

**THE INTEGRATION OF NATURAL RESOURCE MANAGEMENT INTO
THE CURRICULUM OF RURAL UNDER-RESOURCED SCHOOLS:
A BERNSTEINIAN ANALYSIS**

A thesis submitted in fulfillment of the requirements of the degree of

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ABSTRACT

This study was motivated by the need to improve curriculum relevance in poor rural schools through contextualised teaching and learning based on the management of local natural resources. It involved four schools which are located in the Ngqunshwa Local Municipality of the Eastern Cape Province of South Africa. The study's aim was to provide insight into and better understanding of the curriculum implementation process regarding natural resource management (NRM) education in a poor rural education context. This was done by analysing the extent of NRM integration in pedagogic texts, activities and practices in the different fields which constitute the structure of the pedagogic system in this education sector.

The study adopted an interpretivist approach to the analysis, which was based on indicators of the extent of NRM integration, and was informed by Bernstein's concepts of *classification* and *curriculum recontextualisation*, and his model of the structure of the pedagogic system. The items which were analysed included national and provincial Grade 10 Life Sciences curriculum documents, Grade 10 Life Sciences textbooks, in-service training workshops for Life Sciences teachers, and various school documents, activities and practices. The analysis also involved interviews with educators, and classroom observations of Grade 10 Life Sciences lessons.

The results revealed a very high overall level of NRM integration in the Grade 10 Life Sciences curriculum documents produced at national and provincial levels. The overall level of NRM integration was also found to be very high in the Grade 10 Life Science textbooks that were analysed, but very low in the in-service teacher training workshops, and in the schools' documents, activities and practices, especially in the Grade 10 Life Sciences lessons, and in schools' end-of-year Grade 10 Life Sciences examination papers.

The study makes a number of recommendations towards effective integration of NRM into the curriculum of Eastern Cape's rural poor schools which include more specific and explicit reference to NRM in the official Grade 10 Life Sciences curriculum documents, the provision of environmental education courses to district education staff and Grade 10 Life Sciences teachers, the training of teachers in the classroom use of textbooks and other educational materials, and regular monitoring of teachers' work.

The study also exposes important knowledge gaps which need urgent research attention in order to enhance NRM education in the poor rural schools of the Eastern Cape. These include

analysing power and control relationships between the various agencies and agents that are involved with curriculum implementation in this education sector, and conducting investigation into the creation of specialist NRM knowledge and into the quality of NRM knowledge that is transmitted as pedagogic discourse in schools.

This study contributes to the fields of rural education and environmental education in South Africa, and to the growing interest in the study of curriculum from a sociology of education perspective in the context of the country's post-apartheid curriculum reforms.

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LIST OF ACRONYMS AND ABBREVIATIONS

ANC	African National Congress
C2005	Curriculum 2005
C.A.P.E	Cape Action for People and the Environment
COSATU	Congress of South African Trade Unions
CSIR	Council for Scientific and Industrial Research
DET	Department of Education and Training
DoE	Department of Education
EC	Eastern Cape
EECI	Environmental Education Curriculum Initiative
ERP	Education for Rural People
et al.	and others
FAO	Food and Agricultural Organisation
FET	Further Education and Training
GET	General Education and Training
GNP	Gross National Product
HIV/AIDS	Human Immuno-Deficiency Virus/ Acquired Immune Deficiency Syndrome
IEEP	International Environmental Education Programme
INRULED	International Research and Training Centre for Rural Education
IUCN	International Union for Conservation of Nature
NQF	National Qualifications Framework
NRM	Natural Resource Management
NCS	National Curriculum Statement
NEAC	National Environment Awareness Campaign

NEEP-GET	National Environmental Education Project for General Education and Training
NEPAD	New Partnership for Africa's Development
NEPI	National Education Policy Investigation
NGO	Non-Governmental Organisation
NMF	Nelson Mandela Foundation
NNP	Net National Product
NQF	National Qualifications Framework
OBE	Outcomes-based Education
ORF	Official Recontextualising Field
PRF	Pedagogic Recontextualising Field
RSA	Republic of South Africa
SADTU	South African Democratic Teachers' Union
SGB	School Governing Body
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States
WCED	World Commission on Environment and Development
WWF	World Wide Fund for Nature

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CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

This study investigated curriculum implementation in a rural under-resourced education context¹. Specifically, the study looked at how the policy of curriculum integration within the subject of Life Sciences was being enacted in this education context. The study not only attempted to provide insight into curriculum integration practices at grass roots level, but also to contribute to the growing field of sociology curriculum in South Africa.

This chapter serves as an introduction to the study and to the thesis. It starts with a discussion of what motivated the study. This is followed by an overview of the main concepts and theories which shaped the study. The chapter also introduces the goals and research questions which guided the study, and ends with an outline of the thesis structure.

1.2 MOTIVATION FOR THE STUDY

My interest in conducting this research project stems from my experiences as a high school Biology teacher at an isolated rural under-resourced school in one of South Africa's poorest provinces, the Eastern Cape (see Section 6.2). The state of affairs in the majority of this type of schools is well documented, and includes poor physical facilities, inadequate teaching resources, high learner to teacher ratios, a poor learning and teaching culture, low attainment levels, and lack of parental involvement (Nelson Mandela Foundation [NMF], 2005). However, teaching in a deprived rural community was not all doom and gloom. I enjoyed nurturing talented rural learners (most of whom eventually left for 'greener' pastures in urban areas), and participated in the local community's festivities.

Working in such isolated and deprived conditions, with very little support from the provincial and district education offices, I was tested on several fronts on my ethics as a professionally trained teacher. Two major issues stand out in my experience as a teacher of Biology at a rural isolated under-resourced school. The first issue concerns the relevance of what I was teaching to my learners' needs and those of the local community. These were residents of a

¹ For this study, this context is characterised by isolation from major urban centres, serving mostly poverty-stricken communities, and disadvantaged by poor school infrastructure, a general lack of educational resources, and under qualified teachers.

rural community that was heavily dependent on a natural resource base which was rapidly being degraded through unsustainable practices (see Section 6.4). I found that most of my teaching time was spent explaining biological concepts that were very abstract and alien to my learners, and whose usefulness to the majority of learners as future users and managers of local natural resources was questionable. For example, I had to teach the bio-chemical pathways of photosynthesis and respiration; detailed microscopic descriptions of various organisms and their structures; and the reproductive biology and neurological functioning of obscure organisms. Below are some examples of the examination questions that I had to set for my learners in order to comply with the curriculum and examination requirements of my subject.

- Draw a labeled diagram of the body wall of Hydra,
- Describe the circulatory system of the earthworm,
- Draw a schematic diagram to illustrate the major bio-chemical pathways of the three stages of aerobic respiration, and
- Describe the process of locomotion in Amoeba.

Increasingly, I began to ask myself if there was a way by which the specific educational needs of rural learners could be addressed in the formal education system without jeopardising their chances of urban-based alternative livelihoods should they so desire, and without losing access to valuable ‘basic’ knowledge as represented in the questions above. This was the beginning of my journey into the realm of rural education, which is one of the major concerns of this research (see Section 1.3.2 and Chapter 2).

The second major issue that I had to confront was the powerful position I found myself in, as an implementer of curriculum policy at grass roots level. In the case of the Grade 12 learners, there were centrally set high stake end-of-year national examinations that I had to contend with, which forced me to strictly comply with the official curriculum requirements for my subject (hence the highly academic questions listed above). However, for the rest of the grades, where there were no external examinations involved, I soon found out that I did not have to strictly adhere to official curriculum policy when it came to selecting the scope and breadth of what to teach. In other words, I was in a very influential position when it came to curriculum interpretation in these grades. Again this had me asking myself questions, such as: To what extent do the implemented and planned curricula differ in rural under-resourced schools? What is the most cost-effective way to enable effective curriculum implementation and meaning-making by teachers and learners in rural unde-resourced schools? Which agents

and agencies are best suited to offer curriculum support for such schools? These questions stimulated my interest in the second major thrust of the research project: that of the trajectory of the curriculum interpretation and implementation process in isolated rural under-resourced schools.

1.3 CONCEPTUAL AND THEORETICAL MAPPING OF THE STUDY

1.3.1 Introduction

Five major concepts shaped this study, and these are illustrated in Figure 1.1 below. Rural Education formed the major thrust of the study. Within the dimension of education quality in rural education, the study focused on the area of curriculum (see Chapter 4). Environmental learning is one strategy by which curriculum relevance in rural schools can be enhanced (see Section 1.3.3). Natural resource education (see Chapter 3) is one form of environmental learning which is especially important for rural schools because of its focus on the management of local natural resources. South Africa has adopted an integrated approach to environmental learning, and natural resource management is supposed to be integrated into all subjects and across all the grades (curriculum integration) (see Chapter 5). This study investigated the implementation of natural resource management as an integrated part of the Grade 10 Life Sciences curriculum in a rural isolated under-resourced educational context (curriculum implementation) (see Chapter 9, 10 and 11).

