CHAPTER ONE

ORIENTATION

1.1 INTRODUCTION

Chapter one aims to provide an overview of the problem investigated. The chapter sets out the problem that was examined and emphasises the essential nature of the problem. Furthermore, the chapter also highlights the scope, objectives and hypotheses of the study. Some concepts are defined and explained and a brief discussion on the research methodologies which were used to collect data is also given. Lastly, the chapter ends by setting out the programme of the study.

1.2 GENERAL BACKGROUND OF THE PROBLEM

The South African education system is currently undergoing a major transformation process, from an education system which encouraged the transmission of information to an education system which supports the constructivist paradigm of thinking. The previous education system was mainly based on the principles of Christian National Education (CNE) which was "...used to divide and control, to protect white privilege and power - socially, economically and politically - and to ensure Afrikaner dominance" (Hartshorne 1989, cited by McGregor 1992: 20). This resulted in gross inequalities among schools which catered for different races in South Africa (Department of Education 2001a: 10 and Education and Training Act 1995: 18). As such, there is inadequate supply of resources to many schools and most teachers in historically black

schools have low qualifications and poor morale (Christie and Collins 1984: 178; Harber 1989: 184; Hartshorne 1992: 79 and McGregor 1992: 24).

A perusal of various studies indicates that this sad state of affairs affects the practice of teachers who resort to survival teaching methods (Department of Education 2001a: 10; Harber 1989: 184; Hartshorne 1992: 79; Kallaway 1984: 25; Maree 1984: 153 and Mhlongo 1996: 3). It seems as if the emphasis is on teaching for examination without encouraging learners' participation in the lessons. Hence, the quality of teaching is not likely to foster the development of independent, critical and creative thinking in learners. It is likely that this problem affects all secondary school subjects in general. Research also indicates that in most geography classrooms, learners are taught geographical facts and concepts with minimal understanding (Ballantyne 1986: 33 and 39, Magi 1981: 152 and Rambuda 1994: 57).

After the dawn of the new political dispensation in 27 April 1994, the government sought to address educational problems such as these through Curriculum 2005 (cf. 3.5). Curriculum 2005 calls for the adoption of outcomes-based education (OBE) in South Africa. The adoption and implementation of Curriculum 2005 is trying to effect a paradigm shift from a content-based education system to an education system based on outcomes. This may imply a shift from the traditional product approach to a process approach. Hence, OBE focuses on what learners understand and are able to do (cf. 3.6). Bhengu aptly puts it:

> *Essentially, the new curriculum will effect a shift from one which has been content-based to one which is based on outcomes. This aims at equipping all learners with the knowledge, competencies and orientations needed for success after they leave school or have completed their training. Its guiding vision is that of a thinking, competent future citizen* (Department of Education 1997a: 1).

This statement implies that within the OBE frame of reference, teachers are required to teach the processes required by the learner for the construction of knowledge (cf. Chapter 4). Hence the researcher argues that science process skills can be achievable as outcomes (cf. 4.3.5). However, it is important to note that not all people are in favour of OBE (cf. 3.7).

Outcomes-based education has been phased-in in the General Education and Training band (GET) and Further Education and Training band (FET) (cf. 3.5.1 and 3.5.2) with effect from 1998. Before it was phased-in, the Department of Education released a White Paper on education which envisaged an education system that encourages independent and critical thought (Education and Training Act 1995: 22). According to the then Minister of the Department of Education, Prof S M E Bhengu, the new education system was expected to cultivate and liberate the talents of all people without exception (Education and Training Act 1995: 5).

Furthermore, the Education and Training Act (1995: 22) also maintains that learners should *"...develop the capacity to question, enquire, reason, weigh evidence and form judgements. achieve understanding, recognise the provisional and incomplete nature of most human knowledge, and communicate clearly."* This statement implies that teachers are required to teach processes through which knowledge develops. The learners are required to investigate and discover knowledge through observation, measuring, inferring, manipulating variables and so forth. These activities are the science process skills that both teachers and learners have to acquire and master in order to develop and expand their knowledge. It is important to note that most people follow these processes when solving problems and developing new knowledge.

Hence, it is envisaged that an introduction of science process skills to the teaching of

geography is likely to enable learners to learn geographical phenomena with insight and understanding. As a result of this, it might not be easy for geography learners to forget the information they have investigated, discovered and 'felt'. Geography education at secondary schools is regarded as a burden to the memory because learners are expected to memorise too many facts (cf. 2.2.2). The application of science process skills is likely to reduce problems such as these as science process skills may encourage learning by doing. Furthermore, science process skills enable learners to learn how to learn by thinking critically and using information creatively (Martin, Sexton, Wagner and Gerlovich 1994: 11).

It is important to note that there is a link between science process skills and South African outcomes-based education. This link is also shown by the fact that science process skills are called lifelong learning skills (Carin and Sund 1989: 67) and Curriculum 2005 and outcomes-based education are also based on the idea of lifelong learning for all South Africans (Department of Education 1997a: 1 and Department of Education 2001a: 17). Furthermore, Curriculum 2005 also claims to encourage and develop critical thinking, rational thought and deeper understanding (Department of Education 1997a: 2) which are the basic elements of outcomes-based education which activates the minds of the learners. However, it is also important to note that there is of course the argument that science process skills are not easily transferable between different subjects and programmes (cf. 2.6).

