2 If no please explain why?

6. Are your Scheme and Record books checked? _____
6.1 If yes, By who?
6.2 If no, Why not? _____

7. Are there any other set accountability and monitoring measures set by the school?

D. ACTION RESEARCH

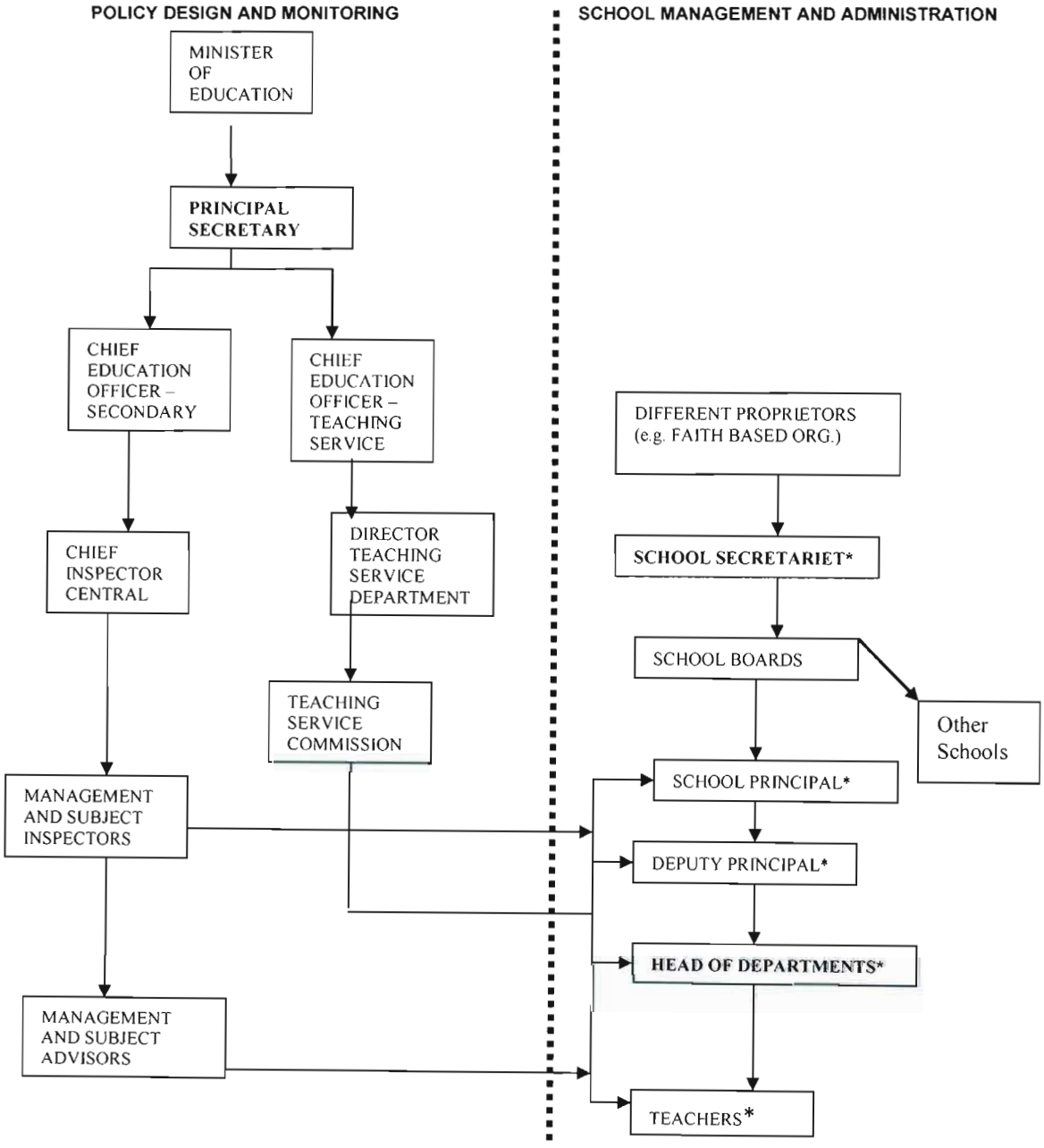
1. Do you understand or know what is meant by action research? Explain.

2. If you are selected to take part in action research project, can you accept this invitation?
_____

APPENDIX D

THE STRUCTURE OF THE MINISTRY OF EDUCATION AND TRAINING AND MANAGEMENT OF SECONDARY SCHOOLS OF LESOTHO

*The different positions that are paid by the government.