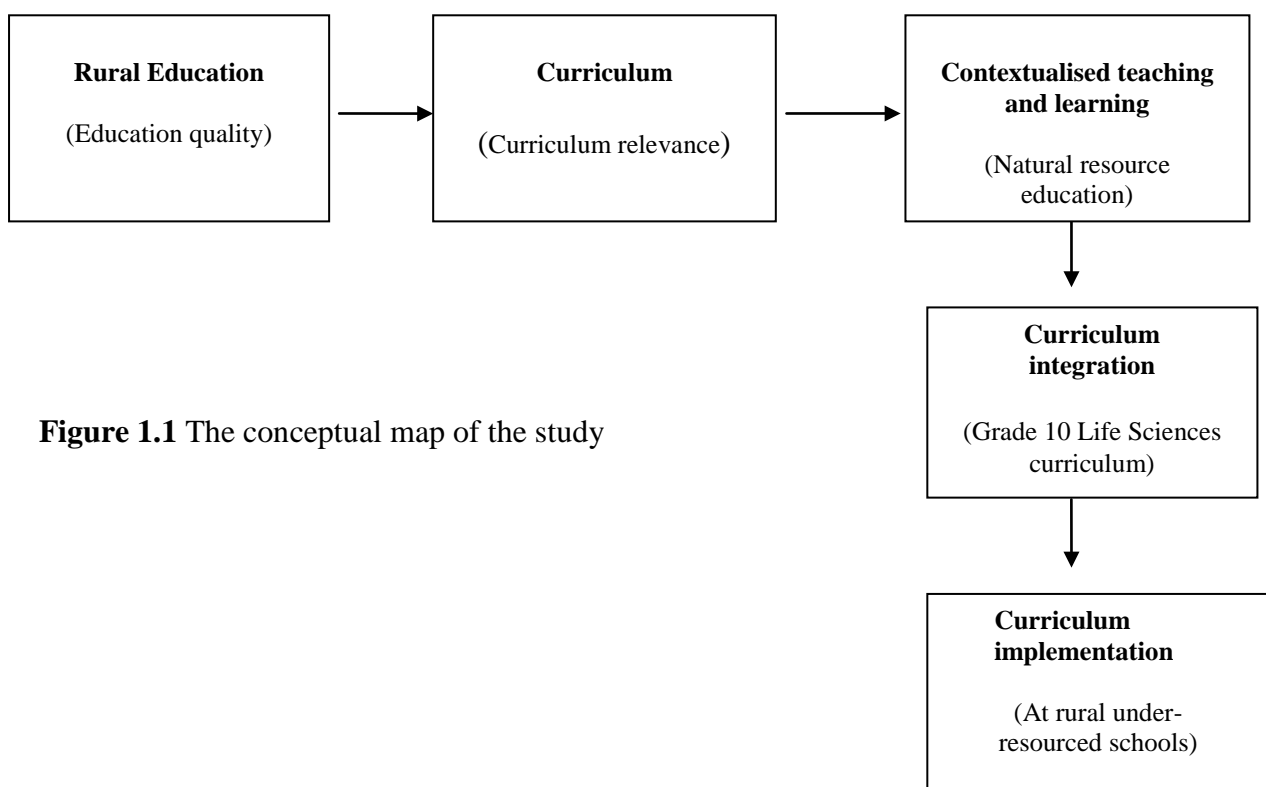


Figure 1.1 The conceptual map of the study

A mapping of the main theoretical fields which underpinned the study is illustrated in Figure 1.2 below. Theoretically, the study is located in the ‘new’ sociology of education field, which is one of the approaches to the sociology of education (see Chapter 7). One of the main focus areas in the ‘new’ sociology of education is sociology of curriculum (see Section 7.5), which may be studied from a phenomenological or a structural perspective. The study is underpinned by the ideas of Basil Bernstein (see Section 7.7), who adopts a mainly structural approach to the study of the sociology of curriculum. Out of Bernstein’s vast theoretical corpus, this study made use of his construct of *classification*; his model of the structure of the pedagogic discourse; and his theory of knowledge recontextualisation.

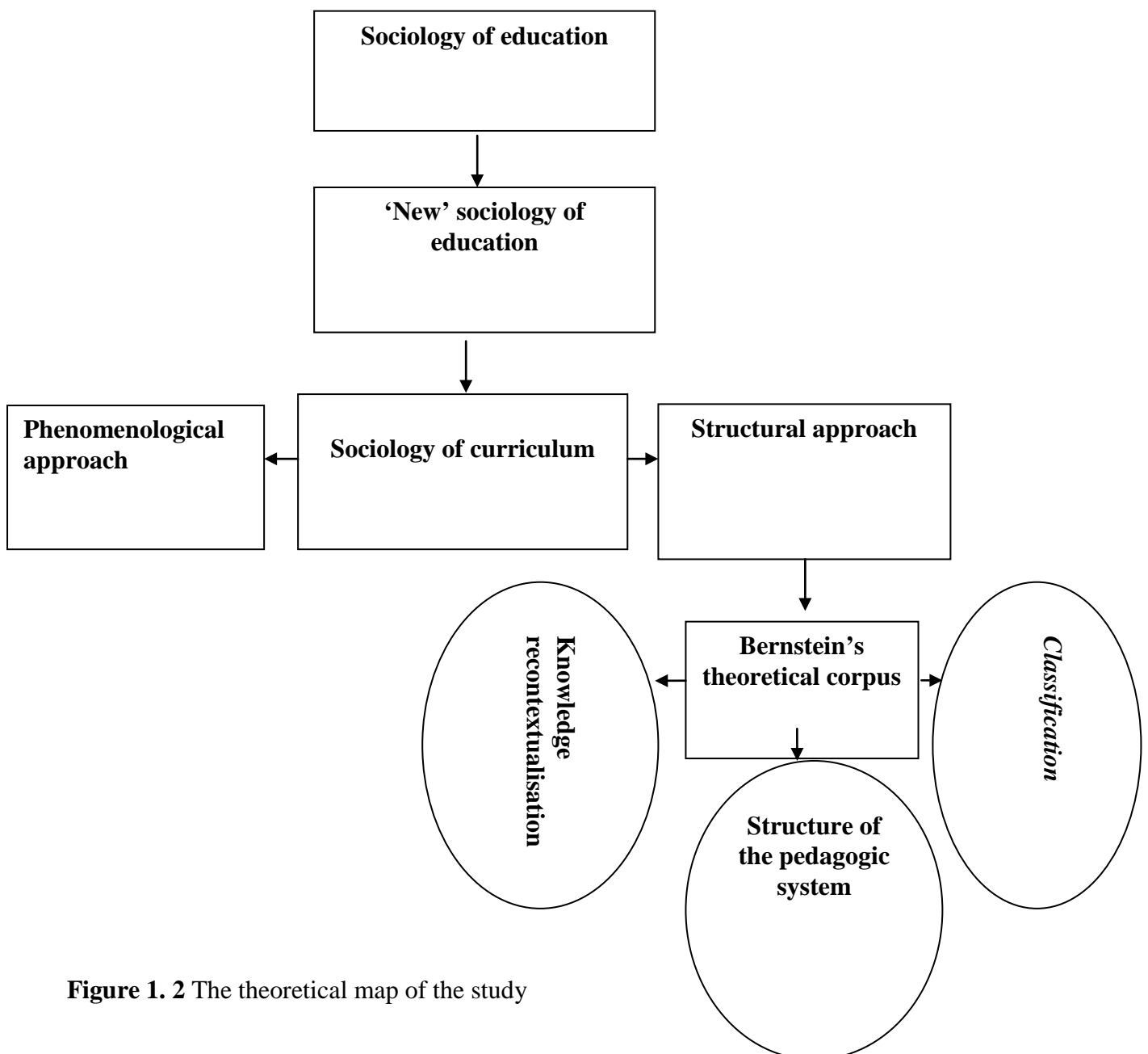


Figure 1. 2 The theoretical map of the study

1.3.2 The challenge of rural education

The concept of 'rural education' conjures up conflicting images among researchers and education policy makers. Alternative terms have been suggested as a replacement for this concept, for example 'education for rural people' and 'education in rural areas.' In the South African context, rural education relates to those schools which were previously known as farm schools and community schools (see Section 2.3). In 2005, these schools catered for more than half of South Africa's learner population of 11.4 million (NMF, 2005). South Africa's racist political and educational policies placed these schools at a vast disadvantage in terms of physical infrastructure, educational resources availability, teacher quality and quantity, and learner attainment, as compared to their urban counterparts. At the end of apartheid in 1994 there was a concerted effort by the new government to remove the inequalities and the injustice of the past from the country's education system, and to form a system that is underpinned by principles of democracy, equity, redress, transparency and participation (Republic of South Africa [RSA], 1996c). Considerable educational gains have been made since then, among them the desegregation of once racially divided schools, the formation of one national system of education and training, more equitable budgetary allocation and the decentralisation of school governance, full enrolment at the primary level of schooling, while that at the secondary level (over 70%) is among the highest in Africa (Jansen & Taylor, 2003, p.12).

Despite these educational gains, inequalities still persist in South Africa's education system, and nowhere else is this more apparent than in the country's rural education sector (NMF, 2005; South Africa. Department of Education [DoE], 2005). A recent comprehensive overview of rural schooling in South Africa's poorest provinces is provided in *Emerging Voices* (NMF, 2005). This report contains ample evidence that despite the advent of democracy, government policies remain insensitive to the specific conditions and needs of South Africa's rural poor, and that education in rural South Africa remains very much on the margins as it was during the apartheid era. Post-apartheid educational reforms have tended to paint black educational problems with one brush, ignoring the unique circumstances of rural schools, especially community schools, within the black education landscape. As a result, these educational reforms generally have not produced the desired effects in rural schools, which continue to be as marginalised as they were during the apartheid era (Human Rights Watch, 2004). The lack of a rural-based political voice during the apartheid era ensured that

urban education issues received prominence over rural ones (Hartshorne, 1992). Bringing rural schools to the fore of South Africa's education reform debate, and improving their capability to provide quality education to rural communities remains one of the major challenges facing the post-apartheid government (NMF, 2005; South Africa. DoE, 2005).

1.3.3 Enhancing environmental learning in the school curriculum

An issue which emerges again and again in the discourse on education in rural areas is one which relates to the quality of the education experience (NMF, 2005). The position taken by the Ministerial Committee Report on Rural Education in South Africa (South Africa. DoE, 2005) is that quality in education has quantifiable and qualitative dimensions. The quantifiable dimension of education quality relates to school funding, infrastructure and resource provision, in addition to the conventional measures of quality, such as academic performance, enrolment and repetition/drop-out rates. Qualitative aspects of quality in education on the other hand, are intimately associated with curriculum, pedagogy, competence of educators and the needs of the learners and the community (South Africa. DoE, 2005). In the Ministerial Committee Report on Rural Education (South Africa. DoE, 2005) and in Muskin (1999) it is argued that it is the latter category of factors that contributes most strongly to the quality of education. Unfortunately, in South Africa the discourse of rural education has been dominated by issues around facilities (South Africa. DoE, 2005). For example, in the Ministerial Committee Report on Rural Education it was reported that most of the submissions that were made on rural education focused on issues of resources, rights and equity (South Africa. DoE, 2005). Such an approach, the report notes, not only overshadows the curriculum, but is also responsible for depicting life in rural South Africa with a 'deficit model,' which contributes to a sense of helplessness among rural people. One of the recommendations this report makes is the need to focus on the resources, knowledge and skills of rural communities as a basis for formulating strategies towards improving the quality of education in rural areas of the country.