This paradigm shift to outcomes-based education has to be supplemented by innovative teaching and learning processes in order to assist learners to achieve anticipated outcomes as outcomes-based education provides opportunities for logical, rational and critical thinking to learners (Department of Education 1997a: 7). Therefore, it is suggested that innovative teaching and learning strategies should include process skills of science which demand from learners more than mere memorization. The Department of Education (1997: 9) also states

that:

> *...the main set of outcomes that every teacher needs to plan around are called the 'critical cross-field outcomes'. These are the outcomes that are essential to learning and include skills and values such as being able to think, to solve problems; to collect, organise and analyse information, to work in a group, as well as independently, to communicate effectively and to make responsible decisions. The curriculum is built on these critical outcomes.*

As a result of the above statement, the researcher is convinced that the application of science process skills to the teaching of all secondary school subjects in general may equip learners to achieve to such ends.

1.3 RESEARCH OUTLINE

The problem investigated in the study, the aims and objectives of the study and the questions investigated are outlined in this section. The section also lists the hypotheses and concludes with a brief discussion on the research methodology for the study.

1.3.1 The Problem Investigated in this Study

The present poor condition of geography teaching and learning in secondary schools led to this investigation. The researcher's experience and most studies show that the teaching of geography in the world in general is largely expository in nature (cf. 3.2). Perusals of various literature indicate that the teaching and learning of geography in countries such as the United Kingdom and Australia are also plagued by similar approaches which are seen as content-based and teacher-centred (Bailey 1987:13; Battersby 1997: 77; Fien 1983: 47; Lambert and

Balderstone 2000: 236 and Levy 1984: 211). In Japan, geography teachers are trained mainly to teach knowledge and understanding at the expense of geography skills (Nakayama 1995 - 1996: 26). There was also a call for Japanese teachers to learn and apply the activity-centred approach (geographical skills) to teaching. Trüper and Hustedde (1990: 109) also found that most American citizens demonstrated a weakness in geography skills and general knowledge.

In most schools serving the majority of the population in South Africa, there has been a sharp decline in the quality of educational performance in the 1980s and 1990s (Education and Training Act 1995: 21). Table 1.1 also confirms this gloomy state of affairs (cf. 1.4). In order to remedy the current situation of geography teaching and learning, the researcher calls for an inquiry-based, learner-centred approach which empowers learners to be "meaning-makers". This is likely to encourage learners to learn geographical knowledge with insight and understanding. Hence, learners are likely to be able to construct new geographical knowledge through the usage of science process skills.

At the moment, secondary schools in the Free State province use the 1996 Core Syllabus for Geography for Grades 10, 11 and 12 (Appendix 1). Its preamble and guidelines indicate that science process skills are supposed to be applied to geography teaching and learning (Guideline Document and Interim Syllabus for Geography 1996: 3). This is also supported by the critical and developmental outcomes of the new curriculum, that expects South African citizens to possess the elements of science process skills throughout their whole lives (Department of Education 1997a: 16 and Department of Education 2001a: 13). However, the review of literature on geography teaching in South Africa (cf. 1.4 and 2.2) and the researcher's observation of geography classroom practices (Rambuda 1994: 70) suggest that contrary to the requirements of the syllabus and Curriculum 2005, knowledge transmission by teachers still dominates the teaching-learning process in South Africa. As a result, few geography

learners have inquiring minds and critical ability (Davies 1987/1988: 118). The research problem therefore, is to investigate teachers' perception of their application of the science process skills to geography education as science process skills were likely to encourage the development of inquiring minds and critical ability in learners.

1.3.2 Questions Investigated

The research questions that emanate from the research problem are likely to be answered by the literature study and the empirical investigation. A literature survey attempted to answer the following questions:

1. What are science process skills?
2. Which science process skills are appropriate to the teaching of geography?
3. What are the science process skills' outcomes?
4. What is the association between the science process skills and the learning outcomes of the natural sciences?
5. How should the science process skills be taught as outcomes?

Empirical investigation attempted to answer the following questions:

6. Why do geography teachers find it difficult to develop inquiring teaching and inquiry learning?

7. How can the problems geography teachers encounter when developing inquiry teaching and inquiry learning be alleviated?

8. How can the problems geography learners face when they are engaged in inquiry learning be alleviated?

9. What are the problems geography learners contend with when science process skills are applied to the teaching of geography?

10. How can the problems geography learners experience when science process skills are applied to the teaching of geography be alleviated?

11. What are the problems geography teachers meet when applying science process skills to the teaching of geography?

12. How can the problems geography teachers experience when applying science process skills to the teaching of geography be lessened?

1.3.3 Aims and Objectives

The aim of this study was to examine teachers' perception of their application of science process skills to the teaching of geography in secondary schools in the Free State province. It is assumed that the application of science process skills might develop inquiring minds and critical analytical skills in learners. It is also assumed that this was likely, only if geography teachers developed an inquiry teaching approach and encouraged inquiry learning in their learners, which in turn could lead to the application of science process skills.