APPENDIX E

SAMPLE LESSONS FROM DIFFERENT CYCLES:

THE BASELINE STUDY: MRS MAKI

The lesson was conducted in a laboratory that was well resourced compared to most schools in this area. The teacher started the lesson by greeting all learners and allowing them to settle. She stated that today they will be measuring time. However, the opening discussion concerned microscopes:

T: What do we use the microscope for?
S: To look at small things.
T: To look at small things. Right. There are some things that we cannot….. There are some other points of information that we cannot get using our sense organs, we need more instruments such as the Ultrasound, telescopes and binoculars. Let us look into our laboratories, what do we use to measure time? Yes (pointing at one learner).
S: time (with low voices)
T: Time.
S: Watch.
T: Watch (repeating twice). Yes (pointing at another learner)
S: Minutes.
T: ……(repeating what the learner has just said). What instrument do we use to measure time? One is saying time while the other is saying minutes.
S: Watch (all answered in a chorus)
T: Have you ever seen a watch like this? (She said holding a stopwatch in her hand). Yes (pointing at another learner)
S: Yes (some said). No (others said and there was a lot of noise).
T: Is this a watch? Yes (pointing at another learner)
S: No it is not?
T: It is not. A stopwatch is used to measure time phase. If you want to know how long it takes for someone to run from one point to the next then we use a stop clock rather than watch because watch is moving continuously. But the stop clock can be started at the beginning of the action. So then we are saying we are using it for time space, for a particular action. I hope all of you know about the common watch that we have on the walls or on our wrists. You know that one?
S: Yes Madame (All said).
T: How many minutes make one hour?
S: 60 minutes (all said)
T: (very quick she asked)What time is it now?
S: ……(noise)…….
T: Yes *(pointing at another learner)*.
S: 11:45
T: So we measure time, to measure time we use instruments, a clock, a watch, a stop clock, but our focus today will be on the stop clock because all of you know how to use the clock and watch. So let us divide ourselves into six groups. *(Each group received a stop watch)*. Usually the green colour means go ahead, so that means this is where you start the clock. The beginning of the action you start the clock by pressing the green knob, all right? And if the action has come to an end you stop the clock by pressing which one?
S The red knob.
T Yes, the red knob means stop, then the black one is to bring back the pointers of the clock to zero. So let us look at the graduations. Eh the stop clock have the numbers of seconds taken for an action, the number that we have inside are number of seconds. So to check time taken for action you look for the number of seconds, so if you started from zero where it is now, then goes back to that point it means it has taken how many seconds?
S 60 seconds.
T And that is a?
S A minute.
T Yes 1 minute.
S Yes.
T So let us measure the time I will take to write my name (she started writing her name on the board).

S 10 seconds(some said) No 12 seconds(others said)
T Eh usually when you use this, when you carryout an experiment we do it at least for 3 times to cover up the time we are taking. I am doing it again.
S 11 seconds.
T So is 10 seconds and this the time taken for your teacher to write her name. It takes how many seconds?
S 10 seconds.
T Right. Eh what other thing did you want us to do for measurement of time? Did you check the time?
S Yes madam.
T This is the time he takes to answer the question yes. Which cell is used for reproduction?
S Nucleus .
T She said nucleus, did you start and stop the clock?
S Yes madam.
T How long does she take?
S A second.
T 1 second. Anyway is the answer right?
S No!
T Let us say the right answer the. Ok. Before you answer it let me ask again which cell is used for reproduction? Did you start the clock so that we can check the time. So when we use the clock we do not just use our common sense to say we left this point when the dark started and then we arrived at that point when it stopped. Alright so that is measuring time, you keeping saying 10, 2, 4, seconds. Why do we use that word seconds, what do you know about second? *Why do we say 10 doors mm.???????(as if she has forgotten something)*
S It is the thing that changes minute. Yes.
T Yes you have an idea, somebody else?
S It is the thing that changes an hour.
T Yes. You have an idea.
S Because it is smaller than a minute.
T Ok eh basically we use this term seconds because it is the unit of time. How many years equal to a decade?
S 165, 65, 35 *(they all gave different answers).*
T Let me repeat my question. How many years make a decade?
S 4 years.
T Do you remember a hexagon. How many sides does it have?
S 6.
T Pentagon.
S 5.
T …. *(she went on with other shapes and students giving answers until they reached a decagon)* Decade is 10 years. How many decades have you lived?
S 16.
T 16 decades. Do you understand what you mean by 16 decades? If 10 years is equal to a decade and he has lived 16 decades. How many years has he lived?
S 160 years.
T Yes, 160 years, so come down, how many decades have you lived?
S One decade.
T One decade plus some years. How many years?
S 6 years.
T A decade is a period of 10 years, a century? 100 years. You know that your money will correspond with a certain quantity that you are going to buy, 12.5 kg of maize meal is a measurement of weight. It is a …. *(not clear).* What measurement do we use for….. *(not clear)* usually those things we buy from the shop are already measured.
S We use scale.
T What is the name of a particular scale? Have you seen this one? *(holding a scale in her hand).*
S Yes *(some said)* no *(the rest of the class said)*
T You have or you have not? What is this scale? A triple beam balance.
S A triple beam balance *(repeating after her)*.
T This is an instrument that we use to measure things in the laboratory. This is a pan, (*holding and pointing at the scale)* which is where we place an object that we are measuring. Let us place something on the pan but before we do that it has to be cleaned right then here we have

the largest beam which is measuring from 100 to 500 grams and next to it we have a beam that is measuring from 10 to 100 grams and the smallest beam is measuring the units that is from 1 to 9 grams. On the part of the beams we have white line can you see it? So that others can see … yes we have the white line can you see what I am talking about?