The ongoing degradation of the natural resource base in the Eastern Cape (and elsewhere in southern Africa) poses a threat to the survival of the rural poor, most of whom depend on these resources for their livelihood (Shackleton & Shackleton, 2004) (see Section 6.4). Documented forms of natural resource degradation in the Eastern Cape Province include loss of arable land, soil erosion, deforestation, poor water quality, spread of unpalatable species and over harvesting of wild species (Council for Scientific & Industrial Research [CSIR],

2004). The management of natural resources located in South Africa's densely populated communal land has received little support from the government (Shackleton & Shackleton, 2004). To offset further degradation of these natural resources, it is important that the values, attitudes, knowledge and skills that are essential for their sustainable use and effective management be made a key focus area in the curricula of local schools. This view was supported in the Ministerial Committee Report on Rural Education (South Africa. DoE, 2005), in which the potential that this curriculum approach has for enhancing rural natural assets was highlighted. Similar sentiments are expressed in Lotz-Sisitka, Timmermans and Ward (2005), when they write that a curriculum that focuses on local environmental concerns in rural areas has the potential of not only improving the quality of education, but also of contributing to environmental sustainability in these areas. According to these authors the importance of natural resources to rural communities should be reflected in the curricula of the local schools, just like for other contexts where local assets form a core area in the local school curricula. Responding to the specific curriculum needs of South Africa's poor rural communities remains one of the major challenges facing post-apartheid South Africa (NMF, 2005; South Africa. DoE, 2005).

The relevance of education is a recurring theme in the rural education debate (see Section 2.6). In *Emerging Voices* (NMF, 2005) rural parents voiced concern over the failure of the current school curriculum to impart to their children skills that are important to their rural livelihoods, especially those skills that relate to subsistence agriculture. The parents expressed a desire for a wider and varied education for their children. Writing in their article on education quality in South Africa, Coetzee and Le Roux (2001) acknowledge the fluid nature of quality in education, but nevertheless point out that education relevance is a key ingredient of education quality. They define quality education as:

... relevant education that endeavours to address the unique and changing needs, demands, possibilities and problems within the total context of a country while offering equal opportunity for ... self-empowerment of its citizens to enable them to live a meaningful life within society at large (Coetzee & Le Roux, 2001, p. 210).

Vandebosch (2007) notes that for many rural schools in the developing world, curriculum content, teaching approaches and teaching and learning materials are not suited to the local context. Vandebosch (2007, p.1) points out that improving the relevance of education in rural schools has often meant the introduction of some 'localised' topics, for example agriculture

and other forms of vocational education. UNESCO and the World Bank have been major advocates for such an approach to rural education since the 1960s, despite a long list of past failures in such education initiatives. For example, in South Africa early attempts by missionaries to ‘ruralise’ the curriculum by the introduction of practical agriculture were seen by blacks as an attempt to limit their future options and were subsequently rejected (NMF, 2005).

The relevance of education can also be enhanced through contextualised teaching and learning. Taylor and Mulhall (1997) state that this process occurs where the content of the curriculum, and the methods and materials associated with it are related directly to the experience and environment of the learner. Taylor and Mulhall (1997) point out that contextualisation of teaching and learning not only makes the schooling experience more meaningful to the learners, but also helps to forge stronger links between the school and its community. In most developing countries the majority of rural learners have direct experiences of natural resources as a result of their activities, or observations of their immediate surroundings (Vandebosch, 1997). Natural resources offer excellent opportunities for contextualising teaching and learning because ‘the concepts (related to natural resources, their uses and management) can be experienced at school, at home, and in the wider community’ (Vandebosch, 1997, p. 5). Vandebosch (1997) further notes that the scientific, political, social, economic and cultural aspects of natural resource management promote an integrated approach to the school curriculum. Importantly, contextualised teaching and learning retain the core knowledge, attitudes and skills that are contained in the official curriculum policy, and therefore does not disadvantage rural learners in terms of their future career prospects outside rural areas (Vandebosch, 1997).

1.3.4 The challenge of implementing curriculum reforms

South Africa’s adoption of outcomes-based education (OBE), under which learning and teaching are driven by learning outcomes rather than subject content (see Section 3.7.5), has proved to be a major challenge. This approach has been critiqued by Jansen (1998, 2001) as being based on political rather than pedagogical motives. There are those who question whether such an approach can be implemented at all in South Africa’s rural schools given the adverse conditions under which the majority of them operate (NMF, 2005). The Report of the Review Committee on South Africa’s first major post-apartheid curriculum framework, Curriculum 2005 (C2005) (see Section 6.6), noted that among the major obstacles to its

successful implementation in schools were: flaws in its basic structure and design; the poor quality and quantity of teacher training provided; the poor quality of learning support materials and their unavailability; and the incapacity of provinces to offer implementation support (South Africa. DoE, 2000). A revised version of C2005, called the National Curriculum Statement (see Section 6.6) was incrementally introduced into schools, starting with Grade 1 in 1998 in the General Education and Training band (GET; Grades R-9). Zafar (n.d.) warns that if the pitfalls that befell C2005 are to be avoided, the political will behind the National Curriculum Statement needs to be accompanied by systems readiness in the schooling system. In their review of research on C2005, Harley and Wedekind (2004) reported that so far empirical research on classroom practices is very limited, and is mostly survey or interview-based rather than observational. Conducting observation-based research on classroom practices in Eastern Cape's isolated rural and under-resourced schools, as in this study, is one strategy towards enhancing system readiness in this educational context for the implementation of the National Curriculum Statement framework.

1.4 ON CURRICULUM INTEGRATION

Curriculum integration is one of the major underlying principles of curriculum that curriculum theorists and practitioners have to contend with (see Chapter 5). In South Africa, interest in curriculum integration began in earnest during the 1980s, out of concern in the People's Education movement over the division between theoretical and practical knowledge, and mental and manual work (see Section 5.8). In post-apartheid South Africa, interest in curriculum integration is driven by a constructivist and learner-centred approach to teaching and a quest to bridge the gap between school knowledge and everyday knowledge (Taylor, 2000). Post-apartheid's major curriculum initiatives, C2005, and its streamlined version, the National Curriculum Statement are both based on the principle of knowledge integration (see Section 6.6). Referring to the approach of knowledge integration in C2005, South Africa's National Department of Education had this to say:

It involves the most radical form of an integrated curriculum ... Not only are we integrating across disciplines into Learning Areas, but we are integrating across all 8 Learning Areas in all educational activities ... The outcome of this form of integration will be a profound transferability of knowledge in real life (South Africa. DoE, 1997, p. 29).

The numerous interpretations and approaches to curriculum integration that exist in literature (see Chapter 5), pose a challenge to teachers as to how best to interpret and implement this

concept at classroom level. The National Department of Education in South Africa refers to curriculum integration as ‘... a view of learning which rejects a rigid division between ‘academic’ and ‘applied,’ ‘theory’ and ‘practice,’ ‘knowledge’ and ‘skills,’ ‘head’ and ‘hand’ (South Africa. DoE, 1995b).

The (Revised) National Curriculum Statement Grades R-9 (Schools) supports knowledge integration because:

The principle of integrated learning is integral to outcomes-based education. Integration ensures that learners experience the Learning Areas as linked and related. It supports and expands their opportunities to attain skills, acquire knowledge, and develop attitudes and values encompassed across the curriculum (South Africa. DoE, 2002, p.13).

In C2005 curriculum integration was enhanced by the framework’s design features such as the 12 Critical and Developmental Outcomes, the 66 Specific Outcomes, Assessment Criteria, and Phase and Programme Organisers, most of which were later dropped following criticism that C2005 was over designed (South Africa. DoE, 2000). Teachers working with the National Curriculum Statement in the FET band (Grades 10 to 12) are expected to use the streamlined curriculum design features, namely the 12 Critical and Development Outcomes, the subject specific Learning Outcomes and their associated Assessment Standards (see Section 6.7) to enhance knowledge integration across and within the 8 Learning Areas that are recognized within this curriculum framework, and between school and everyday knowledge. The importance of an integrated approach to Life Sciences is underlined in the national curriculum policy document for the subject, called the *National Curriculum Statement (NCS) Grades 10-12 (General)* (South Africa. DoE, 2003). In this document, it is stated that:

The integration of knowledge and skills across subjects and terrains of practice is crucial for achieving applied competences. ... In adopting integration and applied competence, the National Curriculum Statement Grades 10-12 (General) seeks to promote an integrated learning, of theory, practice and reflection (South Africa. DoE, 2003, p. 3).

There is more support for curriculum integration in the document *National Curriculum Statement (NCS) Grades 10-12 (General) Life Sciences Learning Programme Guidelines* (South Africa. DoE, 2007a, p. 8), which states that:

Integration within a subject involves the grouping of Assessment Standards that link naturally. This grouping is a mechanism that enriches learning, teaching, and assessment. Life Sciences allows for an integrated approach to learning, teaching and assessment in that the issues dealt with in the subject are integrated across the three Learning Outcomes of the subject ... It is important that the integrated nature of Life Sciences is reflected in the development of learning programmes for Life Sciences. This will ensure that the three Learning Outcomes are learnt, taught and assessed in an integrated and holistic manner.