In order to accomplish this aim, the following objectives should be realized by the study. These objectives are to:

1. establish geography teachers' and learners' perception of teachers' use of inquiry teaching methods.

2. examine problems which geography teachers encountered when they developed inquiry teaching.

3. establish difficulties which geography learners experienced when they were engaged in inquiry learning.

4. suggest how the problems experienced by geography teachers when engaged in inquiry teaching, could be alleviated.

5. suggest how the problems which geography learners experienced when engaging in inquiry learning could be alleviated.

6. establish the science process to be applied during the teaching of geography.

7. examine problems which geography learners encountered when science process skills were applied to the teaching of geography.

8. suggest how the problems experienced by geography learners, when science process skills were applied to the teaching of geography could be alleviated.

9. examine what problems do geography teachers experience when they apply science process skills to the teaching of geography.

10. examine how the problems experienced by geography teachers, when applying science process skills to the teaching of geography, could be alleviated;

11. determine the relationship between the science process skills and the learning outcomes of the natural sciences.

These objectives were likely to be attained through two main sources, namely, a literature survey and an empirical investigation. In addition to these objectives, the researcher was also prompted to list some hypotheses.

1.3.4 Hypotheses

A hypothesis (cf. 2.5.2.7 and 4.5.2) is a prediction, a statement of what specific results or outcomes are expected to occur (Fraenkel and Wallen 1996: 18). A hypothesis can also be defined as a tentative prediction of the results of the research findings (Gay and Airasian 2000: 71). Hypotheses state the researcher's expectations with regard to the relationship between the variables of the research problem (Ary, Jacobs and Razavieh 1990: 94; Gay 1992: 66; Gay and Airasian 2000: 71 and Van Dalen 1979: 196-197). The researcher formulated the hypotheses stated below in anticipation of the outcomes of this study.

First, the following two research hypotheses were tested on the grounds of a literature survey.

Hypothesis 1. Science process skills are suitable and effective to the teaching of geography at secondary school level.

Hypothesis 2. The science process skills link specifically to the learning outcomes of the natural sciences and can be realized and achieved as observable

and demonstrable outcomes.

Second, empirical investigations tested the *null hypothesis* below.

Hypothesis 3. There is no relationship between the teaching approach used by the majority of geography teachers and science process skills.

1.4 SIGNIFICANCE OF THE STUDY

The questions and hypotheses outlined above are important because they could be linked to poor teaching of secondary school geography and a high failure rate in the subject in the Free State Province. For example, Table 1.1 which follows below, indicates Grade 12 learners' performance in geography in 1998 and 1999 (Appendix 2).

Table 1.1 Grade 12 Learners' Performance in 1998 and 1999 Examinations in the Free State province

YEAR	1998	1998	1999	1999
GRADE	Higher Grade	Standard Grade	Higher Grade	Standard Grade
% PASS	50.36	51.3	29.09	44.62
% FAIL	49.64	48.7	70.91	55.38

(Free State Department of Education)

Table 1.1 clearly indicates that the state of secondary geography education in the Free State province is a matter of growing concern. Learners' poor performance in geography needs to be improved to guarantee the future existence the subject in the new curriculum.

As it has been mentioned before, this study argues for the application of science process skills

to the teaching of geography. A question arises as to why science process skills should be applied to the teaching of geography? As already mentioned in section 1.3.1, some researchers on geography education in South Africa, such as Ballantyne (1986: 142); Davies (1987/1988: 118); Magi (1981: 150); Nicol (1979: 71) and Rambuda (1994: 71), claim that teacher transmission of geographical knowledge characterises the teaching of geography in South Africa. However, it is heartening to note that this poor state of affairs can be corrected. For instance, Radford (1988: 4) pleads for the teaching of science process skills in classes where lecturing is most dominant. It is claimed that this is indeed possible through a lecture-class discussion approach rather than a laboratory-centred approach. It appears as if the application of science process skills to the teaching of geography may suit the teaching styles of many teachers who "tell" the learning content (knowledge) all the time.

The adoption of science process skills is also appropriate to the material conditions which exist in most secondary schools in South Africa. The researcher's experience (Rambuda 1994: 6) is that most schools have inadequate learning materials and are impoverished and poorly resourced (Education and Training Act 1995: 18). Radford (1988: 4) claims that the lecture-class discussion approach *"...requires fewer material resources than a lab-activity based approach"*. This implies that the lecture-class approach describes most secondary schools which offer geography, because most schools in South Africa have a shortage of teaching resources (Education and Training Act 1995: 18, and Rambuda 1994: 28).

Furthermore, it is argued that the use of the science process skills approach requires less instructional time and can be added to any curriculum quite easily (Radford 1988: 4). Science process skills are valuable to teachers who normally waste a lot of time at the end of the lesson in an effort to recap the learning content taught (Radford 1988: 4). Instead, time wasted could rather be used to teach process skills. Geography teachers should rather utilise the time

wasted productively by teaching science process skills during the last few minutes before the end of each period.