S Yes.

T The white line on one part of the beam and on the other side?

S Yes madam.

T Those are the lines of the impact when we measure an object. Before we measure the 1st thing you need to do is to clean the pan and then make sure that the lines are in line. The line should coincide. They should be aligned horizontally in one side, they should point in one side. After making sure that they are pointing one side then place your object on the pan and the beams should always be on the zero mark, do not play with the machine *(saying to one student).* Then place your object on the pan. Ok place anything that you have on the pan, what happens? Those who can see this one tell us what happened to the line. Are they still aligned?

S No madam.

T They are not, so if they are coinciding, we move the beams and change the beams. We start with the one that uses units, our aims is to make sure that the lines eventually point sides, we move the smallest beams so that the lines were pointing sides. So move the smallest beams, you can try this one then you place your object on the pan. You should wait for me do not go too fast, yes are they coinciding?

S No.

T What happened? Its either going down or up?

S Down *(some said)* it is going up *(some said).*

T Then?

S Down.

T Alright all of us, we are meeting a problem, when you reach that point you have to move a little to the right, what happens?

S The beam goes down.

T Yes the beam goes down when you move a little backwards it goes up. Right?
That means the mass of the object is around there. So what do you do? You go back to where the line is above. Just to think of it? Have you done that? Is the line now above the other one?

S No madam there is no change.

T No there is no change? It is lighter than the… so you add the mass by moving the smaller beam, it should come back to 50 so your mass is around here. They have not yet coincided. Come to the small beams or the smallest beam until you get the lines coinciding. Speak English?

S Yes madam.

T Do not shake the table.

S Eh eh.

T Go for the ones that counts with 10s step by step, you are no longer doing the…. . yes why not? Have they coincided? Make sure that you make the lines to coincide. Let us work. For the mass we are counting the 10s now, we started with the 100s and we got 300, 400, you got 50, right let us go to the units 300 and the other unit is zero so we are going to add all these readings.

S Madam ours is 400. *(the others said)* for us it 450.

T Oh so you add all these values.

S 300 for the largest scale.

T So for the 10s?

S 10.

T 10 and the units?

S 1.4

T Let me check if it is 1.4, between 1.3 and 1.4. if it is between. What number is between 1.3 and 1.4?

S *(They gave different numbers)* 1, 2, 3, 4, etc.

T 1.35 the half of 0.1 = what? 2 into zero into 10?

S 5.

T So you had 1.5 plus a small fraction that means you are adding 1.35 that gives you 5.3 or 5.4 grams so we have used a sum… (not clear). Do you remember what we have used? First the pointer balances, make sure the lines balances. At the sides of the pan there is an adjustment knob, can you find it?

S Yes madam.
T That knob is used to help the beam balance to ensure that the mark coincide so when they coincide you can start to weigh your objects. Then after that what do you do, you move the smallest, middle and largest and at the end you add the readings. 1000 grams is too heavy for laboratory scale. A gram is just a fraction of a kilogram. You know what is a fraction?
S Yes madam.
T What is a fraction?
S A number over a number.
T A fraction is not just a number over a number but a fraction is a part of a whole. Eh so a kilogram is 1000 grams. What fraction of a kilogram is gram? Copy this down, it as an assignment.
THE END OF THE LESSON

THE LESSON FORM CYCLE 1: MR. KHABA

T Right now, eh, there is something that is quiet interesting, what I want u to do, I just want each of you and every one of you today without showing what you have written to your neighbour to tell me whether the magnets can be made or not. Can they be made naturally?
S No (some Yes)
T Look at this is there any possibility that magnets can be made. Ok who are those that are saying no! do not be afraid if you are saying yes. Write down the ways in which magnets can be made. Every one of you writes something down in your notebooks. I will give you 10 minutes to do that so that you can more time to think properly. Relax and think properly.
T (after some time) Now I want you to discuss what u have, that is the way that magnets can be made.

Students started discussing. It was not clear what they were saying but this was picked up.
E. **One Learner** Magnets are made using certain chemicals such as iron and steel.
Another learner *How? What are those chemicals*
First Learner *I don't know them.*
The discussion was not clear but went on for some time.
T The number from those groups and I have already given those magnets alright. I want them to tell us to..... ***(there was a cut)*** the what do you do? Okay your saying u move a magnet and how do you move on by writing on and then what do you u do. You the take another ..... then you are saying they will attract? Or is there any way by which other members would like to say this? ***(this was said as the teacher was drawing on the board.)***