Examples of benefits that accrue from an integrated approach to curriculum knowledge include overcoming limitations to learning and teaching that are caused by the traditional separate subject approach, such as atomising knowledge, the absence of local relevance in school knowledge (Venville, Wallace, Rennie, & Malone, 2001), improved engagement and higher achievement levels among learners, and the rejuvenation of teaching styles (Applebee, Adler & Flihan, 2007, p. 1002). However, there is increased concern that such claims are based more on rhetoric than classroom-based research, and that in general, the field of curriculum integration suffers from lack of empirical data on which to base informed decisions regarding curriculum integration practices at grass roots level (see Section 5. 10). Unlike in the United States (US), and in Australia, South Africa is yet to conduct large scale surveys which specifically look at curriculum integration in schools. The lack of information on curriculum integration practices of South Africa's teachers is attributed to the poor research record into classroom practices in South Africa's schools, especially those which are isolated, rural and under-resourced (Taylor, 2000). Much of what is known about curriculum integration practices in South Africa's rural schools has come by way of incidental reporting, for example in the President's Education Initiative Research Report (Taylor & Vinjevold, 1999), in the Review Committee Report on C2005 (South Africa. DoE, 2000), and in the Learning for Sustainability project report (Janse van Rensburg & Lotz-Sisitka, 2000). Taylor (2000, p.8) notes that the lack of information on classroom practices 'severely constrains the design of curricula appropriate to local conditions...and renders impossible any effort ... to track any improvement or deterioration over time.'

Bernstein (1990, 1996) analyses curriculum integration from a novel perspective, namely, that of sociology of education (see Section 5.9 and 7.7). His analysis of curriculum organisation and structure is distinguished by a focus on how external power and control relations manifest in the organisation of subjects within a curriculum, and in the relations that

exist between subjects in a given curriculum. Bernstein provides reasons why research in curriculum integration from a sociological perspective is necessary. They relate to the need to establish what determines the status of a subject within a curriculum, analysing changes to subject status following curriculum reform, and the educational and sociological implications of such changes. His construct of *classification* is especially helpful as a conceptual tool with which to research curriculum integration, while his scale of *classification* is useful as an analytical tool and theoretical language with which to examine and express the extent of curriculum integration, respectively (see Section 7.7.4).

Analysing curriculum documents such as subject syllabi, teaching guidelines, and learners' work, as well as that of teachers' classroom practices, represent two vantage points from which curriculum integration can be investigated from a sociological perspective. Such research is still in its infancy in South Africa, although pioneering work has been done by researchers such as Hoadley (2005, 2008), Ensor (2004) and Bertram (2005, 2008). This type of research is necessary to lay a strong theoretical base from which to design curriculum integration policies and implementation strategies that address the South African educational context, especially as they relate to the specific needs of rural under-resourced schools in the Eastern Cape (see Chapter 6).

1.5 RESEARCHING CURRICULUM IMPLEMENTATION

Most of the literature on curriculum is on planning and development, with only scant attention being devoted to implementation (Virgilio & Virgilio, 2001). This has contributed to the problems that schools face in implementing new curriculum, the so-called gap between intended and actual practice. With no theory and information base to act as guidance, the usual practice, especially in developing countries, is to devote most of the attention to the planning and designing of curriculum texts, while paying little attention to strategies of how the curriculum innovations will be carried out at school and classroom level (Rogan & Grayson, 2003). As noted by Porter (1980) and quoted in Rogan and Grayson (2003, p. 1171), 'the people concerned with creating policy and enacting the relevant legislation seldom look down the track to the implementation stage.' Very often these curriculum plans are well thought out, visionary and are based on sound educational principles (Cross, Mungadi & Rouhani, 2002). However, the lack of specifications of how they should be enacted in the field has meant that the curriculum reforms have for the most part remained on

paper. The overall result has been vast wastage of time and resources, which most developing countries can ill afford (Rogan & Grayson, 2003).

South Africa's post-apartheid curriculum reforms conform to the above description. There has been a strong focus on formulation of new policies without any attention being paid to the specification of implementation plans, or where they exist, they are a last minute after thought, rather than a plan of carefully crafted strategies (Jansen, 2001). Writers who have written about the lack of implementation plans to accompany South Africa's curriculum reform policies include Welton (2001), Sayed and Jansen (2001) and Cross, Mungadi and Rouhani (2002), among many others. The South African experience has highlighted the need to conceptualise policy as what happens and not as merely text (Cross, Mungadi & Rouhani, 2002). How to translate the noble intentions of curriculum reforms from paper into visible classroom practices that exploit the full potential of all her citizens remains a challenge in post-apartheid South Africa. Dyer (1999) points out that without attention being paid to implementation, curriculum innovations run into unexpected outcomes, while at the same time lessons from past innovations are lost and are not used to inform new policies. The practice also leads to the unfortunate separation of curriculum implementation from policy formulation, and the belief that those who formulate curriculum policy are not responsible for its implementation. Yet, 'the success of any education policy lies in its implementation' (Niewenhuis, 1997, as quoted in Dyer, 1999, p. 46).

A comprehensive overview of the field of curriculum implementation research is provided in Snyder, Bolin and Zumwalt (1992). What is lacking in this overview is sociology of education perspective. For this it is helpful to turn to Bernstein's theory of recontextualisation (1990, 1996) (see 7.7.3). Bernstein used a sociological lens to analyse the process by which specialised academic knowledge is created and transformed into pedagogic discourse. He proposed a three-tier model for the structure of the relay system which makes this transformation possible. According to Bernstein (1996), this relay system consists of three hierarchically related fields: the production field; the recontextualising field; and the reproduction field (see Section 7.7.2). The production field represents the intellectual field of the pedagogic discourse, where specialist academic knowledge is produced through research at universities and private research institutions. According to Bernstein (1996), the specialist knowledge that is created in the production field needs to be converted into a form that is accessible to the general public, especially teachers. Bernstein called this process of

knowledge transformation ‘recontextualisation’ and the pedagogic field in which it takes place, the ‘recontextualising field.’ Recontextualisation also takes place when teachers interpret the recontextualised texts (and the teacher training programmes that they undergo) to produce their own classroom practices. At school level (what Bernstein calls the reproduction field), recontextualisation is influenced by the context, the teacher’s own pedagogic ideology, and the nature of the school-community relationship. Bernstein sees the recontextualising process as very dynamic, and subject to contestations and resistance from various recontextualising agents and agencies for gain of control over the content of pedagogic discourse, and the means by which this content is delivered (see Chapter 7 for more details on the theoretical framework of the study).

Bernstein’s sociological perspectives on education have found fertile ground in South Africa, in the context of ongoing curriculum reforms. His work has been hailed as breaking new ground in the analysis of the link between macro-level education changes and their impacts at classroom level. Bernstein’s ideas on knowledge recontextualisation have major implications for curriculum delivery in the rural isolated and under-resourced schools of the Eastern Cape. For example we may ask:

- Who are the major agencies and agents involved in the curriculum recontextualisation, and what are their underlying pedagogic ideologies?
- How can the effect of adverse contextual factors on curriculum delivery at these schools be reduced?
- How relevant is the official pedagogic discourse to these schools?
- What power relations exist between the various recontextualising agencies and agents, and how do they impact on the final pedagogic product that is delivered at these schools?

There are three recent South African studies that have worked with Bernstein’s theory of recontextualisation, though in vastly different contexts. Wilmot (2006) used this theory to explain the social process that took place involving a group of teachers who were part of a teacher professional development intervention in two highly resourced private schools. Wilmot explained that the intervention gave the teachers epistemological access to recontextualising rules, which empowered them to interpret the official Grade 9 Human and

Social Sciences assessment policy on their own terms. Ramsarup (2006) used the same theory to research changes to the environmental discourse of the National Curriculum Statement for Grades (R-9) made by agents operating in three case sites run by different organisations. She found that factors such as the history, context, ideology of the three sites, and agents' experiences with the environmental discourse, influenced how they interpreted this curriculum policy. Bertram (2008) used the recontextualisation theory to track the trajectory of the FET history curriculum through the schooling system. She found that as the history curriculum message was relayed across the three pedagogic fields, there was a shift away from content knowledge to procedural knowledge (assessment strategies).

A sociological perspective on curriculum implementation at isolated rural under-resourced schools (as in this research) has the potential to enhance understanding of how this process takes place in this educational context. It can help to illuminate the social division of labour, and the power and control relations that are involved, the practices and activities that take place, and the texts that are produced. It provides information on the effect of the curriculum interpretation process on the actual teaching and learning which take place under these conditions. This broadens the landscape of effective curriculum support interventions on offer to these schools beyond the provision of financial and physical resources. The insight so gained can go a long way towards improving the design and delivery of curriculum programmes for schools in this educational context.

1.6 RESEARCH GOALS AND RESEARCH QUESTIONS

As explained in Section 1.5, according to Bernstein's model of pedagogic discourse recontextualisation of knowledge takes place in the official recontextualising field (ORF); the pedagogic recontextualising field (PRF); and the reproduction field. The primary goal of this study was to generate better understanding of the extent to which each of the three above named fields of pedagogic discourse in a rural disadvantaged education context integrate natural resource management. The study's second goal was to track the trajectory of the curriculum recontextualising process in a rural disadvantaged education setting through the 'lens' of the extent of NRM integration.

My main research objectives were to analyse the extent of NRM integration in the:

- Grade 10 Life Sciences pedagogic texts that are produced by the official recontextualising field (ORF),

- Grade 10 Life Sciences pedagogic texts and in-service teacher professional development programmes that are produced/conducted in the pedagogic recontextualising field (PRF), and
- Out of class school activities, practices and documents, and in the classroom practices in the reproduction field.

I set six research questions to help me achieve the above research objectives. They were:

- To what extent do the Grade 10 Life Sciences pedagogic texts that are produced by the National Department of Education integrate NRM?
- To what extent do the Grade 10 Life Sciences pedagogic texts that are produced by Eastern Cape's provincial Department of Education integrate NRM?
- To what extent do the Grade 10 Life Sciences pedagogic texts and the in-service teacher professional development programmes that are produced/conducted by the King William's Town District Education Office integrate NRM?
- To what extent do the Grade 10 Life Sciences textbooks that are used by teachers and learners at rural disadvantaged schools in the Eastern Cape integrate NRM?
- To what extent do rural disadvantaged schools in the Eastern Cape integrate NRM into their out of class school activities, practices and documents?
- To what extent do teachers at rural disadvantaged schools in the Eastern Cape integrate NRM into their Grade 10 Life Sciences classroom practices and texts?