It is envisaged that the outcomes of this study might influence geography teachers to integrate process skills' instruction in their practice. It is also envisaged that the application of science process skills to the teaching of geography could well contribute to the realization of the principles of outcomes-based education(cf. 3.6). This is indeed the case because Curriculum 2005 was structured around the realisation of critical and developmental outcomes (cf. 3.8) which are in turn linked to science process skills.

Science process skills are essential in the realisation of the critical and developmental outcomes outlined in South African OBE. Proponents of science process skills argue that science process skills are transferable and generalisable to other life situations (Funk, Fiel, Okey, Jaus and Sprague 1979: xii, and Kok and Woulnough 1994: 31), hence a knowledge of science process skills is essential to any person. However, some researchers oppose this view (cf. 2.6). The researcher, like proponents of science process skills, is convinced that the application of science process skills to the teaching of geography could contribute positively to the attainment of the skills needed for survival in life.

Furthermore, it was envisaged that the outcomes of this study might generate interest in teaching-learning activities that fostered the development of the outlined critical and developmental outcomes of South African OBE. These are teaching-learning activities that allow learners' involvement in the learning process. Participative methods such as discussion and problem-solving characterise such teaching and learning activities. Learners who are engaged in these activities are likely to acquire and master skills such as observing, communicating, classifying, measuring, inferring, predicting, hypothesising and controlling

variables. These skills are more or less similar to Spady's Fundamental Life Performance Roles, namely, *"listeners and communicators, teachers and mentors, supporters and contributors, team members and partners, leaders and organisers, learners and thinkers, implementers and performers, problem finders and solvers, planners and designers, and creators and designers"* (Spady 1994b: 70 - 71). These are the life roles which American citizens are expected to possess in life (Spady 1994b: 70). South African citizens, through OBE are expected to possess more or less the same type of skills.

However, it is important to note that most of the critical and developmental outcomes of outcomes-based education are not new to secondary school geography education. Some of the elements of the critical and developmental outcomes are found in the preamble and guidelines to teachers of the 1996 Guideline Document and Interim Syllabus for Geography Grades 10 to 12. The syllabus points out that geography teachers must develop the intellectual skills and abilities of learners to promote life-long education. Amongst others, the aims and objectives of the interim syllabus are the following:

> *In lesson presentation teachers should bear in mind the higher abilities of comprehension, analysis, synthesis, evaluation and application;*
>
> *This subject should be taught in such a way that pupils develop eagerness for further study and individual inquiry* (Guideline Document and Interim Syllabus for Geography Grades 10 to 12 1996: 2).

Proper scrutiny of these aims and objectives indicates that as is the case in Curriculum 2005 and science process skills, the geography syllabus is also based on the idea of lifelong learning. Furthermore, in its teaching guidelines the syllabus recommends the adoption of science process skills. It is stated that learners should be educated in the scientific method of

inquiry *(statement of hypothesis, collection and classification of information and the testing of hypotheses)* (Guideline Document and Interim Syllabus for Geography Grades 10 to 12 1996: 6). The recommended scientific method involves the process of inquiry. Millar (1989: 51) maintains that scientific inquiry ..."*involves the exercise of skill: in deciding what to observe, in selecting which observations to pay attention to. in interpreting and drawing inference, in drawing conclusions from experimental data, even in replicating experiments.*" This implies that a person cannot be engaged in scientific inquiry without applying one or more of the science process skills.

Therefore, it was also assumed that the outcomes of this study might encourage geography teachers to introduce scientific inquiry in their practice. Hence, the introduction of scientific methods of inquiry could enable geography teachers and learners to apply science process skills, which might empower their dealings with geographical knowledge in an organized manner.

Mastery of science process skills could also contribute to the development of a variety of functions, namely, oracy and literacy, numeracy, graphicacy, interpretation, problem solving and so forth. Oracy and literacy enhance peoples' communication skills. This implies that individuals may think logically, write concisely and speak with assurance and accuracy. Those who possess numeracy skills have the ability to quantify descriptions of objects and events. They also have the ability to draw graphs and tables of measured objects or events. Furthermore, people who possess graphicacy skills are able to draw, read and interpret graphs. Graphicacy skills empower them to understand trends and patterns of change of events or objects. Interpretation skills influence peoples' concept of space. Interpretation of pictures, photographs, statistics and maps is likely to enhance spatial conceptualization in people. According to the Department of Education (2001a: 13) education in South Africa should

produce a kind of a learner who is equipped in dealing with some of these tasks.

Mastery of science process skills could provide opportunities for learners to respond to problem solving and decision-making situations through critical, divergent and creative thinking. These processes could empower geography learners to act upon evidence and to make decisions based on scientific understanding of reality.

It can also be argued that science process skills are likely to influence cognitive learning. Cognitive learning enhances discovery of new knowledge, processes, facts, concepts and evaluation. According to Farrant (1988: 107) "*cognitive learning is achieved by mental processes such as reasoning, remembering and recall.*" These mental processes are essential for learners to use basic and integrated skills of science process, while constructing new knowledge.