S I take steal and iron then crash them into small pieces.
T Then what happens?
S Heat them. After they have malted we take them
S Yes sir. Then put them into the containers and will heat them *in oil sheet*? Then it forms horse shoe by cooling then let them cool. The take them out of container and put them in the machine and mix them to form forces of attraction.
T my concern is how is this machinery you are taking about going to turn this into the course of attraction, what kind of the machine is that? Especially after all this melting. Ok let us this for a while.
S I then divide them into north and south poles.
T You know my concern is how are these iron and steel that are crashed going to turn into a magnet. Not how is that machine going to turn them into a magnet.
S Steel and iron .....
T Oh you are saying steel and iron. So how are they going to turn into a magnet. Ok lets just suspend it. Are there other pupils who still have something to say? I heard interesting answers from this side. (pointing at one group) Don't be afraid to say those things that you were saying. Guys! Eh!
S We don't have anything.
T But you said something, what did you say.
S (said something that is not important and the teacher just ignored it)
T Ok this was from the first group and this from the second group. Let's look at this, this is the 3rd group. What are you saying sir?
S Magnets can be made by taking non magnetic materials and rubbing them on the hair or on the ground so that they will be able to attract.

T Alright, ok eh. Now I would like us to try and think as to which one of these methods you are talking about here do you think will easier make magnets? Eh? (pointing on learner)
S The 1st one and the 3rd one.
T Oh you are saying the 1st will be very easy for us to make magnets with. The 3rd one also alright. Ok lets suspend these ones and say we will investigate more about this methods but there is one thing that I like about these methods. But I could not get the way by which we could be able to make the magnets. But we were told that here we could make these things. What do we call this?
S Ligaments or magnetic materials?
T Ok, we were all told that we were going to use magnetic materials that is one thing that is interested me a lot and some words I underlined there which are those?
S Iron, steel, horse shoe magnet, magnet that is bar.
T These are the things that are important that I have noticed although I said we should suspend it and find more about them some other time. Now for those pupils who got methods right, oh I gave you these things that you are going to work with to make a magnet. Now lets see. Have those things that you were using or have the way that you have suggested of making these magnets able to.... Have those things been able to turn into magnets?
S Yes Sir.
T Eh is that true, are u sure? So can you and other pupils from one group come and connect these so that we can be able to see how they connect?
S Yes sir (some)
T So I would like just one of you to come and demonstrate and make the diagram on the way you have been able to rub this magnets because you have to rub in a certain way. One volunteer please. Yes. (student draw the diagram on the other side of the board). I want all of you to know how magnets are made using one method because we should not bother about this because it failed to show us how the machine is going to do magnets. Do you get it?
S Yes Sir (all)
T For this method I want you to look at this here and these one. What kind of materials have you been using here?
S Magnetic materials.
T that is very true and lets look at this one here, eh beside magnetic materials what else have we used here?
S Magnets.
T I would like us to make magnet we have to use magnet and magnetic materials so we will move about this in the later lessons. Now for us I want us to adopt this method only. I want u to go and find out what we call this method and how these magnets are made by this method in any textbook. Find out what this method is called and we will check that in our next class. We use only the first method, tell us how magnets are made.

THE END OF THE LESSON

THE LESSON FORM CYCLE 2: MRS. THABI

T Good morning class
S Good morning madam
T Today we are going to talk about iron bonding. Can some one come to the front and draw the structure of an atom. Please sit down. Label a structure. So what is an atom? Lindiwe?
S The positive electric charge.
T The positive electric charge/ what about the electron?
S The negative electric charged
T neutron?
S It means there is no charge.
T These one they have charges (students said something that is not clear). What do you understand by the word charge?
S Charge means when the electric is charging or .... (did not finish)
T It something that has electricity. Ha kere! So electricity makes something to come together.
S The battery madam?
T The what?
S The battery.
T The battery
S Yes madam
T It is an example?

S Yes madam, of an element. (another said) Magnet
T Magnet is an example. Yes that is true. Another one?
S The solar (some said)
T the solar?
S No! it works with the battery(one said). Yes madam some of them.
T In your daily life, what is something that you always play with that had a charge?
S The gun.
T The gun? Ok just try to take out peace of paper and cut it into small pieces. Put a ruler on top and the papers …… (there is noise, not clear). What we want to do to rub the ruler and see what will happen brought closer to the pieces. What do you think is going to happen?
S Heat energy (another said). Attraction
T Put this ruler against your pen. What is it gaining from your pen?
S Attraction and heat.
T What? Gaining heat?
S Mocheso, heat.
T And that heat will make ruler to do that? Gaining what?
S To attract (all of them said)
T Lets go back to the structure of atom. We said that batteries are the positive charge and the electrons are the?
S Negative charge. (all)
T So what do you think the ruler have
S Negative (some said). Not negative (some said, while others said). Neutral.
T Neutral?
S Not negative.
T So when you put negative and neutral together is the any charge there?
S no
T Is there any charge there?
S Yes madam (some said)
T Hona le charge moo?
S No!
T There is no charge. Is that so?
S Positive, negative
T Positive and negative? So let us describe the charge in the example selected. That is the hair and the ruler. So your are saying the hair is neutral?
S Negative and positive
T Let's forget about the hair and talk about the paper.
S Negative
T What makes you say the paper is negative?
S Because it is attracted to the ruler.
T Yes it is attracted to the ruler and the ruler is what?
S Positive if you put the……. To the ruler
T And the ruler is positive, if you put the…? Please say it aloud, repeat it, you rub it on the hair, it won't attract the ….
S Yes madam
T So I want you to correct the mistake. You see that? So what do you think it happening there? (there was a diagram drawn on the so they are using it)
S There is no charge
T There is no charge ha kere?
S Yes madam
T Yes the ruler and paper has the same charge and they both having either negative or positive. They some charge. So what will the ruler gain?
S The heat
T It will gain electrical charge that is due to the electrons. Ha kere?
S Yes madam
T That will make the ruler be attractive. Let's talk about the sodium?
S Madam
T What is the atomic number of sodium?
S 11
T 11 ha kere!
S Yes madam