1.7 STRUCTURE OF THE THESIS

Chapter 1: Introduction

This chapter serves as an introduction to the study and to the thesis. It provides a broad rationale for conducting the study, and introduces the conceptual and theoretical frameworks that framed the study. The chapter also introduces the research goals of the study, and the study's major research questions. The chapter ends with an outline of the thesis structure.

Chapter 2: Whither Rural Education?

This study is located within the realm of rural education, which forms the main thrust of this chapter. This chapter provides an overview of the main issues that are driving the rural education agenda. It discusses South Africa's past and present struggles with rural education, and the resurgence of interest in rural education worldwide.

Chapter 3: Natural Resource Education

Natural resource education forms a key component of the study's conceptual framework. This chapter describes the field of natural resource education as a form of environmental education. It explains why protection of the natural environment is core to environmental protection, and human well-being, despite the broadening of the term environment to include social, economic and cultural aspects. The chapter discusses the link between natural resource protection, sustainability and human well-being. It reviews the various approaches to environmental education, and their implication for natural resource education practices. Lastly, the chapter reviews the implications that education for sustainability has for natural resource management education.

Chapter 4: Curriculum

This chapter serves as an orientation to the curriculum debate. It aims to provide a contextual background to curriculum approaches and their interpretations in the South African context. The chapter examines various curriculum perspectives and definitions, and how they influence views about teaching and learning. It also describes main features of recognized curriculum approaches, and ends with a discussion of South Africa's post-apartheid struggles with curriculum reforms.

Chapter 5: Curriculum Integration

This chapter maps out the structure of the curriculum field. It discusses the origin of curriculum theory and its role in curriculum reforms. It analyses the concept of curriculum integration, and its evolution in South Africa's education system. The chapter also examines various curriculum integration practices, and the major research trends in this field. The chapter ends with a discussion on curriculum integration from a sociology of education perspective.

Chapter 6: Research Context

This study involved four rural disadvantaged schools that are located in Ngqushwa Local Municipality in the Eastern Cape Province of South Africa. This chapter provides a contextual profile of the study site. It starts with general information about the Eastern Cape Province and Ngqushwa Local Municipality to provide a socio-economic and cultural background to the study. Details on the four case study schools are provided. This is followed by descriptions of the organisation of the national and provincial education systems of which

the four case study schools are part. The chapter discusses the management of natural resources in rural areas of the Eastern Cape, and the causes and consequences of their degradation. It also provides an overview of post-apartheid curricular reforms, especially as they relate to environmental learning in schools and the subject of Life Sciences.

Chapter 7: Theoretical Framework

This study draws on theories from the sociology of curriculum, which is a sub-section of the sociology of education field. This chapter describes the theoretical framework that shaped the study, namely Basil Bernstein's model of the structure of pedagogic discourse, his theory of recontextualisation, and his construct of *Classification*.

Chapter 8: Research Methodology

In this chapter the ontological and epistemological perspectives that informed the study are discussed together with the resultant implications for the study's research design and methodology. The chapter outlines the methods and the analytical tools that were used to obtain information about the extent of NRM integration in the field. The chapter also reviews how issues of quality and ethics were dealt with in the study.

Chapter 9: The Analysis of the Extent of NRM Integration in the Official Recontextualising Field (ORF) texts

One of the aims of the study was to analyse the extent of NRM integration in various Grade 10 Life Sciences official curriculum documents. This chapter describes the four national and the three provincial texts that represented the ORF texts in the study. It also describes the analytical tools that were used to obtain data on the extent of NRM integration in the ORF texts. The chapter also provides the result of the analysis.

Chapter 10: The Analysis of the Extent of NRM Integration in the Pedagogic Recontextualising field (PRF)

Another aim of the study was to analyse the extent of NRM integration in the PRF. This chapter analyses the extent of NRM integration in two Grade 10 Life Sciences textbooks which represented PRF texts in the study, and in the in-service teacher training programmes that were run for Grade 10 Life Sciences teachers. The chapter also describes the analytical tools that were used in the analysis, and the results of the analysis.

Chapter 11: The Analysis of the Extent of NRM Integration in the Reproduction Field

This chapter reviews the analysis of the extent of NRM integration in the reproduction field. It describes the various school documents, school activities and practices that were analysed, the analytical tools that were used, and the results that were obtained.

Chapter 12: Discussion of Results

This chapter describes and discusses the major findings of the study regarding the overall extent of NRM integration in the different fields of pedagogic discourse. The chapter also compares the extent of NRM integration across the different fields and discusses the resultant implications for the curriculum recontextualisation process in a rural disadvantaged education context.

Chapter 13: Synthesis and Conclusions

This chapter provides a synopsis of the study by outlining the study's key elements. It synthesises the major findings from the previous chapters regarding the extent of NRM integration and the curriculum recontextualisation process. The chapter discusses the study's major contributions, and reflects on the research process. It also outlines possible research gaps opened up by the study, and makes recommendations towards strengthening the integration of NRM into the Grade 10 Life Sciences curriculum, and towards more effective and participatory curriculum recontextualising in rural disadvantaged education contexts.

1.8 CONCLUSIONS

This chapter provided an introduction to the study, and to the thesis. It explained the motivation for conducting the study, which is based mainly out of concern over the relevance of education in rural under-resourced schools in the Eastern Cape. The chapter located the study both conceptually and theoretically. Conceptually and contextually, the study straddles the fields of rural education, natural resource education, and those of curriculum integration and implementation. Theoretically the study is underpinned by Bernstein's ideas about the sociology of curriculum. The chapter introduced the main goal of the study, which is to generate better understanding of the extent of NRM integration in rural under-resourced educational contexts in the Eastern Cape. This was followed by the six research questions which guided the study. Lastly, the chapter described the structure of the thesis, and the main contents of each chapter.

The next chapter provides a detailed account of rural education, one of the five major concepts which framed the study.

CHAPTER 2

WHITHER RURAL EDUCATION?

2.1 INTRODUCTION

In the previous chapter rural education was introduced as one of the major concepts that framed the study. This chapter provides a more detailed discussion of rural education with the aim of bringing some clarity to this complex and often controversial education issue. The chapter also provides a brief historical review of the development of black education in South Africa as a backdrop to understanding rural education as experienced in South Africa. It also reviews the major issues in rural education discourse, and highlights recent South African and international policy initiatives in rural education.

2.2 DEFINING RURAL

‘Rural’ is a term which is yet to be clearly conceptualized and defined. For Ashley and Maxwell (2001), the term suffers from ambiguity, which is a result of being based on an arbitrary and varied divide between urban and rural. Seroto (2004, p. 21) supports this view, noting that the term is often loosely used in literature, and is usually implied rather than explicitly stated. The situation is further compounded by the fact that rurality is experienced differently in different countries, and in different contexts within the same country (Atchoarena, 2006). Atchoarena (2006) doubts that a single universal definition for this term is capable of capturing both its regional diversity and the unique characteristics of individual rural areas: hence the numerous definitions of rurality that abound in literature. One unfortunate result of this is the difficulty which arises when comparing results from research on rural issues across different countries and contexts (Atchoarena, 2006). The lack of a standardised and explicit definition of ‘rural’ poses a challenge to research in rural education (Seroto, 2004).

The simplest definitions of ‘rural’ are those that take a one-dimensional approach to the concept. For example ‘rural’ as used in McKenna (1994, p. 13) simply refers to ‘belonging to the countryside.’ In apartheid South Africa, rural areas were simply those areas which happened to fall outside declared municipality borders (Statistics South Africa, 2003). Cities and townships were regarded as ‘urban’ and everything else as ‘rural.’ Seroto (2004) regards such definitions as simplistic and restrictive, and advocates a multi-criterial approach to the

concept. Ashley and Maxwell (2001) suggest that these criteria be related to the distribution of people in space (ecological), to the availability of employment opportunities (economic), and to the residents' beliefs, attitudes, and norms (socio-cultural).

Two criteria advocated by the Food and Agricultural Organisation (FAO) are that the definition of rural should relate to the land settlement pattern, and to the type of work the majority of residents engage in to sustain their lives. For example, areas which are dominated by farms, forests, water, mountains and desert, and whose human population is less than 10 000 are termed 'rural' by Avila, Gasperini and Atchoarena (2005, p. 3). Such definitions do not hold true for the South African context, where past political ideologies have created a unique milieu of rural experiences. For example, Hartshorne (1992) regards poverty and its associated derivatives such as unemployment, malnutrition and disease as being central to rurality in South Africa. Wiggins and Proctor (2001) also associate poverty with 'rural.' However, even in the poverty-stricken former black homelands there are pockets of wealth just as there is poverty amidst South Africa's peri-urban squatter camps (NMF, 2005).

The definition of 'rural' adopted by the Ministerial Committee Report on Rural Education (South Africa. DoE, 2005) is that which was put forward in the 2001 Census Report (Statistics South Africa, 2003). Here, 'rural' refers to those areas in the former homelands that fall under traditional authority, and those on which commercial white farms are located. The underlying argument is that in South Africa, the availability of resources in these areas differs markedly from those in urban and peri-urban areas. However, the Ministerial Committee Report on Rural Education report recommends more refinement of this definition by the inclusion of more criteria which have a bearing on the provision of quality education, such as infrastructure, accessibility to services, distances to towns and social conditions in the community.

This view of 'rurality' seems to support that of Smith, as quoted in Hartshorne (1992, p. 123). Smith's views on 'rural' are still as applicable today, fifteen years into democracy, as they were in the apartheid era. According to him, 'rural' in South Africa is characterised by isolated learning communities, separation from mainstream educational thought and progress, low levels of internal/external efficiency and of professional expertise in the community, low rates of input, powerlessness among local leadership, high levels of wastage, and geographical isolation and inaccessibility.

2.3 RURAL SCHOOLS IN SOUTH AFRICA

Schools described as ‘rural’ within the South African context fall within two main categories (Graaff & Gordon, 1992). The first category consists of those schools termed ‘farm schools’, because they are located on white owned commercial farms, or on land owned by churches, hospitals and mining companies. The second group of ‘rural’ schools consists of ‘community’ schools that are scattered across the villages of the former Bantustan homelands. Between them, these rural schools accounted for 65% of South Africa’s public schools in 1994, and catered for the educational needs of 6.8 million learners (Gordon, 1999).