The syllabus also suggests that learners should undertake short independent projects throughout the year on work related to the curriculum (Guideline Document and Interim Syllabus for Geography Grades 10 to 12 1996: 4). An implementation of this activity could provide learners with ample opportunities to apply science process skills while investigating geographical significant problems through inquiry.

Rambuda (1994: 18) also noted that the nature of geography education in South Africa has changed from descriptive geography to geography which studies the interrelationship between people and their environment. Learners are expected to understand the cause and effect of this relationship through inquiry learning (Winter 1992: 141). However, some studies on the state of secondary school geography education in South Africa, indicate that inquiry teaching is rarely applied (Ballantyne 1986:116; Boqwana 1991: 105; Magi 1981:150; Mphaphuli 1992:

120 - 121 and Rambuda 1994:83). Geography learners memorize the content without insight and understanding and are seemingly not critical thinkers (Magi 1981: 151). If this regrettable state of affairs is not corrected, changed or improved, it may not be possible to realize the principles of OBE.

Subsequently, it is assumed that the outcomes of this study might promote inquiry teaching and learning in most geography classrooms. Inquiry teaching and learning might encourage learners to shift from rote learning to meaningful learning, as inquiry teaching and learning encourage active learning and the development of critical thinking skills in learners. Hence, these might create opportunities for learners to raise their level of thinking and understanding of geographical facts and concepts. Inquiry learning, according to Winter (1992: 142), is "*a learning process involving the investigation of a question, a problem or an issue, in which the interrelationship between people and their environment is studied.*" This stance correlates with that of Lambert and Balderstone (2000: 73), who argue that inquiry learning refers to situations where learners are actively inquiring into issues, questions, or problems rather than passively receiving information from teachers and other sources.

However, it is important to note that the researcher at no stage was under illusion that this work alone would bring about miracles to the identified problems in geography education. Various experts in the field of educational practice would need to work together to find solutions to these problems. What is important is that the outcomes of this study and the solutions propagated by other experts should indeed be implemented to improve the teaching of all secondary school subjects in South Africa. This in turn might equip future learners with skills that could enable them to confront socio-economic problems of the 21st century with confidence. The outcomes of the study are likely to play a role in empowering geography learners to participate as active citizens of South Africa who can compete internationally.

1.5 RESEARCH METHODOLOGY

This study implemented the following two research methodologies, namely literature survey and empirical investigation.

1.5.1 Literature Survey

The researcher reviewed literature that was related to the research problem. Literature reviewed is discussed in detail in Chapters 2, 3 and 4. The main purpose of literature study was to test hypotheses 1 and 2 (cf.1.3.4). For instance, Chapter 2 attempted to justify that science process skills were suitable and effective for the teaching of geography at secondary schools. Chapter 3 indicated that science process skills were linked specifically to the learning outcomes of the natural sciences. Furthermore, in this chapter it is also argued that science process skills could be realized and achieved as observable and demonstrable outcomes, whilst Chapter 4 took cognisance of the application of science process skills to the teaching and learning of geography. Literature reviewed also assisted the researcher to select research strategies, procedures and instruments that rendered the opportunity to conduct the empirical investigation under discussion.

1.5.2 Empirical Investigation

Both quantitative and qualitative research methods were applied to this research (cf. 5.2). Scott (1996: 59) maintains that the two research methodologies do not belong to separate research paradigms and thus can sensibly be used within the same investigation. Questionnaires (cf. 5.2.1) and interviews (cf. 5.2.3) were used to gather data. These research instruments were employed so that the results from one form of data could help to inform and

refine the other data. Verma and Mallick (1999: 115) note that the process of using both research instruments ensures that the conclusions drawn are meaningful, precise and representative, hence the discussion in the next section.

1.5.2.1 Quantitative Empirical Study

In quantitative research, data was organised in non-experimental quantitative terms and expressed in numerical measures. Quantitative data analysis was applied in the closed items of the questionnaires because of its objectivity and context-free generalization. Responses on science process skills items were subjected to factorial analysis (cf. 6.2.3.1) which confirmed two groups of science process skills. In empirical research, interpretations and conclusions were drawn from evidence obtained from gathered data irrespective of the researcher's experiences and beliefs (McMillian and Schumacher 1993: 11; and McBurney 1994: 412).

Survey questionnaires were sent to randomly selected public and independent secondary schools in the twelve education districts in the Free State province (cf. 5.4.2). The questionnaires (Appendices 3 and 4) requested the participants to respond to questions relating to inquiry teaching and the application of science process skills to geography teaching. The evidence which was obtained from collected data was used to describe the application of science process skills to geography teaching, hence this is also a descriptive study.

A descriptive study simply describes an existing phenomena (McMillian and Schumacher 1993: 35; and Gay and Airasian 2000: 11). Furthermore, descriptive research is conducted to obtain information about the preferences, attitudes, practices, concerns, or interests of some people (Gay and Airasian 2000: 11). Mahlangu (1987: 14) maintains that descriptive research "*involves the description, recording, analysis and interpretation of the present nature,*

composition, or process of phenomena. It focuses on prevailing conditions, on how a person, a group or thing behaves or functions in the present." This study attempts to describe the application of science process skills to the teaching of geography in secondary schools.

