# CHAPTER 1
# CONTEXT OF THE STUDY, AND THE RESEARCH PROBLEM

## 1.1 OVERVIEW OF THE STUDY

This study involved an investigation of some of the factors affecting the implementation of the new *Junior Secondary Science* curriculum in Lesotho. First implemented in 1998, this curriculum aims to enable teachers to develop in the students appropriate scientific skills and attitudes in addition to acquiring knowledge, and to use a learner-centered and activity-based approach in their teaching. Since it was difficult to establish from the policy documents what the new approach involved, the first step in the research was to establish exactly what changes the new curriculum required teachers to make. Two strategies were used to gather the data: interviews with four *National Curriculum Development Centre* staff, and document analysis of the relevant documents, including the syllabus and available textbooks from two publishers and teacher's guides from one publisher. The second step was to investigate teachers' awareness of the new requirements, and how they were implementing them in their classrooms. Questionnaires were completed by twenty-eight *Junior Secondary Science* teachers in one district in Lesotho, and four teachers were interviewed to probe for in-depth information.

This chapter sets the scene for the research by describing the context of the study and the problem that motivated the research.

## 1.2 A BRIEF HISTORY OF THE EDUCATION SYSTEM IN LESOTHO

Many countries across the world are realizing the need to change their science curriculum as a way of improving science education, and Lesotho is not left out in this important endeavor. Lesotho's reform of its science curriculum follows trends world-wide which focus on a more learner-centred approach, with active learner involvement in classes. This approach makes a shift from traditional science teaching which was teacher-dominated and content-laden.

The need to reform Lesotho's education dates as far back as the 1960s, when Lesotho gained its independence. To understand the journey this transformation took, a brief history of the education system in Lesotho is provided. Formal education in Lesotho was introduced by the missionaries in the early nineteenth century, while the country was a British protectorate. This gave the churches control over daily administration of the schools, and the curriculum offered in them. This has been claimed to be a contributing factor to delayed changes in the education system in Lesotho (Thelejane, 1990; Letseka, 1992; Khalanyane, 1995).

While missionaries played an important role as pioneers of the formal education system in Lesotho, the education they were offering seemed to be mainly concerned with providing communication skills,

and propagation of Christian values (Thelejane, 1990; Letseka, 1992; Seotsanyane and Muzvidziwa, 2002). The development of life-long skills of individuals was not a primary responsibility of Christian education (Seotsanyane and Muzvidziwa, 2002), and this education system did not seem to respond to the developmental needs of the country. Ansell reports that the 1978 National Pitso[1] saw the overemphasis on examinations as a contributing factor, claiming that

> *"many of the problems with curriculum and instruction stem from the inordinate emphasis given to the preparation for terminal exams which undermines the attainment of certain education objectives that are critical for the country's economic development. These include problem solving; the practical application of concepts and skills; the spirit of co-operation and team work; creativity and imagination; and the development of a moral, socially conscious character."* (Ansell, 2002, 93-94)

The secondary school curriculum also seemed to be overloaded with too many subjects, which left little room for learners to acquire productive skills and education for life-long living (Seotsanyane and Muzvidziwa, 2002). An interesting observation one makes from this is that not much has changed since then, as the same concerns raised in 1978 form the basis for the development of the new syllabus in Lesotho (on which my study is based).

On gaining independence in 1966, the new Lesotho government inherited an education system that was dominated and administered by the churches. The government found it very difficult to disentangle the Lesotho education system from church control (Thelejane, 1990; Seotsanyane and Muzvidziwa, 2002). However, the post-independence government had aspirations for changes in education that would bring about a difference from the colonial-type education. The government wanted to restructure the education system to *"promote education and training as a means of creating skills and aptitudes"* (Seotsanyane and Muzvidziwa, 2002). A number of commissions were set up during the independence era, with the purpose of ensuring that the government assumed complete control of the education system. This was initially met by strong resistance from the churches, but by 1977 a truce was reached and a tripartite partnership was established between the missions, the community and the government (Khalanyane, 1995). In 1978 the government launched a National Dialogue (National *Pitso*) in which the participants were a wide range of stakeholders such as chiefs, parents, university staff, churches, teachers and members of the interim Parliament. The result of this conference was the appointment of the 1980 *Education Sector Survey Task Force*, which was set up to prepare an education policy document meant to guide the government in planning an education system appropriate to the developmental needs of Lesotho, and which would promote the economic and social development of the country (Khalanyane, 1995; Motaba, 1998).

In the early 1990's three important conferences were held which led to the current revision of the syllabus. The 1990 *Jomtein Conference* in Thailand made Lesotho realize that there were global changes in education (Ministry of Education, 2002) and that Lesotho needed to change its curriculum. This resulted in the 1992 conference on the *Clarification of National Goals for Basic Education* and the 1995 conference on *Clarification of Goals for Secondary Education*. After these conferences Lesotho decided to look critically at the kind of education it was providing to see whether it would

[1] *Pitso* is a Lesotho term for a gathering of people to discuss community issues. Some authors refer to this 1978 Pitso as the "1978 National Dialogue".

meet the newly established goals. A review of the existing secondary curriculum was undertaken, followed by the development of a new curriculum that would meet the needs of Lesotho (Ministry of Education, 1995).