T Can some one come and show the sodium atom. (one came and draw it). So how many atomic numbers?
S 11
T 11 is these negatively or positively charged particles?
S Positively
T Positively? Listen to Mosa, hey?
S Sodium is metal.
T So what?
S So metals are in negative form.
T Let's talk about chlorine. So what can you say about it. Can someone come and show the atomic structure of it?
S Madam
Someone came to draw
T How many here/
S 17 the drawings are wrong.
T The drawings are wrong so!
S Madam we must say 23 – 11 which is 12, so we must make those things 12 not more than 12. (some students did not agree).
T Let him finish, what can you say about the structure? How many shell, number of circles?
S 3, 4
T Can somebody come and draw number of circles in chlorine. What about the shells. Let's count the number of particles in the out most shell. We have 1.... We said that sodium is a metal hakere?
S Yes madam.
T What about chlorine?
S It is a non metal
T Why is it a non metal?
S Because it is negative
T Why is it negative?
S Because it is coloured in black
T Coloured in black? Ah!
S I don't understand the difference between metal and non metals.
T What is the difference?
S (the student is trying to explain and there is a lot of noise)
T Please repeat (the student repeated but still not clear). Which means the metals does. Lets go back to your example of the ruler and the pen. Where do you put the ruler under the metal or non metals?
S Non metals
T Why do you put the ruler under non metals? He said that non metals do not conduct heat or electricity. So where do we put the ruler? Under non metals or metals?
S Under non metals because when heat..... (others repeated after in a mocking way)
T Lets talk about the plastic ruler, where do you put it? What happens when placed near heat, what will it do?
S Melt
T So what? Does id conduct heat or electricity?
S Heat
T So this one is a non metal. Let's come to the papers and put the pen next to the pen and tell me what will happen. Masabi?
S Masoabi!!
T Yes, what will happen? Under which does the paper fall?
S Non metals
T Does the paper fall under non metals
S Yes madam
T Because it does not conduct heat ha kere? So you are saying that the ruler falls under the non-metals?
S No madam (some said). Yes madam, the ruler is an insulator.
T Don't shout, what is an insulator/
S Insulator is any material, which does not allow heat from.... (There is noise)
T Is it the bad conductor of heat?
S Yes madam (they all said) ruler is one of them

T So ruler and paper are non-metals.
S Yes madam.
T What are you trying do when you rub the ruler against the pen? What will happen?
S Trying to get heat or forming friction
T So what will happen to the ruler?
S (not clear)
T So what? It will attract what? We said that the ruler and the paper are non metals. What about the hair/
S It is neutral
T Rub your ruler against the paper?
S Nothing
T To your hair what do you think your hair has?
S Positive charge
T Positive charge, which means that the rule conducts the heat from the hair. That will make this to get the charge against the paper. Ha kere? Then lets go back to sodium and chlorine. We said chlorine is negative and sodium is a metal and so what do you think will happen when you put these two together. Which one is going to lose the electrons or some particles? Which on is going to lose and which one is going to gain those lost elements?
S Chlorine will lose
T Why are you saying chlorine will lose?
S Sodium is going to gain.
T Is it correct?
S No madam sodium will lose (others said) why?
T Why? Sodium is going to lose, because it has few elements in the outer most shell and the other one has more?
S How?
T How many electrons are supposed to be in the outer most shell?
S ..... (could not hear the first part) they are going to expand.
T You said that this one is positively charged so as you see we have 1 but chlorine we have how many in the outer shell.
S 4
T They are supposed to be seven this structure is not correct (looking at the drawing on the board). In the 1st shell they should be 2 another one not more than 8.
S They were answering.
T So the metals atoms can lose electrons to the positively charged atoms. They are unlike electrons, they should gain in order to be negatively charged. Ok?
S Yes madam (all said).
T (showing on the diagram) It shows that it has lost the electrons in order to be positive but this will gain the electrons hence become negatively charged. Any questions?
S Madam, the total electrons in chlorine 35.5 (others said) no madam 18.5
T chlorine has got 17. then don't go to that ones they are for the atomic weight. So that is how the ironic bonding is formed. Next time when we meet we will discuss the covalent bonding. Two chlorine then we have this. (showing on the board).