Geography teachers and learners respectively rated their inquiry teaching and learning activities. Teachers rated their application of science process skills to the teaching of geography whilst learners indicated their responses to general statements about teacher applications, i.e. whether teachers apply science process skills. The SAS statistical program was used to compute and analyse the collected data (cf. 5.3). As it was already mentioned, quantitative research was complemented with qualitative research.

1.5.2.2 Qualitative Empirical Investigation

Qualitative research is used to obtain a more holistic picture of what goes on in a particular situation or setting (Fraenkel and Wallen 1993: 10). Qualitative methods are probably the best means for discovering educational problems and enable researchers to better understand the total environment in which education takes place (Borg and Gall 1989: 404). Hence in this study, qualitative research was used to attain objectives 2, 3, 4, 5, 8, 9,10 and 11 (cf. 1.3.2) and questions 7, 8, 9, 10, 11,12 and 13 (cf. 1.3.3). The researcher interviewed geography teachers and learners in order to find problems that they experienced when they taught and learned geography respectively (cf.5.2.2 and 6.4). Interviews also attempted to find solutions to the problems that were identified.

1.6 CONCEPTS AND DEFINITIONS

This section attempts to define concepts that were used in the study. Mhlongo (1996: 10) maintains that a given concept may have a different meaning to different people. Furthermore, the same concept may evoke more than one meaning to the same group of people depending on the time and the context in which it is used. Concepts that are defined in this section are: *Inquiry teaching, inquiry learning, science process skills, basic science process skills, integrated or advanced science process skills, outcomes and outcomes-based education.*

These concepts are defined more explicitly because it is assumed that they are associated. For example, inquiry teaching and inquiry learning are likely to lead to the application of science process skills. Furthermore, science process skills and the outcomes are closely associated (cf. 4.3.5) as indicated by the next paragraphs.

1.6.1 Inquiry Teaching

Inquiry teaching is a systematic way of teaching by giving learners inquiry tasks that develop learners' thinking skills to perform. Learners are taught how to confront questions and problems they could encounter in their environment. Children are able to discover something new as they are engaged in hands-on learning opportunities and appropriate materials to manipulate. Eggen and Kauchak (1988: 208) maintain that the General Inquiry Model of teaching strategy proceeds as follows:

- ☐ Question or problem identification
- ☐ Hypothesis generation
- ☐ Data gathering

- ☐ Assessment of hypotheses through data analysis
- ☐ Generalizing

These procedures involve the testing of ideas in the public arena (Fraenkel and Wallen 1993: 6). The teacher may guide learners to solve problems by making use of these five phases. The teacher becomes a facilitator in the teaching-learning process.

Hassard (1992: 21) also maintains that this method of instruction includes guided and unguided inductive inquiry, deductive inquiry and problem-solving. In inquiry teaching, learners are encouraged to learn how to investigate and solve problems (cf. 2.3). This process is called the scientific method. It appears as if inquiry teaching could lead to the application of science process skills to geography which are realizable as outcomes (cf. 2.4). It is likely that inquiry teaching might promote inquiry learning.

1.6.2 Inquiry Learning

According to Eggen and Kauchak (1988: 208) inquiry learning is ... "*viewed as a process for answering questions and solving problems based on facts and observations.*" This statement implies that inquiry learning is a systematic way of learning by investigating a problem or a question. Hence learners' critical thinking skills are developed through the application of science process skills.

Martin et al. (1994: 11) state that in inquiry learning, learners search for truth or knowledge that requires them to think critically. This implies that learners who are engaged in inquiry learning are likely to observe, to ask questions and to state conclusions.

Furthermore, Hassard (1992: 21) claims that learners who are engaged in inquiry learning learn about concepts and phenomena by using observations, measurements and data to develop conclusions. All these are elements of science process skills.

1.6.3 Science Process Skills

Science process skills are all activities which scientists execute when they study or investigate a problem, an issue or a question. These skills are used to generate content and to form concepts (Funk et al. 1979: ix).

Furthermore, Martin et al. (1994: 11) regard process skills as the way of thinking, measuring, solving problems, and using thoughts. This implies that thinking and reasoning are involved in inquiring teaching and learning. Hence teachers and learners could apply science process skills while developing inquiry teaching and inquiry learning.

Science process skills are classified into basic science process skills and integrated science process skills. Integrated science process skills are more advanced than basic process skills. Brotherton and Preece (1995: 5) argue that scientists are only able to effectively use integrated skills once they have first mastered basic skills.

1.6.4 Basic Science Process Skills

These are skills which are appropriate to elementary grades. They are the foundation of science which learners are required to possess before they could acquire and master integrated science process skills which are more advanced (Brotherton and Preece 1995:5). Funk et al. (1979: 1) maintain that basic science process skills are interdependent. This implies

that an investigator may display more than one of these skills in any single activity.