The *National Curriculum Development Center* (NCDC) in Lesotho was mandated to review curriculum materials and syllabi. Their task focused on a review of the education goals, a revision of the existing syllabus, and the implementation of a whole revised curriculum at *Junior Secondary* level. The education system in Lesotho is organized into three levels, with learners attaining a different qualification at the end of each level (see Table 1), and "Junior Secondary" level refers to the eighth, ninth, and tenth years of schooling. At the *Junior Secondary* level all learners must take *Science* (previously called "Integrated Science") as a subject (Ministry of Education and Manpower Development, 2002). Three disciplines (biology, chemistry and physics) are dealt with within the *Science* curriculum.

**Table1. Grade level arrangement in Lesotho**

| Education levels | Lesotho term for different grades | Equivalent South African grade levels | Public examinations |
|---|---|---|---|
| **Primary** | Standard 1 | Grade 1 | |
| | 2 | 2 | |
| | 3 | 3 | |
| | 4 | 4 | |
| | 5 | 5 | |
| | 6 | 6 | |
| | 7 | 7 | Primary Leaving Examination (PLE) |
| **Junior Secondary** | Form A | Grade 8 | |
| | Form B | 9 | |
| | Form C | 10 | Junior Certificate (JC) |
| **Senior Secondary** | Form D | Grade 11 | |
| | Form E | 12 | Cambridge Overseas School Certificate (COSC) |

## 1.3 THE NEW CURRICULUM IN LESOTHO

### 1.3.1 Implementation of the new curriculum in Lesotho

The review and revision of the *Junior Secondary Science* curriculum was completed in 1997. Prior to full-scale implementation the curriculum was piloted by 20 secondary schools in Lesotho in 1998, starting in Form A that year and followed by Form B and C in 1999 and 2000 respectively. Teachers at each level were given in-service training at regular intervals, which was followed up by school visits by members of the *National Curriculum Development Center* team to check on the progress and to identify problems teachers and schools might be experiencing. By 2001 all schools in Lesotho were fully implementing the new *Junior Secondary* curriculum.

However, the transition from piloting to implementation did not go smoothly, as during the trials process some disagreement arose about implementation of the new curriculum in all schools in 2001.

In 1998 some principals at a trial-school headteacher's workshop expressed reluctance to implement the new syllabus fully because they felt that trialing should go on for a few more years before full implementation. However, most principals felt that implementation should go ahead, their argument being that some people fear change and this should not be used as a reason to retard the change process (Trial report, undated). The concern expressed by some of the principals is an indication that some headteachers, and probably some teachers, felt they were not ready for the change. This issue is discussed in more detail in Chapter 2, which examines curriculum change from a theoretical perspective.

The new curriculum is now in place in Lesotho. According to the *Junior Secondary Science* syllabus document (Ministry of Education and Manpower Development, 2002) the purpose of the revised *Science* curriculum

> "*is to enable learners to acquire knowledge, skills and attitudes in science and technology that would enable permanent and functional literacy and numeracy for continuous learning and effective participation in social issues and activities*".
>
> (Ministry of Education and Manpower Development, 2002, 1)

This implies that there should be a shift in the ways teaching and learning happens, so as to accommodate the new goals.

### 1.3.2 The requirements of the new *Junior Secondary Science* curriculum

Change in practice puts new demands on teachers. Pinto *et al*. (2005) points out that it is only when teachers understand what is required of them, and when they have got practical guidelines concerning changes, and have developed the expertise, that they will effectively carry new requirements into the classroom. For the purpose of this research I have tried to deduce what the requirements of the new curriculum were, and the following claims about the requirements of the new curriculum are based on the information in the syllabus document and cover pages of the *Science* textbooks, the only two sources of information available to teachers. The syllabus document puts emphasis on the development of appropriate scientific skills and attitudes in addition to acquiring knowledge, as indicated in the above quote. The new syllabus document recommends that the following approaches should be used to achieve the new goals.

> *"It is intended that in teaching this syllabus, learner-centred approaches and methods should be used, (sic.) these include, among others:*
>
> - *Practical work through experiments,*
> - *Inquiry through investigations,*
> - *Projects involving analysis, synthesis and designing of articles/ items."*
>
> (Ministry of Education and Manpower Development, 2002, 1)

A second source of information was the set of textbooks prescribed for use when the new curriculum was introduced. These were used because one of the authors was the senior member of the *Science* curriculum development panel at the *National Curriculum Development Center*. The cover pages of this set of *Junior Secondary Science* textbooks indicate that *"the course is activity-based and gives students hand-on experience"* (Mpeta *et al*., 2003). From these two sources I have deduced that teachers are required to make four changes.