THAT IS THE END OF THE LESSON

THE LESSON FROM CYCLE 3: MRS MOTLOUNG

T Do you still remember the characteristics of living things?
S Yes.
T List the, if you still remember? Yes.
S They reproduce.
T (*repeated after the child*) yes.
S They move.
T Yes another one.
S They breathe.
T At the back there. Mohau?
S They respond to stimulus.
T (*repeated after the child*).
S They excrete.

T (*repeated after the child*) The last one, all of you?
S They eat.
T These are the characteristics of living things, which we have learned.
S Yes.
T We are still learning more about them. Can you please choose one? I am giving you the opportunity to choose the one that you would like us to talk about. Tebello?
S Reproduction.
T Do you all agree with her?
S (*all said*) yes (*except one or two boys who said*) no (*in deep voices*).
T I did not ask you to make noise. If you disagree raise you hand. If you do not want to talk about reproduction, what do you want us to talk about? Yes?
S They feed.
T How many are saying they reproduce?
S House / class.
T It is like the whole class would like us to talk about reproduction.
S Yes (*all*).
T That is what we are going to talk about today. You have chosen this topic now but I have chosen it yesterday. So reproduction. Why do you want us to talk about reproduction? Why did you say you would like us to deal with how living things reproduce? Can you tell me your reasons? Yes?
S Because I want to know how they reproduce.
T Does it mean you do not know?
S Yes madam. (*one said*) I want to know more.
T You want to know more.
S Yes.
T What do you know? What is that you know. Ha kere you are saying you want to know more. Can you tell me what is it that you know at the moment? Falimehang? Do you know anything about reproduction?
S No.
T She is saying no. what about Mpho?
S We have two Mpho's in here, which one?
T Any of the two. Dingane. What do you know?
S I know the life cycle.
T Of what? He knows the life cycle.
S Of a house fly.
T Of a house fly. What else do you know about reproduction? Yes?
S Reproduction is the multiplication of living things.
T (*repeated after the child*) so you know that reproduction is about multiplication. How are things able to multiply themselves? Here you are how do you multiply. Let us talk about human beings not necessarily you as students, how do human beings multiply themselves?
S By sexual intercourse.
T They make sexual intercourse and what happens?
S The female and the male gametes fuse together.
T (*repeated after the child*) Do you the female gametes?
S Yes.
T What is the name of the female gametes? Mpho?
S Ovum.
T She is saying the ovum. And the other is…..(*not clear*).
S Egg.
T If you do not want to say ovum you will say an egg. We talked about the male gametes and we said they fuse. What is name of the male gametes?
S Sperms.
T The sperm is the male gametes. Now we said they fuse. Fuse, do you know it? Ho thoe fuse e chele. Is it the one that you are talking about?
S No.
T What do you mean when you saying they fuse? Yes?
S They combine.
T They combine. They come together.
S Yes.

T And what is the process called? What do you call that fusion process? What you call that coming together of the gametes?
S They make a zygote.
T They make a zygote. But what do you call the process?
S Fertilisation.
T Fertilisation. So today you talked about the life cycle and you know about life cycle. And also you know about fertilisation. Now do you anything about fertilisation like the types of fertilisation.
S Yes.
T Which are those types. Penane? Answer the question. Relebohile, do you know types of fertilisation?
S Internal fertilisation.
T He knows about internal fertilisation. What is internal fertilisation? (*they are quite for some time*) while you are still thinking give me another type of fertilisation.
S External fertilisation.
T It is the external fertilisation. Is there any other type of fertilisation?
S No madam.
T Now let us talk about each type. What happens in internal fertilisation? Let us see hands. What do you think?
S -----(*not clear*).
T She is speaking Sesotho.
S Madam I think the sperm.....(*not clear*).
T (*repeating what has just been said*) fertilisation takes place inside the body. Give me examples of organisms in which internal fertilisation takes place. Sello? (*she repeated the question*) Lieketseng?
S In a nucleus.
T Is a nucleus an organism.
S No madam.
T Is it a living thing.
S It is a cell.
T Is it a cell or part of a cell?
S Part of a cell.
T Where is fertilisation taking place (*silence for sometime*).
S .....(*not clear*).
T It is written like this (*writing the word vagina*) .
S Vangina.
T Vagina not vangina. Where does fertilisation take place?
S In the ovum.
T In the ovum.
S No in the ovary.
T In the ovary.
S In the human being.
T The ovary is in the human being, the ovum is in the human being. But the thing is where in the human being will the fertilisation take place, main in this organism called man. By man we mean all the human beings. Hence man is an example. So where is it taking place in the human being? You talked about it when you were in Form A. it in not in the ovum, it is not in the ovary but where do you have fertilisation taking place. Yes?
S In the oviduct.
T Good, which is where it takes place. So we have talked about internal fertilisation. Let us move on and talk about external fertilisation. What is external fertilisation? Not the same pupils again.
S External fertilisation is when fertilisation is taking place outside the body of an organism.
T (*repeated after the child as she is writing it on the board*) give examples of such organisms? Telang?
S Fish.
T Fish. Falimehang?
S Ostrich.
T Do you agree? The sperm and the egg meet together to form a zygote out side the body?
S No.
T They are saying no. Yes.