South Africa’s past political ideologies and legislation created a unique set of problems around the country’s rural schools, many of which were detrimental to the quality of schooling that these schools attempted to provide, as mentioned in Chapter 1. The lack of a rural-based political voice during the apartheid era ensured that urban education issues received prominence over rural ones (Hartshorne, 1992). Post-apartheid educational reforms have tended to paint black educational problems with one brush, ignoring the unique circumstances of rural schools, especially community schools, within the black education landscape. As a result, these educational reforms generally have not produced the desired effects in rural schools, which continue to be as marginalized as they were during the apartheid era (Human Rights Watch, 2004). Bringing rural schools to the fore of South Africa’s education reform debate, and improving their capability to provide quality education to rural communities remains one of the major challenges facing the post-apartheid government. This issue featured strongly in the African National Congress election manifesto of 2009.

2.4 FARM SCHOOLS

Farm schools represent the earliest initiatives in the provision of formal education to African rural dwellers in South Africa. The first farm schools were established by missionaries on white owned land under special agreement between the missionary societies and the land owners (Hartshorne, 1992). By 1949 the number of farm schools in the country had reached 1 119, of which 937 were church owned (Graaff & Gordon, 1992, p. 215). Prior to 1948, farm schools had no legal status, and apart from the office of the Missionary Superintendent of Schools, the state had no direct say in their affairs. The existence of farm schools was formalized after the 1949-1951 Eiselen Commission into African education, and the subsequent promulgation of the Bantu Education Act of 1953 (Hartshorne, 1992). Thereafter

missionaries lost control of farm schools which were now placed under the jurisdiction of the land owner, usually a farmer. Wilson (2002) sees this development as benefiting both state and the land owner (but not the rural learners). He explains that the state could now ensure that its policy of providing limited basic education to Africans reached the remotest part of the country, while the land owners were provided with a stable and steady supply of cheap labour.

From the beginning, financial support to farm schools by the state was kept at the minimum and was mainly in the form of teachers' salaries and a building subsidy paid to farmers (Graaff & Gordon, 1992). Power was skewed in favour of the land owner on whose land the school was located. For example, the land owner had powers to appoint and dismiss teachers, open and close the school, in addition to determining the grades offered at the school and the school's admission policy. Farmers had little incentives to improve the schools on their land, resulting in a deplorable state of affairs on farm schools, such as poor physical structures, lack of water, electricity, telephones and sanitation, and inadequate teaching resources (NMF, 2005). This contributed to undesirable teaching and learning conditions at farm schools such as under qualified teachers, low enrollment ratios, overcrowding, high repetition and dropout rates and multi-grade teaching. Although the De Lange Committee which was commissioned in 1980 to look at black education focused only on black urban areas, its report in 1981 called for improvement of conditions on farm schools. Farm schools received more state attention following the 1986 Department of Education and Training² report on education for African learners in rural areas of the country (Seroto, 2004). Following this report, farmers still retained control over farm schools, but the state now provided more funding for building and maintenance costs, teachers' housing and training, and for the establishment of senior secondary grades. In addition the state illegalized the employment of African farm children who were aged less than 15 years (Seroto, 2004).

A major problematic farm school issue which persists today is what Wilson (2002) calls the 'hybrid status' of farm schools. This arises from the fact that farm schools are public schools but are located on private land. The Ministerial Committee on Rural Education Report (South Africa. DoE, 2005) explains that this unique status of farm schools embroils them into the labour and production dynamics and intricacies that exist on the farms, to the detriment of

² During apartheid, education for blacks outside the homelands fell under the Department of Education and Training.

what should be their primary purpose: that of providing quality education to farm children. After apartheid, the new government hoped to use the South African Schools Act No. 84 of 1996 (RSA, 1996) to secure tenure for these schools and to extricate them from the control and influence of land owners. According to Section 14 of this Act, provincial educational departments are supposed to enter into contractual agreement with farmers, or to expropriate the affected land if no agreement is reached. This agreement involves issues such as access to the school, school governance and management, as well as maintenance and closure. However, according to the Ministerial Committee on Rural Education Report (South Africa. DoE, 2005), apart from the Western Cape, the bulk of the agreements are yet to be concluded. For example, by 2005, only in 146 of the 400 farm schools in the Eastern Cape had such agreements been successfully completed, and no land had been expropriated due to failure to reach agreement (South Africa. DoE, 2005). The report identifies the failure to solve the legal status of farm schools as the main cause of the provincial governments' and school governing bodies' (SGBs) reluctance to invest in the physical development of farm schools. Meanwhile some farmers, fearful of land expropriation, have resorted to farm evictions, although the Extension of Security of Tenure Act 62 of 1997 has offered farm labourers some protection against this (South Africa. DoE, 2005).

With the failure of South Africa's post-apartheid school funding policy (the National Norms and Standards for School Funding) (South Africa. DoE, 1998a), to specifically address the plight of farm schools, poverty and inequality still affect farm schools. According to Human Rights Watch (2004), post-apartheid educational reforms have barely improved conditions for the majority of South Africa's farm schools. At the same time there has been a steady decline in the number of farm schools and subsequent decrease in learner numbers, though how much this is a result of school closures, farm evictions, migration and amalgamations is not yet clear (Human Rights Watch, 2004). On the whole, farm schools continue to function on the margin of South Africa's education system. Wilson (2002) describes them as the 'Cinderella' section of South Africa's education system, while the Human Rights Watch (2004) refers to them as sites of gross human rights violation, and places where children are denied their right to basic education.

It is heartening to note that in the Ministerial Committee on Rural Education Report (South Africa. DoE, 2005), which is the latest review on South Africa's rural schooling, the unique position and problems of farm schools seem to be officially recognized at last. A whole

section is devoted to recommendations which address educational problems that are specific to farm schools. The report calls for their immediate legalization, as an initial step towards severing them from the labour and political dynamics on farms, even if this means the expropriation of private land. Other recommendations made by the report include amalgamation of farm schools provided hostel and transport alternatives are made available. Almost five years since the submission of the Ministerial Committee on Rural Education Report, it remains to be seen what the national and provincial education departments have made of these recommendations.

2.5 COMMUNITY SCHOOLS

The origin and development of what are called community schools in South Africa is closely intertwined with the country's past ideological and political developments. Hence a discussion of South Africa's community schools would be incomplete without providing the historical background under which these schools developed. Fortunately there is abundant literature on the history of education in the Eastern Cape, although it tends to focus more on the former Transkei than on the former Ciskei. Ngubentombi (1988) reviewed the history of education in the Eastern Cape (Transkei) from the colonial era up to 1976, when the Transkei became an independent sovereign state. Ngubentombi (1988) divides this period into four phases: the missionary era (1799-1854); the Cape Colony and provincial government era (1854-1953); the Bantu education system era (1954-1963); and the self-rule era (1964-1976). Rural education in the former Transkei and Ciskei underwent another phase following the granting of independence to these homelands, in 1976, and 1981, respectively (see below). The end of apartheid in 1994 and the educational reforms that soon followed necessitate the addition of another phase of education history: that of the post-apartheid era (see Section 6.6).

Ciskei and Transkei are recognised as the first sites of formal schooling for Africans in the Cape Colony (Hartshorne, 1992). In Ciskei, this took place in 1799 with the establishment of a school on the banks of the Tyune River, near what is now King William's Town (Ngubentombi, 1988). Ngubentombi writes that in Transkei, formal schooling for Africans was pioneered by Anglican and Methodist missionaries in the 1820s. During this time, which constitutes the missionary period of education, Ciskei and Transkei were designated native reserves within the Cape Colony, supplying migrant labour to the diamond mines at Kimberley (Seroto, 2004). The missionaries used education as a means of evangelising the native populations (Hartshorne, 1992; Behr, 1984), with the costs of erecting and running the

schools being borne by the missionaries themselves. The schools were located around church missions and were mostly of a boarding nature. According to Behr (1984, p. 173) by the early 20th century, there were 2 702 missionary schools in the Cape Colony, catering for a total population of 215 956 learners. Many of Eastern Cape's (see Section 6.2) prestigious schools for African learners such as Lovedale, Healdtown, Clarkebury, St Cuthbert's, St John's and Holy Cross trace their origins to this missionary era (Behr, 1984).

During Dutch rule of the Cape Colony, which lasted from 1652 to 1806 (Seroto, 2004), there was little state interest in the schooling of African children. State interest in providing schooling for Africans residing within the Cape Colony began to slowly take off during the British colonial rule, which lasted from 1806 to 1910. It started with the colonial government paying small subsidies to missionaries who were involved with black schools (Seroto, 2004). By the middle of the 19th century state involvement in missionary schools for Africans had extended to the provision of inspectional control (Ngubentombi, 1988, p. 14). Ngubentombi also points out that under British colonial rule, black education came to be managed through a complex administrative system. While the state controlled major decisions such as funding and teacher appointments, the curricula and examinations were under the auspices of the colonial provincial governments. At the same time missionaries and communities were responsible for local management of these schools. (Behr, 1984) reports that in 1841 the colonial provincial government started a system of state aided missionary schools for Africans, with emphasis being placed on the development of industrial trades such as carpentry, masonry, bricklaying and blacksmithing. This eventually led to the establishment of leading Eastern Cape trade schools for Africans during the early 1900s, for example the trade school at Butterworth, and the agricultural college at Tsolo, both in the Transkei.

The Bantu education system period and that of self-rule were preceded by a number of developments which were to have a major impact on the shape of black education in the Eastern Cape and the rest of South Africa. The first development took place in 1949, when apartheid was adopted as the ideology for South Africa's political, social and economic development, following the ascent of the National Party to political power in 1948. According to apartheid policy, each ethnic group in South Africa was to develop separately as a means of ensuring the preservation of their culture. Apartheid policy was enforced through the promulgation of numerous legislations such as the Group Areas Act No. 41 of 1950 which created different residential areas for different races and was designed to curb the

movement of blacks from rural to urban areas; the Bantu Authorities Act No. 68 of 1951 which sought to create a hierarchy of traditional authority in rural black areas as a precursor for self government; and the Promotion of Bantu Self-Governing Act No. 46 of 1959 which laid the foundation for the creation of black homelands (Seroto, 2004).