**Requirement 1: Teachers are required to use a learner-centered approach**

In the quote in the previous section (1.3.2) it is clearly stated that the curriculum requires that "learner-centred approaches" are to be used, but the term "learner-centered" is not defined. However, the use of practical work through experiments, and inquiry through investigations are given as examples of *"learner-centered approaches and methods"*, which implies that the curriculum developers might see "learner-centered" to mean "activity-related" learning. Sanders and Kasalu (2004) found that eight of the ten teachers in their South African study used "learner-centred" and "activity-based" synonymously, and point out that even though the two share some common features they are not the same. To avoid this confusion, explanations of each concept and how they link will be given in the next six pages.

**A main focus of "learner-centredness": Recognising and accommodating learners' differences**

A learner-centred approach is a perspective that puts emphasis on learners as distinct and unique individuals, with different cultural backgrounds, beliefs and practices, home language, experiences, capabilities, needs, interests, and styles of learning (McCombs and Whistler, 1997). For teachers to make their classroom more learner-centered they need to understand and accommodate these differences when preparing and conducting lessons, so that individual learners are provided with appropriate challenges and opportunities for their learning and self-development (McCombs and Whistler, 1997; Sanders and Kasalu 2004). The above-mentioned differences are discussed in more detail in the following paragraphs

- ***Differences in cultural backgrounds, beliefs and practices*:** Dimmock (2000, 46) defines "culture" as *"patterns of thinking, feeling and acting underpinning the collective programming of mind which distinguishes the members of one group or category of people from another"*. Teachers in learner-centered classrooms should acknowledge and understand that learners may come from different cultural backgrounds and have differing customs, values and points of view (McCombs and Whistler, 1997), and that because of environmental and hereditary influences people *"create unique thoughts, beliefs and understanding of themselves and the world"* (McCombs and Whistler, 1997, 8). Thus knowledge is culture bound, and what may be considered worthwhile in one community may not be regarded that way by members of a different culture (Dimmock, 2000).

  In Lesotho, individuals usually come from the same cultural background and thus share cultural values. Most people, especially those from rural areas where cultural beliefs have not been affected by modern urban ideas, believe that lightning is caused by witchcraft, and will talk of places that are regularly hit by lightning as "*maphakatlali"*. They also believe that protectors called "*lithakhisa*" prevent lightning. No matter how hard the science teacher tries to explain about electrical charges students tend to remain adamant about their beliefs, and carry their beliefs along with the scientific explanation which will be used for the purpose of the examination. The learner-centred teacher in such situations is expected to be understanding and

to create a classroom atmosphere that allows for scientific inquiry but which accommodates such culturally established interpretations (Lee, 2004).

In multi-cultural classrooms teachers have to take cognizance of the fact that students from diverse cultures bring to the classroom home-cultures which include practices, forms of talk and interactional norms that may not be in line with the science discipline being taught. These incompatibilities may *"require students to shift between different types of knowledge, practices, and discourse if they are to have access to school science without abandoning their home cultures"* (Lee, 2004, 67). Teachers have to accommodate and respect different cultures when they plan instruction and classroom interactions so as to make science accessible and meaningful without compromising scientific accuracy (McCombs and Whistler, 1997, and Lee, 2004).

A second issue pertains to cultural beliefs about how learning should happen. Most African societies exhibit an unequal power distribution, where adults are considered to have authority and children are expected to be obedient and respectful, and should not question the voice of an adult (Dimmock, 2000). In a classroom situation where learners take the teacher as an authority figure, as is the case in Lesotho, learners might find it easier to learn in a traditional way where they get information from the teacher. Such learners may find it difficult to exhibit curiosity, and inquisitiveness, and might feel uncomfortable if they are expected to 'construct their own knowledge' as required by the new curriculum, because it goes against their traditional cultural norms. This is different from some western societies where children are encouraged to ask questions. Children in some western societies are brought up to be assertive, curious, independent and exploratory (Dimmock, 2000). Children in such cultures tend to have fewer problems adapting to the demands of activity-based learning, as it seems to be an extension of what happens at home.

- ***Differences in experiences and prior learning:*** Learners from different backgrounds bring rich and diverse experiences and resources to the classroom, some of which may be in conflict with scientists' science (Lee, 2004). For example, in Lesotho some learners come from rural areas where they may not be exposed to a variety of media and other sources of information, whilst others from urban backgrounds may have access to such. Both groups of learners bring with them to the classroom experiences common to the backgrounds they come from. Learning is likely to be more effective when learners are allowed to construct knowledge based on new learning experiences which build on learners' previous knowledge or experiences, as Ausubel, cited by Novak (1977, 455), states *"the most important single factor influencing learning is what the learner already knows"*. Ausubel, in his theory of meaningful learning, suggests that learners consciously relate new knowledge to relevant existing ideas in the learners' cognitive structures (Novak, 1977). Thus teachers should take learners' prior experiences and knowledge into consideration and strive to help learners build the links between their current knowledge and the new information, and should encourage them to reflect on and apply that knowledge (Brodie *et al.*, 2002).