S Frog.
T Frog. These are the examples of organisms, which have external fertilisation. But I would like to go back to Falimehang answer. She said an ostrich. What is an ostrich?
S It is a bird.
T It is a bird. In birds where does fertilisation take place?
S Inside.
T Inside the body of the bird. An then what?
S And it will produce an egg.
T And then it lays eggs. So that is an internal fertilisation. That egg is already fertile. We call it an egg but I think it is a zygote. An egg is a female gamete and after fusing with the male gamete it is a zygote. Which means after the fusion the female gametes is no longer an egg but a zygote. For your homework find out whether what is laid by the ostrich is an egg or a zygote. Yes?
S A zygote comes first and then the egg.
T (*writing on the board*) we have an egg + sperm ----give zygote which then produces an egg?
S No madam.
T No go and find out what actually happens. You have talked about internal fertilisation and external fertilisation, which are the two types of fertilisation that we have. I would like us to talk about something else. I wrote this thing. (*Pointing at the board*) some body said reproduction and mentioned lifecycle. When you born? (*Pointing at one learner*)
S 1985.
T On which day and month.
S 7 April.
T 7th April 1985. This is when Masupha was born. He grew up and was taken to doctors and started attending primary school. When did you start your primary school?
S 1993.
T Primary? When did you start your secondary school?
S 1999.
T Are you saying in 1999? Are sure? You were doing Form A?
S Yes madam.
T Now you are here, when do you intend getting married?
S (*they all laughed*) When I am 35.
T when will you 35?
S (*silence, when he is trying to calculate*).
T Ok, you wish to have how many children?
S Two.
T Two children. What do you prefer? Would you like to have both boys or both girls or a mix?
S A boy and a girl.
T A boy and a girl. The two will grow and start the process that their father has gone through, attend primary, secondary schools and they will get married. They will have their children. Those children will be the grand children of Masupha. Now what can you call this process.
S Life cycle.
T Now some one said he knows about the life cycle of a housefly. That is what I want you to work with. Life cycle. What would you life cycle is? What is a life cycle? Mosito?
S A stage of living things after they were born.
T There is only one stage.
S No we have different stages.
T We have different stages in the development of living things. Dingane said he knows the live cycle of a housefly. I want you to draw the life cycle of a housefly. Again there is another thing that I want you to draw its life cycle, this thing lives in water, it lays eggs in water, it breaths with gills, it is covered with scales and it is very nice when fried.
S (*they laughed*) Fish.
T I want you also….. Is it nice? There is other one which I also want you to draw its life cycle. Most of the time at LIFE high school we eat… and that thing comes from this organism and it covered with feathers. Those animals supply our school with that thing. What is this thing? There is some one who has never said anything in this class. What is you name?
S Siimane.
T Siimane, what is this thing?
S Chicken .
T She is saying chicken. What is chicken?

S It is a living thing.
T In which group of living things does it belong? Mammals?
S Birds.
T I want you to make groups of 5 and draw the stages in the life cycles of housefly, fish, birds and locust. Let me see the groups. (*After some time*) let us have one member of the group to come and show us the stages in the life cycle. Why do you all come?
S To give her support.
T No she will be ok.
S But she is shy.
T (*they waited for sometime for her to come to the front*) she is taking too long. Don' t come to the front back speak where you are. Lets star with the house fly, state the stages. Ok any group that is ready. Yes let us listen to them. We are not going to make comments now. Listen and compare with what you have written. Yes?
S Adult housefly.
T Adult housefly (*repeated as she is writing on the board*).
S Fertilisation.
T He says fertilisation.
S Zygote.
T Zygote (*repeated as she is writing on the board*).
S Larva.
T Larva (*repeated as she is writing on the board*).
S Pupa.
T Pupa (*repeated as she is writing on the board*).
S They are all.
T They are all. From adult you have fertilisation. You have zygote, you have pupa. What does it mean to say you have a life cycle? What does a life cycle mean? If you are starting from this point you are going to end where. (*making a point on the board*) if this is point A where you are staring, where are you going to end?
S At A.
T Yes, you will come back to A. with this life cycle that you presented I do not know…
S It has to end with an adult housefly.
T Ok, all groups look at what you have written on the housefly. Do you agree with the one on the board? What do you think? Do you think that fertilisation is one of the stages in the development of a housefly? Yes?
S From my group, we have adult---egg—larva--- pupa--- adult.
T (repeated as she is writing on the board) this two life cycles that is A and B are different. Which one are you saying is the one.
S B.
T Why B? Why?
S In a live cycle there is no zygote.
T He is saying there is no zygote. Fertilisation takes place in all organisms. But we are concerned with the stages. So the zygote is the egg that has been fertilised. Let us take…… Internal and external gills, is that a stage? What do we say? We have to show that fertilisation takes place. What are the stages in the life cycle of fish. You do not know the life cycle of fish? You know but you are not saying it.
S Fish – external gametes.
T What are external gametes.
S The eggs and the small fish.
T The small fish. Do you agree or there is something that you think should be added to the cycle. Matjeka, what do you think? Fertilisation takes place outside the body. Do we have to show it? Is it a stage in the life cycle?
S No.
T We don't need to show that. So you mean it is complete now.
S Madam if the fish is laying eggs external, we have the female eggs and the male eggs, they are going to meet and they are going to form a zygote or the young tadpole (not pronouncing it correctly) which will develop into the adult fish.
T So what you are saying is you have eggs + sperm ---- they fertilise form zygote --- form a small fish --- adult fish?
S I don't agree.
T Why do you disagree?