For instance, to *measure* a distance between two points on a map, the investigator may start by *observing* the two points, then *measure* the distance and *communicate* the same distance by means of a symbol. Thereafter, the investigator may *predict* how long it may take a person to travel from one point to another. (S)he may then *infer* the best form of transport to use to travel between the two points. In this scenario, the investigator was involved in the skills of observing, classifying, predicting, measuring (metric), inferring and communicating (cf. 2.5.1).

It appears as if basic skills provide the intellectual ground work in problem solving. Children who can perform these skills are likely to show understanding of basic science processes (Martin et al. 1994: 11) and perform integrated science process skills.

1.6.5 Integrated Science Process Skills

These are immediate skills which are used in problem solving. Integrated skills include skills such as identifying variables, constructing tables of data and graphs, describing relationships between variables, acquiring and processing data, analysing investigations, constructing hypotheses, operationally defining variables, designing investigations and experimenting (cf. 2.5.2) (Funk et al. 1979: 83). As the term *integrated* implies, learners are called to combine basic process skills for greater power so as to form the tools they execute when they study or investigate phenomena. This process could lead to the realization and achievement of integrated science process skills as observable and demonstrable outcomes (cf. 4.5).

1.6.6 Outcomes

Various researchers (King and Evans 1991: 73; Spady 1994a: 18 and Spady and Schlebusch 1999: 44) define outcomes as what learners are able to do at the end of the teaching-learning process. Furthermore, King and Evans (1991: 73) regard outcomes as the end -products of the instructional process which may be observable or lead to internal changes in the learner. This implies that at the end of the learning process. learners should be able to demonstrate an ability to do something. This also implies that learners are likely to be seen thinking and behaving in a specific manner. Reflection on learners' actions and behaviour might indicate whether teaching and learning were successful or not.

This idea is also supported by Spady (1994a: 18) who maintains that outcomes are high-quality, culminating demonstrations of significant learning in context. Demonstration is the key word - an outcome is not a score or a grade, but the end product of a clearly defined process that learners carry out. Outcomes are the results of learning processes and refer to knowledge, skills, attitudes and values within particular contexts. Learners should be able to demonstrate that they understand and can apply the desired outcomes within a certain context (Department of Education 1997a: 32 and Department of Education 1997b: 4). This discussion implies that outcomes are statements of the significant things that learners should be able to demonstrate as a result of a period of instruction and learning.

Curriculum 2005 and Department of Education have identified three sets of outcomes, namely, critical and developmental outcomes (cf. 3.8), specific learning outcomes (cf. 3.9) and lesson's outcomes. Critical, developmental and specific outcomes were pre-specified by the Department of Education. The terms used to describe these outcomes are constantly changing as are the actual specific outcomes themselves.

Curriculum 2005 has seven critical outcomes and five developmental outcomes. Critical and developmental outcomes are generic, cross-curricular, cross-cultural outcomes that focus on the capacity to apply knowledge, skills and attitudes in an integrated way (Curriculum 2005 1997: 32; Department of Education 1997a: 3 and Pretorius 1998: 3).

Amongst others, examples of critical outcomes are problem solving, critical and creative thinking, efficient information processing and effective communication. Developmental outcomes include issues such as developing business opportunities, exploring education and career opportunities, and reflecting on and exploring a variety of strategies to learn more effectively. These are the qualities that the South African education and training system should attempt to inculcate in every citizen (Department of Education 2001b: 9).

Specific learning outcomes are knowledge, information, skills, attitudes and values that learners should know and be able to do in a learning area (Department of Education 2001a: 21). They do not prescribe content but focus on knowledge, skills and values that should be promoted in learning area.

Lesson's outcomes are demonstrated knowledge, skills and attitudes in a particular context or learning field (Department of Education 1997a: 32; Department of Education 1997b: 4; Pretorius 1998: 3 and Van der Horst and McDonald 1997: 48). They describe what learners should know and be able to do at the end of a learning process. Therefore, an education which focuses on the demonstrations of outcomes (knowledge, skills and attitudes), is known as an outcomes-based education.

1.6.7 Outcomes-based Education

Outcomes-based education (OBE) is an education system in which the curriculum, instruction and assessment are organised around and focused on outcomes (cf. 3.6). It is a learner-centred, results-oriented design, which relies on the assumption that all learners can learn (Department of Education 2001b: 17; Naicker 1999: 87; Department of Education 1997a: 17 and Spady 1994b: 9). What a learner is to learn is clearly identified. These are outcomes which are focused on life skills and context. In OBE, learning is supposed to be active and experienced-based for maximum application of knowledge, skills and values which are essential for life. Hence programmes of learning are designed to help learners to achieve the desired outcomes. The learners are expected to be able to contextually display learned knowledge, skills and values. Hence this process is likely to enhance the application of science process skills to most learning fields.

1.7 DEMARCATION OF THE STUDY

The study was undertaken in the field of school subject didactics and was confined to the application of science process skills to the teaching of geography in secondary schools in the Free State province. Hence the subjects of the study were secondary school geography teachers and learners.