- ***Differences in learning abilities and pace of learning:*** McCombs and Whistler (1997) point out that individual learners have different capabilities, and learn at different paces. Learner-centered teachers are therefore expected to *"know everyone in the classroom very well – each student's strengths, weaknesses, worries and hopes"* (McCombs and Whistler, 1997, 81), and should try to understand and accommodate these differences in their practices. Teachers should provide learning experiences that will help each learner to reach desired goals and enhance each individual's ability to succeed, no matter what their abilities or pace of learning. According to Dimmock (2000), all learners have the potential and ability to learn, given enough time and appropriate instruction. This requires teachers to use a variety of teaching strategies meant to tap into different abilities of each learner in order to raise each child to the next level.

  Two of the teachers in the study by Sanders and Kasalu (2004) explain the implications of learner-centredness for classroom practice.

  > *"[L]earner-centred means you are supposed to see each learner as an individual, and therefore the needs and wants of that child must be met… It means you must see the child with their own problems, their own individual little things … you are trying to give them individual attention."* (Teacher # 7, Sanders and Kasalu, 2004)

  > "*This means catering to your learners, to every learner's ability. You're incorporating different modes of learning … visual, auditory, kinesthetic. It needs a lot more sensitivity, a lot more monitoring of what is going on… talking to the kids to find out what is going on. You would have to provide a much wider range of activities in order to cater for your various needs.*" (Teacher # 8, Sanders and Kasalu, 2004)

- ***Differences in preferred learning styles:*** Learners differ in the way they learn, and are motivated by different learning strategies (McCombs and Whistler, 1997; Woolnough *et al.*, 1999). "Learning preferences" refers to

  > *"individual's preferred intellectual approach to learning, which has an important bearing on how learning proceeds for each individual, especially when considered in conjunction with what teachers expect from learners in a classroom."*
  >
  > (Pritchard, 2005, 54)

  There are many different models of learning styles. Claxton and Murrell (1987) explain that different models may be based on:

  - characteristics of personality,
  - how people take in and process information,
  - how students tend to interact and behave in the class,
  - instructional preferences.

  It does not really matter which model teachers decide to use as long as they choose one they feel comfortable with. Teachers need to identify learners' preferred learning styles, be sensitive to differences between the preferred learning styles of learners in their classes, and consider learners' preferred styles when teaching or interacting with learners (Nunan, 1988; McCombs and Whistler, 1997). Knowing individual preferences would put teachers in a position to incorporate a variety of teaching strategies to accommodate learners with different preferred learning styles. Teachers can also help expose learners to several other modes of learning with

the aim of improving their learning capacity (Nunan, 1988; Dimmock, 2000). It is worth noting that it is not possible to set up in every lesson activities that will suit each individual exactly, but using a wider range of approaches over a period of time gives learners more choice on how to work. This would require teachers to accommodate a wide range of learning approaches and requires the ability to switch appropriately between different strategies (Dimmock, 2000).

**A second focus of "learner-centredness": Involving learners in decisions about their learning**

In the literature on learner-centredness (Nunan, 1988; McCombs and Whistler, 1997; and Brodie *et al.*, 2002) a second emphasis is made – giving learners choice "*whenever and wherever*" possible (McCombs and Whistler, 1997, 90). To accommodate learners' needs and interests learners in learner-centered classrooms should be given some choices about what and how they learn, and be included in the decision-making process of the classroom (Nunan, 1988). It is the opinion of Nunan (1988) that learners should be treated as co-creators in the teaching and learning process, selecting content, materials and learning activities with the guidance of the teacher (Nunan, 1988). Brodie *et al*. (2002) refer to this as a "negotiated curriculum". There are two important benefits derived from allowing learners to make choices.

- ***Learning and self-esteem are enhanced*** when learners feel they are in a relationship where their potential and unique talents are not taken for granted (McCombs and Whistler, 1997; Malcolm and Keane, 2001). Learners should also believe that their opinions are valued and that they are trusted to be responsible for their own learning. Learning occurs best in a positive environment, one that "*contains comfort and order in which the learner feels appreciated, acknowledged, respected and validated"* (McCombs and Whistler, 1997, 10). Orstein (1993), cited by McCombs and Whistler (1997), claims that research shows that students perform best when they feel "*respected and valued*" as "*higher levels of intrinsic motivation are evoked"*(McCombs and Whistler, 1997, 53).
- ***Learners develop higher motivation to learn*** when they feel they have a "real stake" in their own learning (McCombs and Whistler 1997). This implies that the teacher acknowledges and believes in learners and in their abilities (Malcolm and Keane, 2001). Vatterfort (1995), cited by McCombs and Whistler (1997), claimed that teachers in his study discovered that students chose "*tougher and more challenging learning tasks or more stringent classroom rules than teachers would establish"* when they were allowed to have a voice and make choices about their learning (McCombs and Whistler, 1997, 48). Learners were also found to be more willing to learn and be involved in their own learning. Nunan (1988, 5) claims that learners become more aware of what needs to be achieved in a given time "*hence learning becomes an accretion of achievable goals"*. The teacher should not be the only source of information but should share control of the classroom with the learners and let them explore and experiment (McCombs and Whistler, 1997). This claim is given support by a Swedish study in which Silen (2003) found that allowing learner's choices created a driving force that made learners ask and answer questions more like teachers would ask, like "*what is to be learned?"*, and "*how it should be learned?"*. In this way the learners became agents in the learning situation as they considered their own needs and interest in learning (Silen, 2003).