It was during the Bantu education system period that community schools first flourished, although they had been in existence long before that. Behr (1984) claims that by 1942 the system of community schools was well established. The National Party's policy of limiting education for African urban dwellers to primary level also acted as a stimulus to the growth of community schools, since these were free to offer secondary, trade, technical and commercial education (Hartshorne, 1992). However, it was after the 1949-1951 Eiselen Commission investigation into African education, and its aftermath, the Bantu Education Act No. 57 of 1953, that community schools underwent a dramatic expansion in number and enrolment (see below).

Literature on South Africa's community schools is relatively harder to find compared to that on farm schools. Most of it is grey literature and is in the form of individual case studies, perhaps reflecting the diverse nature of South Africa's community schools. One reference which provides a relatively comprehensive account of these schools in the Eastern Cape is by Jacklyn (1993). This author describes community schools as schools that were built and maintained by local communities (in the homelands). Traditional leaders played a prominent role in the establishment and running of community schools. For example, they allocated the land on which the schools were built and collected funds for erecting and maintaining the school buildings. These responsibilities placed traditional leaders in a powerful position over the management of community schools (Gordon, 1999). Seroto (2004) interprets this as a positive step in that locally based administrative units such as tribal authorities, school boards and school committees offered rural Africans an opportunity to become actively involved in their own schooling.

The expansion of community schools was further fuelled by the granting of self-governing status or full independence to the homelands. For Transkei this happened in 1963 and 1976, respectively, while the corresponding dates for Ciskei are 1972 and 1981. On gaining self-governing status or independence, the department of education was among the first departments to be set up by the homeland governments. With the establishment of these

departments in place, the National Party shifted the bulk of the responsibility of black education to the homelands. By 1976 the majority of South Africa's African learners were being accommodated in community schools spread over ten separate homeland departments of education (Hartshorne, 1992). Some homelands like Transkei had their newly formed education departments breaking ties with the parent body, the Department of Education and Training (DET), and established their own curricula and examination systems. Jacklyn (1993) contends that other homelands, such as Ciskei, lacked the capacity or motivation to alter their school curricula to any extent, and retained strong links with DET. In these homelands, the secondary school curriculum was essentially the same as for DET schools, although inadequate staffing and limited resources narrowed the range of subjects which could be offered (Jacklyn, 1993).

The devolution of black education to homelands introduced a mixture of changes in their education systems. One positive contribution was that in both Ciskei and Transkei many day senior secondary schools were established by communities, thus increasing the accessibility of secondary education to poorer learners. It must be remembered that by virtue of their boarding nature, missionary schools had failed to adequately cater for this group of learners. Homeland governments were also now in a better position to amend their curriculum to suit local needs. For example, Transkei adopted the Cape primary school curriculum for whites (Behr, 1984). Another change was that community schools fell more and more under the influence of the state governments, while the grip of the local chiefs and school boards which had hereto controlled them was loosened. The community school system was eventually abolished. However, the homeland governments were unable to run these schools effectively, mainly due to financial and human capacity constraints (Behr, 1984).

The gross neglect suffered by homelands during the apartheid era extended to all spheres of their development, education research included. Information about community schools during apartheid is mostly based on anecdotal evidence rather than field research. Lawrence and Paterson (1991) identified insufficient information on community schools as one of the obstacles to their successful incorporation into the general education system. According to Jacklyn (1993), community schools differed markedly in quality across the homelands and within the same homeland. Jacklyn (1993) attributes this to the amount of resources the homeland devoted to education, the efficiency of the homeland's education bureaucratic system and the proximity of the homeland to major metropolitan areas. The level of political

interference in the establishment, staffing and funding of community schools was another contributory factor (NMF, 2005). Jacklyn (1993) provides a general glimpse of conditions at community schools in the Eastern Cape in the early 1990s, before the imminent fall of apartheid. In secondary schools, the learner to classroom ratio was as high as 64:1 and 55:1 in Transkei and Ciskei, respectively, while half of the teachers in the Transkei did not have professional training in education (Jacklyn, 1993, p. 8). In Ciskei, there was more non-government organization (NGO) involvement in education than in Transkei as a result of the former's proximity to major metropolitan areas (Jacklyn, 1993). Graaff (1992) reported that in Transkei the 1990 enrollment for Standard 5 was only 27 % compared to 71% in Bophuthatswana.

Once control of a community school reverted to the state, the school was supposed to be funded from state coffers. In Transkei and Ciskei, official school funding policy concentrated on township schools while neglecting those in rural areas (Jacklyn, 1993). As a result, schools in rural areas of Transkei and Ciskei continued to be funded from parental contributions (although they were now state schools), and the adverse school conditions continued to prevail long after homeland self rule. This partly explains why teaching and learning conditions at community schools have always lagged behind those of DET schools, farm schools included (Hartshorne, 1992).

The crisis in black urban education which culminated in the 1976-1980 Soweto riots pushed the plight of homeland schools off the political and (education policy) agenda. As far as policy was concerned, this state of affairs continued even into the 1990s. This neglect was confirmed by the scant attention paid to homeland schools in the two key education policy documents produced by the African National Congress (ANC) just before the dawn of democracy, the *Education Renewal Strategy*, and the *National Education Policy Investigation Reports* (Kgobe, 1993; Lawrence & Paterson, 1991). However, in education research community schools were increasingly attracting more attention, in preparation for their imminent incorporation into the general education system. For example, writing in *Matlhasedi*, a journal that was devoted to rural schooling and development issues in Southern Africa, authors such as Krige (1991), Jacklyn (1993) and Lawrence and Paterson (1991, 1993) voiced concern over schooling conditions in the homelands. Phurutse (2002) was, however, critical of the bias towards resource and infrastructure provision in these writings, and called for more information on the classroom experiences of community schools. This

call was finally responded to with the publication of *Emerging Voices* (NMF, 2005), which provided a comprehensive and in-depth account of rural schooling as experienced in a homeland context, through the eyes of key stakeholders such as learners, teachers and parents. Arnold, Newman, Gaddy and Dean (2005) make an important point concerning research in rural education. The kind of research in *Emerging Voices* is an example of what they call rural specific studies. According to these authors this is research which is conducted with the specific aim of understanding rural education issues. Such studies should not be confused with those which take place in a rural context by coincidence and are not intended to investigate or explain the influence of rurality on education. These authors refer to the latter type of research as rural context research.

Emerging Voices was unique in that it was based on a holistic approach to rural schooling, and provided insight not only into the classroom experience, but also into the socio-economic contexts, and the attitudes and practices of key stakeholders such as learners, teachers and parents. Phurutse (2002) is of the opinion that it is such information which should form the basis of education initiatives in rural schooling, rather than that which focuses on infrastructure and physical provision. The argument underlying the research in the *Emerging Voices* is that rural schooling and the contexts in which it occurs, especially that of poverty, should not be isolated from each other. This view is supported by Lawrence and Paterson (1993, p. 2) in their argument that the textures and dynamics of education in rural areas must first be uncovered, analysed and understood before framing educational changes. More support comes from Gordon (1999, p. 8) who maintains that community schools have their own unique combination of features which distinguish them not only from urban schools but also from farm schools. For example, although they have been declared public schools they are located on community land, and are still susceptible to the powers of traditional authorities.

What all these authors are pointing out is that the social and political history of community schools has a dominant role in determining their socio-economic contexts, which in turn are controlling the trajectory of post-apartheid educational reforms at these schools. It is disconcerting to note that in the Ministerial Committee on Rural Education Report (South Africa. DoE, 2005), the peculiarities of community schools remained in the background and were not teased out like those of farm schools. Other post-1994 official education policies do not treat community schools any differently. For example, the South African Schools Act No.

84 of 1996 (RSA, 1996) recognises only two types of schools: public and independent. As such, community schools no longer legally exist (although they continue to exist in other ways). Secondly, from 1996 data from provincial departments of education no longer distinguishes urban and rural schools, let alone farm and community schools.

Unfortunately the data provided in *Emerging Voices* was based only on schools within the General Education and Training band (Grade 1 to 9), and came from only three of the ten former homelands. Nevertheless the research is a step in the right direction, and there is now a need to extend the study to other rural provinces of the country and to the Further Education and Training band (Grades 10 to 12). This will help fill the gap in understanding of the complexities of schooling in the former homelands, and will help fine-tune the alignment of post-apartheid educational reforms to schools which operate in this education setting.

2.6 THE RURAL EDUCATION ISSUE

Like 'rural,' the term 'rural education' has been conceptualised and operationalised in various ways, often shaped by different political and ideological contexts. These various interpretations of rural education have stimulated much public and academic debate, often critical of the concept. During the 1960s and 1970s rural education enjoyed much popularity in developing countries and among international donor agencies, only to lose favour during the late 1980s and early 1990s. The turn of the twenty-first century has witnessed a renewed interest in rural education, with international bodies once again the driving force behind this renewal. Writers such as Kallaway (1998, 2001) and Wallace (2007) are calling for the re-examination and revitalisation of rural education. At international level, symposia on rural education have been held, the first one in 1991 and a second one in 2003. In 1994, UNESCO backed the International Research and Training Centre for Rural Education (INRULED) which was established at Baoding, Hebei, China to oversee and coordinate international research and training in rural education.

The issue of curriculum relevancy is a recurring theme in rural education discourse, and has shaped the various interpretations of rural education. One prominent interpretation of rural education is that which regards it as a form of technical, industrial or agricultural training for learners in rural areas. Sifuna (1994, p. 7) refers to this interpretation of rural education as vocationalisation of the curricula. This approach to rural education was much in evidence during the colonial Africa period, and during the pre-apartheid period in the case of South

Africa (Kallaway, 1998), as missionaries and colonial governments attempted to reorient school curricula to what they saw as the needs of the African people. Paterson (2004) explains that in the southern African context this form of education was also referred to as industrial, manual agricultural or 'adapted' education. Needless to say, it was highly resisted by the African communities who interpreted it as a strategy to keep them away from white collar jobs (NMF, 2005).