1.8 CHAPTER OUTLINE

The chapter outline of this study can be represented diagrammatically as follows:

Figure 1.1 Programme of the Study

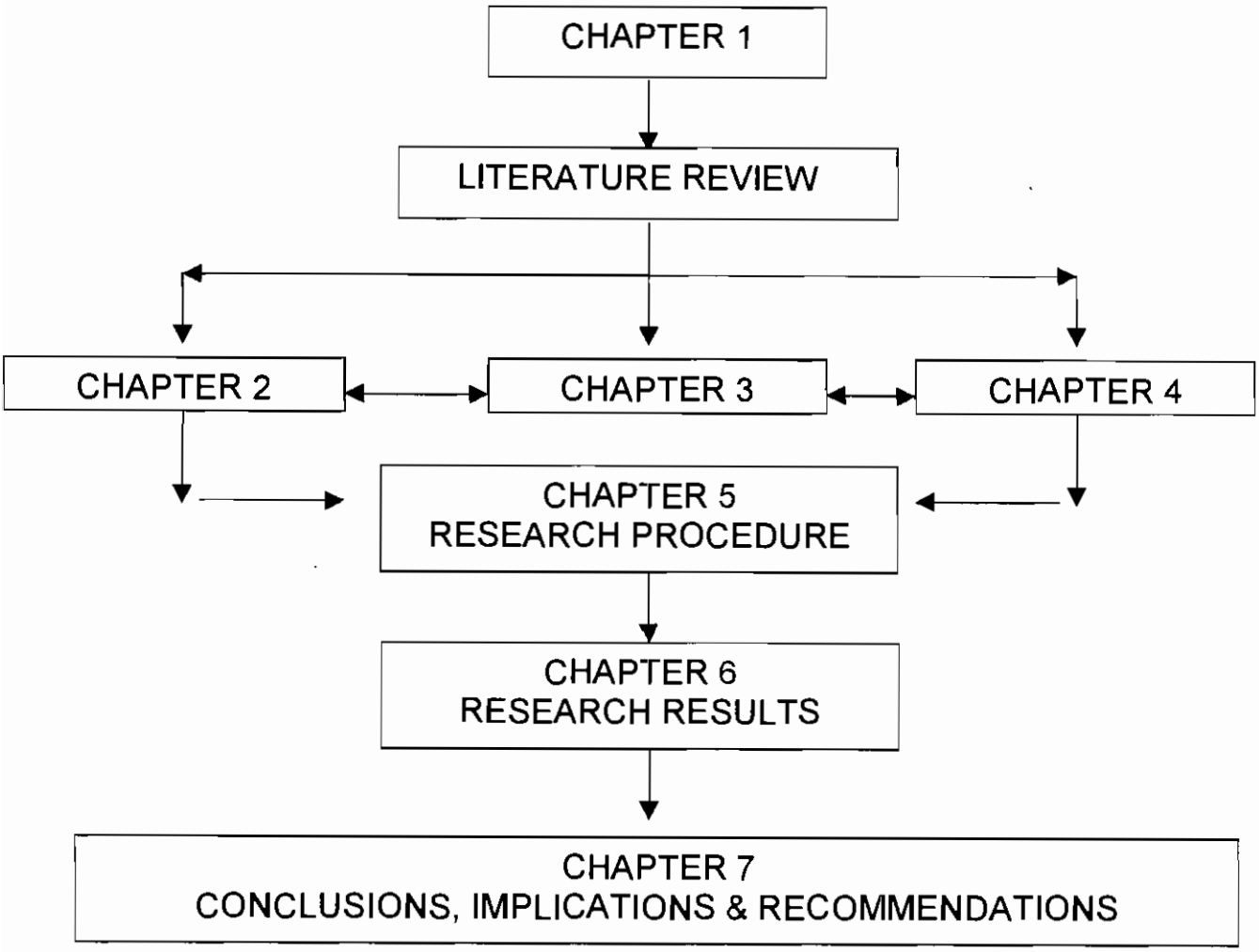

Figure 1.1 indicates that Chapter 1 gives an orientation of the problem investigated. The chapter also highlights the significance of the study.

Chapters 2, 3 and 4 review literature related to the problem investigated. Chapter 2 examines teaching approaches in geography education as recommended by the syllabus and Curriculum 2005. It also explains inquiry as an approach of teaching geography. Furthermore, the chapter reviews the nature and structure of the science process skills and concludes by explaining the

applicability of science process skills to secondary school geography.

Chapter 3 discusses the nature and structure of geography. It also highlights the implications of the nature and structure of geography on the application of outcomes-based geography teaching.

Chapter 4 deals exclusively with the application of science process skills to the teaching of geography.

Chapter 5 reviews the data processing procedures and also describes the statistical techniques applied.

Chapter 6 presents the collected data on the application of science process skills to the teaching of geography.

Chapter 7 provides conclusions and implications of the study. It also highlights some recommendations and identifies possible topics for future research.

1.9 CONCLUSION

This chapter has provided an overview of the study. It also offered a review of the theoretical rationale, hypotheses tested were provided, and a summary of the research's methodological procedure employed was highlighted.

The following chapter reviews literature relevant to geography teaching approaches and science process skills.