Although the idea of learners negotiating their curriculum may look good in theory, there are some pragmatic[2] concerns, based on the realities of the classroom situation, particularly in the context of developing countries (discussed further in section 2.5 in Chapter 2, page 29).

- ***Africa may lack the talented and motivated teaching force needed to implement a learner-centred curriculum:*** Because learner-centredness requires teachers to shift from a well-established role as the source of information to that of facilitator (Lewin, 1992), learner-centred teaching requires skillful teachers with deeper levels of content knowledge and pedagogical content knowledge. Teachers are expected to develop practices that vary greatly from their traditional training and hence their daily experiences, and thus have to embark on new and complex practices. They have to have

  > "*flexibility of understanding, awareness of and familiarity with student's knowledge, ability to relate to, interact with, and learn about students, repertoire of means to represent and extend knowledge and to establish classroom environments.*" (Ball and Cohen, 1999, 2)

  All the mentioned requirements need well qualified and motivated teachers, but there is evidence that teachers in developing countries differ in their abilities and the training they have received (Beeby, 1966).

- ***Students are unlikely to have the overall knowledge to allow them to structure a meaningful curriculum based on personal choices:*** Science is a hierarchical subject where basic concepts have to be taught before one can move on to more advanced concepts (Walberg, 1991). Students don't know enough to understand the complex hierarchical nature of science so that they can make logical choices of what they need to learn first.

- ***Coping with students' choices may overload the teachers:*** Fullan and Promfret (1977) suggest that having the right to decide may lead to confusion, frustration and role overload that could eventually lead to teachers rejecting an innovation.

- ***Time needed to implement a learner-centered curriculum may mean that required content is not covered:*** Curriculum documents normally prescribe what needs to be covered during the academic year, so if different learners are allowed to choose the topics which interest them, it is unlikely that teachers will cover all that they are expected to have taught. External constraints like public examinations leave little room for teachers to deviate from the demands of the syllabus.

So learners making choices of what they want to learn and how to learn it seems to be an ambitious idea in any classroom, when one thinks of the realities of most classrooms, and learners' abilities.

**Requirement 2: Teachers are expected to actively engage learners in the learning process**

Using activities as the basis for learning is not made explicit in the Lesotho *Junior Secondary Science* syllabus document, but seems to be implied from the recommendation that methods used should

[2] Pragmatic refers to "*behaviour that is dictated more by practical consequences than theory*" (Collins English Dictionary)

include *"practical work through experiments, inquiry through investigations, projects involving analysis, synthesis and designing of articles/items"* (Ministry of Education and Manpower Development, 2002,1). Although the syllabus document recommends that learners be engaged in activities, it does not make it clear that there are critical differences between "activity-based" and "activity-orientated" learning, as is explained on pages 10 and 11. However, the cover of the *Lesotho Junior Secondary Science* textbooks indicates that "*the course is activity-based and gives students hands-on experiences … guiding students to carry out investigations that are science-based and can be applied in their everyday lives"* (Mpeta *et al*., 2002).

For meaningful learning to take place learners need to be actively engaged in the learning process. The idea of active engagement in learning is not a new concept. In the 1930's Dewey suggested that children should learn by doing instead of being told facts by the teacher (Carin and Sund, 1980). This kind of learning came to be known as "inquiry learning" or "learning by discovery". Inquiry learning attempts to steer a path between teacher-dominated instruction and student-led discovery learning (Matthews, 1994). When learning science by inquiry learners are actively involved in learning *"by listening, speaking, reading, seeing, thinking and doing, provided their minds are engaged with what is being learned"* (Carin & Sund, 1980, 76). Bruner (1966) suggests that learners learn better if they discover things on their own instead of receiving facts passively and then rote-learning them. This claim is supported by studies carried out by Lott, cited by Costenson and Lawson (1986), where an inquiry approach was compared with a lecture approach, and led to significantly better performance when higher levels of thought were considered (Costenson and Lawson, 1986).