S There are small fish in water but they are old.
T He is saying there are small fish in water but they are old. It is like this small fish is ready to produce eggs. Which small fish are we talking about here?
S Mekulubete (*tadpoles*).
T Is mokulubete a fish?.
S Madam let us talk about fertilisation in human being.
T Yes.
S Eh, fertilisation is when the sperm and the egg form a zygote, which is going to develop into a baby.
T Foetus, it is called foetus.
S So the foetus is going to develop into a baby.
T This is a very good example. She is making an example of a human being. The foetus is in the womb but it is already like the adult in features even though it is small. So we are talking about dwarfs, we are not talking about adults and by small me mean babies ka age. With small fish we are not talking about the fully matured fish but we mean the small fish by age. That is small it is going to grow to be an adult. So this is the life cycle of fish. Now let us talk about the life cycle of birds.
S Life cycle of a bird, we have adult bird, eggs and young bird.
T What do you call the young bird? Ah then?
S We then go to the adult bird again.
T Then the adult, even though some processes are not shown, what happens between here. (*pointing between the eggs and the small bird*) that is the egg and the young one?
S The eggs hatch into the young ones.
T What do you call that process in between, where by the adult bird sit on the eggs and make them warm so that after 21 days they develop into the young ones. What do you call that process?
S Incubation.
T Yes incubation. After incubation the eggs develops the young birds, chicks (*Tsuonyana*). Others are not listening, they are playing. Locust, what about the life cycle of a locust?
S Larva.
T The 1st is the larva?
S The one is the locust.
T Then what?
S The larva.
T You have locust, larva, ..(*They are debating about how to pronounce larva*).
T Let us not laugh. So there are no eggs in this case?
S No.
T Are you saying there are no eggs?
S You have the adult, the larva, the pupa and the adult.
T Do you agree? Ba bang are always saying yes. Do you agree that the locust will take the larva immediately?
S No madam.
T What happens?
S Eggs first before larva.
T And then larva followed by pupa (*there is noise the teacher is trying to bring order and they are apologising*).
T You have eggs, larva, pupa, adult, are you saying that. I have been a Shepard but I have never seen a pupa developing into a locust. You know that thing the we ask, " Maseru ke kae?"
S Yes mokone.
T What is it called in English?
S Pupa.
T What is it develop into? We mean that thing that you play with? You said it is mokone.
S It develops into a butterfly.
T But what about a locust? Have you seen a small locust without wings?
S Yes madam.
T Where does it come from?
S It is one of the stages.
T So in this case we have: adult – larva – nymph – adult. This small locust is called a nymph.
S Yes I know it (*one said*).

T These are the life cycles. How many types of fertilisation have we talked about. (*repeated the question*).
S Internal fertilisation.
T (*repeated the question*).
S External fertilisation.
T (repeated as she is writing on the board) for internal fertilisation, apart from man which other organism has it?
S Cow.
T Cow. That is another organism in which internal fertilisation takes place. Apart from fish and frog which other organism has external fertilisation?
S Eh snake and flower.
T Did we talk about flowers? Yes?
S No.
T Which types of reproduction have we talked about in the past?
S Sexual reproduction in....
T In which organism? Yes?
S In mammals.
T Mammals. House fly is it a mammal? Hominy type of living things do we have?
S Two.
T Which one have we been talking about today?
S Animals.
T Not plant or flowers. For your assignment, want you to look at the life cycles of housefly and locust since they fall under the same group of insects. I want you to look at the life cycles of these two insects and identify the differences. What do you call the cycle or the style of development of the housefly and the style of development of the locust? We will look at that tomorrow.
S Madam does a housefly wink?
T He is asking if the housefly can wink. (*she explained this question using their language*).
S Yes but inside.
T What kind of an eye does it have?
S Compound eye.
T A compound eye. By a compound eye we mean ... (*not clear, then explained in Sesotho, with reference to its reaction*). So that is all for today.

THE END OF THE LESSON