Inquiry classrooms require teachers to use different teaching approaches or strategies to traditional classrooms. As Matthews points out

> *"Instruction in inquiry classrooms reflects a variety of methodologies, discussions, investigative laboratories, student-initiated inquiries, lectures and debates. Teachers serve as role models in deliberating issues, in examining values, in admitting error, and in confronting areas of their own ignorance. The classroom atmosphere is conducive to inquiry ..... thus, in an inquiry classroom there is a time for doing, a time for reflection, a time for feeling and a time for assessment."* (Matthews, 1994, 146)

The term "activity-based learning" is now commonly used in the science education literature, and has much in common with inquiry learning. Activity-based learning is an approach to learning which is characterized by learner's active participation, in a meaningful and purposeful way, in the learning process in order to develop conceptual understanding. It requires learners to do meaningful activities and think about what they are doing (Prince, 2004). In activity-based learning activities should be the starting point of the learning process, and are meant to help learners construct their ideas. Hausfather (2001, 16) points out that when learners "*interact with information, using it in solving problems, answering questions, or discussing interpretations, the information becomes their knowledge tied to their unique understandings"*. To be effective, activity-based approaches should provide strategies that help learners construct their knowledge, including small-group discussions, role playing, hands-on projects, and teacher-driven questioning, to make sense of the materials and tasks carefully designed by the teacher (Lorenzen, 2001).

Activity-based learning is given support and justification by constructivist ideas about learning. Constructivist theory is based on the belief that knowledge is not passively received by learners but is actively built into existing schemata by means of cognitive processing by the learner. The main focus of this theory about how learning happens is that a conscious effort must be made on the part of learners` to relate new knowledge to their relevant existing knowledge by either assimilation or accommodation. It also emphasizes the importance of prior knowledge as the foundation on which new knowledge is constructed (Yager, 1991; Matthews, 1994; Carr *et al*., 1994; Scott *et al*., 1994). Constructivists view learning as involving construction of meanings by the learners from what they see or hear, using their minds and bodies as well as the material and symbolic tools made available by their culture (Matthews, 1994; Hausfather, 2001). What is constructed continuously gets reconstructed and reorganized in the light of new experiences (Hausfather, 2001). Constructivist theory underpins activity-based learning.

Not all activities can be considered to be activity-**based** learning. Inquiry learning is often contrasted with "illustrative teaching", which describes a traditional teaching approach where the source of information is the teacher. In traditional classrooms the emphasis is on transferring conceptual facts, and learner participation is mainly by whole-class question-and-answer mode. It is possible to use activities in such traditional teaching. For example, traditional practical work involves activities, but is used mainly to verify facts **after** being taught the concepts and not necessarily to generate an understanding of the science concepts in a constructivist way, where activities are the starting point for learning. The shortcoming of verification activities for promoting meaningful learning is that they do not provide opportunities for learners to construct their knowledge, as advocated by reformed curricula in which learning needs to be activity-**based.**

In this research I will use the term "activity-orientated" to describe classrooms in which activities are used in a traditional illustrative way, and "activity-based" to refer to classroom situations where activities are the starting point for constructing knowledge. The curriculum developers in Lesotho need to make it clear which of the two types of teaching activities they expect teachers to use, and need to give a clear description of the approach if they want teachers to implement the intended curriculum.

**Requirement 3: Students must be helped to develop skills**

In today's world, filled with the products of scientific inquiry, and where everyone needs scientific information to make decisions and engage intelligently in public debate, there is need for learners to develop life-long skills such as reasoning, critical thinking, decision making and problem solving (Hudson, 2001). However, Beyer and Charlton (1986), writing about American schools, expressed the concern that most learners who were leaving secondary schools and joining tertiary institutions at that time exhibited a lack of skills such as critical thinking. One of the purposes of the new curriculum in Lesotho, as stated on page 1 of the syllabus, is to enable learners to acquire skills. Later in the document the following recommendations are made about the types of skills to be developed: *"development of basic skills of research, ability to form new ideas, solve problems, design and*

*produce materials for self-directed learning in all situations"* (Ministry of Education and Manpower Development, 2002, 1).

Skills are competencies that can be taught and learned. Recently in the science education literature emphasis is put on the promotion of "science process skills" (Roth and Roychoudhury, 1993; Walters and Soyibo, 2001). Science process skills are the skills that are used by scientists to study and investigate the world. They are considered to be vehicles for generating scientific knowledge (Haury, 2002).

The literature classifies science process skills into two categories: basic science process skills and integrated science process skills (Walters and Soyibo, 2001). Basic science process skills are considered to be simple skills that provide ground work in scientific enquiry and which are used to describe natural phenomena (Walters and Soyibo, 2001). Walters and Soyibo (2001) and Sanders 2007) give the following examples of basic science process skills:

- observation
- communication
- classification
- measurement
- inference
- prediction

These basic skills can be integrated when more complex actions are needed, for example designing and carrying out experiments (Roth and Roychoudhury, 1993). The integrated science process skills are more complex skills composed of more than one basic process skill and are considered the "terminal skills" for solving problems or doing science experiments (Walters and Soyibo, 2001). The following are given as examples of integrated science process skills in the literature (Walters and Soyibo, 2001; and Sanders, 2007):

- *Designing experiments* (involves formulating hypotheses, identifying and controlling variables, describing the relationship between variables, *etc*.).
- *Conducting experiments* (involves following instructions, and a variety of manipulative skills).
- *Interpreting data* (involves organizing, analyzing and synthesizing data, and presenting it in the form of tables, graphs, *etc*.).
- *Problem solving*.
- *Formulating models* (involves making pictorial, written or physical representations of ideas or objects with the purpose of clarifying ideas or demonstrating relationships).

The teaching of the science process skills as a component of scientific method is essential (Walters and Soyibo, 2001). These authors point out that the students' level of maturity needs to be considered when teaching basic or integrated skills, because research shows that the acquisition of skills by learners is closely related to the level of formal thinking of the learners, as suggested by Piaget (Walters and Soyibo, 2001).

According to Neilson (1989) learners' lack of skills reflects the way teaching happens in most classrooms, which places emphasis on direct instruction as a means of teaching skills. Beyer and Charlton (1986) indicate that learners cannot comprehend higher order skills, including critical thinking, if they are not given clear explicit instruction on how to execute the skills. Beyer and Charlton (1986) believe that most teachers don't teach skills, merely expecting learners to use the skills. These authors suggest that skills should be actively taught and practiced repeatedly with the teacher giving guidance and frequent feedback. The results of a study by Walters and Soyibo (2001) show that when science process skills are specific planned outcomes of a science programme, those skills will be learned better by students; that teaching increases levels of skill performance; and that learners can more readily transfer the skills to new situations. Beyer and Charlton (1986) believe that for learners to master the skills and to retain them for longer the lessons they are engaged in should have the following features:

> *" 1. the specific skill to be learned is an explicit, publicly-announced lesson objective;*
> *2. how to do the skill is demonstrated;*
> *3. the key procedures and principles that constitute the skill are clearly articulated; and*
> *4. they - the students - discuss with each other what goes on in their heads as they engage in the skill."* (Beyer and Charlton, 1986, 208)

If teachers in Lesotho are to develop skills, as required by the syllabus, it follows that the syllabus documents need to give very clear guidance as to what skills should be taught and how teachers should teach skills, because the literature makes it clear that simply asking learners to use skills does not lead to the development of skills. Learners cannot be expected to excel at skills they have not been taught. Teachers must understand that learners will need multiple opportunities to work with the skills in different contexts.

**Requirement 4: Teachers should help students to acquire appropriate attitudes**

The Lesotho *Junior Secondary Science* syllabus document spells out that one purpose of the new science curriculum is for learners to develop appropriate attitudes. The syllabus states that learners are expected to

> "*acquire attitudes in science such as curiosity, inquisitiveness, critical thinking, and creativeness which, together with the scientific skills will be used in survival in the rapidly changing world, and applied for improvement of life in the society as well as the quality of the environment."*
>
> (Ministry of Education and Manpower Development, 2002, 1)

Ramsden defines an attitude as

> *"a state of readiness or predisposition to respond in a certain manner when confronted with certain stimuli…[ A]ttitudes are reinforced by beliefs (the cognitive component), often attract string* (*sic*. strong?) *feelings (the emotional component) which may lead to particular behavioural intents (the action-tendency component)."*
>
> (Ramsden, 1998, 128)

Falk (1971) points out that a close relationship exists between attitudes and values. She points out that attitudes are directed by the values one holds, and that attitudes are influenced by emotional and motivational factors.

The development of appropriate attitudes in education is important, as children with positive attitudes are found to be more likely to sustain learning and are more inclined to want to pursue the subjects they enjoy (Pell and Jarvis, 2001). Teachers' job satisfaction is also said to be highly influenced by learners' affective response to science lessons (Ramsden, 1998). However, research indicates that science teachers are concerned that negative attitudes to science such as "science is difficult", "science not relevant to most peoples lives", "science creates problems" and "science is more attractive to males than females" seem to exist amongst learners (Ramsden, 1998). Science educators are also concerned that there seems to be a decline in the interest of young people in pursuing scientific careers (Osborne, 2003). It therefore follows that there is necessity for promotion of favourable attitudes towards science and learning science (Osborne, 2003). van Rooyen and de Beer (2007) also point out that, because today's citizens have to make decisions that require application of science in their countries, teaching ethics-related attitudes is important.

How learners respond, and the images and views they develop about science, are the result of influences and experiences they come across in different situations (Ramsden, 1998). Falk (1971) and Pell and Jarvis (2001) encourage teaching of appropriate attitudes at a young age, and claim that attitudes gained at that age become more organized with age and do not change easily once established. Junior years are seen as very crucial for a child's formation of attitudes to science, as this may influence their *"attainment, consistency and quality of class work as well as their later views of science education and scientific occupations in secondary schools and beyond"* (Pell and Jarvis, 2001, 847).

Because values are said to determine the attitudes one develops, a complex mixture of values are deemed necessary for working in science, and need to be taught in the classroom. Some examples of different attitudes important to scientists are:

Attitudes for learning

- ***A desire for knowledge and understanding about scientific phenomena and concepts:*** This requires an inquiring mind, where learners seek the knowledge about how and why things happen the way they do in the natural world (Falk, 1971; Osborne, 2003).
- ***A questioning approach to all scientific ideas:*** This requires not taking things at face value, but understanding that scientific knowledge and theories are constantly changing as more information is gathered, and acknowledging that knowledge is never complete (Osborne, 2003).
- ***A demand for verification:*** Learners need to be aware of the need to repeat experiments to verify results obtained, before they can draw conclusions. They need to recognize the importance of replicating experiments and rechecking data (Falk, 1971; Osborne, 2003).

Attitudes for citizens

- ***Awareness of implications and consequences of their actions on the environment:*** Rational people must think of the consequences of their actions to the people around them, and the possible effects on the environment, before they embark on any action, and must be accountable for their actions (Falk, 1971).

Osborne (2003) indicates that "*such attitudes do not consist of a single unitary construct, but rather consist of a large number of subconstructs all of which contribute in varying proportions towards an individual's attitudes towards science*" (Osborne, 2003, 1054).

## 1.4 THE RESEARCH PROBLEM

The motivation behind this research grew out of distinct personal and professional experiences. I have been a teacher in Lesotho for fourteen years, seven of which I served as the Head of the Science Department in my school. I also got involved in some activities in science education in Lesotho (like being a committee member in the district science committees), during which time I interacted with many science teachers. It was during these associations with other teachers that I increasingly realised that many science teachers in Lesotho are struggling to implement the new *Junior Secondary Science* curriculum. When, as the Head of the Department in my school, I checked the lesson plans of teachers, I could observe no change in the lesson plans from the traditional approaches to their lessons they had used prior to the new curriculum being implemented. Their planned lessons remained content-laden and teacher-orientated, even though they claimed they were actively involving learners in the lessons. Two particular difficulties were identified:

1. **Teachers do not seem to understand clearly what the new approach involves and why it is important to practice it**. If teachers are to promote activity-based, learner-centred lessons as a requirement of the curriculum, it is imperative that they should understand what the new approach in the Lesotho curriculum involves and why it is important. My observation was supported by the findings of a study by Khoboli and Malcolm (2004), which found, for example, that teachers in their study in Lesotho had limited conceptions of what is meant by "learner-centred approach". Pinto (2005) points out that curriculum reforms run the risk of failure if teachers do not accept or understand the innovations, or if teachers are given too little direction and feel they do not know what to do, as seems to be the case with *Junior Secondary Science* teachers in Lesotho.
2. **Teachers do not seem to be changing their practice.** This observation is given support by the trial report which indicates that, even after three years of trialing and school visits, some of the Lesotho science teachers involved in the piloting of the new curriculum were still *"using wrong syllabuses, wrong approaches to teaching and some were still not planning lessons as required"* (Trial report, undated, 36). Classroom observations of six Form A (Grade 8) Physics teachers in a study in Lesotho (Khoboli and Malcolm, 2004) found that all six teachers were following a traditional type of teaching where they introduced topics, gave explanations, followed these with teacher demonstrations, and finally allowed the learners to work with the equipment.

## 1.5 AIM OF THE STUDY

The aim of this study was to investigate some of the factors affecting the implementation of the new approach in the *Junior Secondary Science* curriculum in Lesotho, with a view to eventually helping teachers to change their practices as intended by the curriculum. This included investigating teachers'

understanding of the requirements of the new curriculum and the extent to which they think they are using the learner-centred and activity-based approaches when teaching breathing and respiration, as well as investigating what support or guidelines are provided in policy documents, syllabus and textbooks to help teachers promote the new approach, with particular reference to the teaching of breathing and respiration.

## 1.6 RESEARCH QUESTIONS

The following questions directed the study.

1. What changes does the new curriculum require teachers to make in their classrooms?
2. What did the curriculum developers mean by "learner-centered approach"? (in the syllabus document)
3. What do the curriculum developers understand by "activity-based" lessons?
4. What do Lesotho *Junior Secondary Science* teachers
   - 4a believe the requirements of the new science curriculum are?
   - 4b understand by "learner-centered approach"?
   - 4c understand by "activity-based" lessons?
5. In terms of the current teaching of Form B and C:
   - 5a to what extent do *Junior Secondary Science* teachers think they are currently using the new approaches when they teach the topic of breathing and respiration?
   - 5b How well do they believe they are coping with the approaches and why?
   - 5c What help do they say they need?

Since textbooks and syllabi are considered important support materials in teaching, the final research question was meant to establish the extent to which these documents help teachers to promote the intended new approach.

6. To what extent do the support documents (policy documents, *Junior Secondary Science* syllabi and available *Science* textbooks and teacher's guides) help teachers to promote the new goals (relating to skills and attitudes as well as knowledge) and approaches, with particular reference to the teaching of breathing and respiration?

## 1.7 CONCLUDING REMARKS

This chapter described the context of the study and gave the research questions which the research was designed to answer. This was provided to help the reader to understand why the research was done and why it was important, in the Lesotho context, to do conduct the research.