The shape and history of rural education in South Africa has been shaped by the country's racial history. Paterson (2004) reports that as early as 1890, the curriculum in missionary schools in the Cape Colony was differentiated into trade and industrial training for white learners, and manual training for Africans. At missionary institutions such as Lovedale and Healdtown in Transkei, skills such as carpentry, woodwork, bricklaying and leather work were taught to Africans, although this was hampered by inadequate funding (Paterson, 2004). Paterson contends that the 1949 adoption of apartheid policies in South Africa helped further entrench a form of rural education that was somewhat different from that in the rest of post-colonial Africa. Under the guise of cultural preservation, the apartheid government used rural education to reinforce its racist policies. This it did by placing limitations on the type of curriculum that was offered to Africans, both in rural and urban areas. Even when the Eiselen Commission recommended the expansion of technical and industrial training for Africans, this was to be done within the framework of apartheid policies (Kallaway, *op.cit.*). According to Seroto (2004, p. 145), the expansion of technical education in both urban and rural black schools following the De Lange Commission of 1981 was more of a response to a general skills shortage in the country than a concern with the plight of rural Africans.

The introduction of the Bantu education system saw more emphasis being placed on agricultural education for African schools (Paterson, 2004). Paterson reports that although more school time was now allocated to agriculture, this consisted mostly of extended periods of manual labour with little academic content. Conditions in African schools militated against the teaching of practical agriculture, and agriculture periods in African schools came to be seen and used as free periods (Kallaway, 1998). Overall, the orientation of the primary school curriculum towards agricultural education came to mean equipping learners with appropriate skills for subsistence living in their rural areas, or as labourers on a white farm (Kallaway, 1998, p. 28). Interestingly enough, agricultural education was enjoying a boom among learners in the rapidly expanding secondary education sector in the homelands. Unfortunately

the subject was taught from a theoretical perspective, and its popularity among the learners was driven more by the perception that it was an easy subject than by a desire for practical agricultural skills on the part of the learners (Kallaway, 1998). Another relevant development noted in Kallaway (1998) is that the notion of a rural isolated existence for which African students were supposed to be trained was fast disappearing as increased urbanisation caused changes in the socio-economic contexts of their communities.

During this same period, rural education as a form of agricultural, technical or industrial education was receiving increasing attention from African leaders. Kallaway (2001, p. 23) states that in the newly independent states of Africa and other developing countries, education was seen as having a catalytic role in the socio-economic and technological development of their citizens, especially those residing in rural areas. This view was supported by the World Bank and UNESCO, which provided funding for rural education based initiatives in various countries (Kallaway, 2001). At the UNESCO-sponsored Ministers of Education conferences in Addis Ababa in 1960, in Karachi in 1961, and in Santiago in 1962, African countries were urged to shift away from general education to technical and agricultural education. African leaders responded by initiating rural education innovations in their countries, with specific attention being paid to not only primary and secondary schools, but also to post-secondary school colleges. For example, in Tanzania there was 'education for self-reliance' which sought to prevent rural-urban migration by equipping learners with skills for life and service in rural villages. Botswana had the 'Brigades,' which consisted of out-of-school youths who provided services to local communities in exchange for employment and training opportunities. These rural education innovations were shaped by the belief that providing rural communities with technical and agriculture training would promote the social and economic development of rural areas (Kallaway, 2001, p. 24).

Despite the rhetoric around the vocationalisation of education in post-colonial Africa, little progress was made towards achieving that objective. At the 1968 African Ministers of Education meeting in Nairobi, very few countries reported any significant progress on meeting the specific educational needs of rural communities (Kallaway, 2001). Kallaway explains that the growing influence of the urban elite had caused a shift in investment priorities, and agricultural development was no longer a top priority. In addition, the World Bank was providing less and less funding for rural education innovations. Two other factors which Kallaway blames for working against 'ruralising' of the curriculum in post-colonial

Africa were the inadequate funding of the initiative by African governments, which contributed to the lack of the necessary specialised equipment and workshops, and the shortage of suitably qualified teachers. To these, Wallace (2007, p. 3) adds the lack of clear policies for rural education, the low status accorded to all forms of vocational education, especially agricultural education, the recruitment of academically weak students, low staff morale, and the failure of the curricula to support new innovations such as natural resource management.

Kallaway (2001, p. 28) is concerned by post-apartheid South Africa's unwillingness to learn valuable lessons from the rural education experience of post-colonial Africa. He is critical of the urban bias which is currently driving educational reforms in South Africa (as happened in post-independent Africa), while the specific learning needs of the rural communities are being sidelined. He says that the recommendations contained in the National Education Policy Investigation (NEPI) reports, which represent some of the first major post-apartheid policy documents on education, such as those which relate to the empowerment of rural communities and local knowledge, have been shelved in favour of those which address labour market policies. In his arguments, Kallaway is not calling for the en masse adoption of rural education as was practised in the past. He does not believe that such an approach to rural education holds the key to rural unemployment. Indeed, he regards the post-colonial approach to rural education in Africa as being rooted in romanticism as well as being heavily burdened with socialist baggage, and social engineering apartheid policies, in the case of South Africa. Nevertheless, Kallaway points out that these shortcomings should not blind us to the need for curriculum reforms that are sensitive to the rural context, or to the specific learning needs of rural communities. Kallaway's views of rural education have much in common with those expressed in *Emerging Voices* (NMF, 2005) and with those in the Ministerial Committee on Rural Education Report (South Africa. DoE, 2005). The objective is not to restrict communities to rural areas against their aspirations, which is not only unacceptable and unworkable, but would also be resisted by the learners, teachers and parents (Hartshorne, 1992). Rather, it is to acknowledge the peculiarities of the rural context which impact on teaching, and on the learning needs of rural learners, resulting in a misfit of curriculum reforms which are based on the specificities of urban areas. In *Emerging Voices* (NMF, 2005, p. 98-99), parents expressed the desire for a type of education for their children which is not only relevant to the modern world, but is also appreciative of local history and culture (see Section 1.3). The respondents in the Ministerial Committee on Rural Education Report go

further and suggest that rural education be acknowledged as a special case, and the curriculum (and pedagogy) in rural schools be organised differently from that in urban areas. They also recommend a type of education which gives recognition to community assets such as the natural resource base and indigenous knowledge (see Section 1.3.3). The essence of this approach to rural education is well described by Atchoarena (2006, p. 59), who alternatively refers to rural education as ‘rural sensitive education,’ ‘education through a rural lens,’ or ‘education with a rural agenda.’

2.7 EDUCATION FOR RURAL PEOPLE

The call to address the educational needs specific to rural areas does not emanate from South Africa alone. Other countries for example, China, Brazil and India, and leading international donor agencies are also taking a fresh look at rural education. UNESCO and FAO are offering funds and their expertise to initiatives that address education issues in the world’s poverty-stricken rural areas. Education for All represents one such initiative. Education for All is a global undertaking that was first launched in 1990 in Jomtien, Thailand, with the initial aims of providing universal education and reducing illiteracy by 2000 (UNESCO, 2000). After failing to meet this target, a set of six key educational goals to be met by 2015 was agreed on at the World Education Forum held in 2000 in Dakar, Senegal. All these goals focus on the provision and quality of education for people residing in rural areas of the world.

1. Expand early childhood care and education.
2. Free compulsory education of good quality.
3. Expand adult literacy.
4. Promote the acquisition of life skills.
5. Eliminate gender disparity.
6. Enhance educational quality.

Box 2.1 Education for All goals (FAO/UNESCO, 2006)

In addition, one of the nine flagship programmes under Education for All, called Education for Rural People, speaks directly to rural education. Education for Rural People was launched by FAO and UNESCO at the Johannesburg Earth Summit in 2002 and has six major objectives. Under this flagship FAO and UNESCO coordinate international efforts which address the learning needs of rural communities, in addition to offering technical support to various countries to improve their capacities to do so (FAO, 2002).

1. Overcoming the rural/urban gap in education.
2. Increasing access to basic education.
3. Improving the quality of basic education.
4. Fostering national capacity to plan and implement Education for Rural People.
5. Building awareness of importance of Education for Rural People as part of achieving Millennium Development Goals.

Box 2.2 Education for Rural People objectives (FAO, 2002)

The objectives of Education for Rural People feed into the Millennium Development Goals, a major international initiative which is driving world development and progress during the 21st century. The Millennium Development Goals were set in 2000 at the Millennium Summit in New York, and were reaffirmed at the 2002 Johannesburg Earth Summit. They aim to eradicate extreme poverty in the world by 2015, and speak directly to the need to provide quality education for rural people (for example Goals 2 and 7), and the need to create a suitable environment in which the goals of Education for Rural People can be achieved (for example Goals 1 and 8).

1. Eradicate extreme poverty and hunger.
2. Achieve universal education.
3. Promote gender equality and empower women.
4. Reduce child mortality.
5. Improve maternal health.
6. Combat HIV/Aids, malaria and other diseases.
7. Ensure environmental sustainability.
8. Develop a global partnership for development.

Box 2.3 The Millennium Development Goals (UN, 2002)

Hence the Millennium Development Goals will not be achieved without addressing the specific education challenges of people who reside in the rural areas of the world.

The Millennium Development Goals also underpin Africa's strategic action plan for socio-economic development called the New Partnership for Africa's Development (NEPAD). Lotz-Sisitka (2004a, p. 31) identifies Millennium Development Goals 1, 2, 3, 6, and 7 as being pertinent to a futures perspective in/for environmental education in southern Africa. She writes of the need to integrate the above five Millennium Development Goals into

educational and training programmes in order to address specific educational or environmental sustainability challenges in the region. She believes such an approach to the Millennium Development Goals will contribute towards making the education systems in southern Africa more relevant and responsive to the contemporary socio-ecological and socio-economic challenges in the region (Lotz-Sisitka 2004a, pp. 31-32). Lotz-Sisitka (2004a) also advises that NEPAD's Environmental Action Plan should engage more deeply with environmental education processes, and should also promote a more socially critical action-based approach to environmental education, instead of technicist and behavioural modification approaches, as is currently the case. Lotz-Sisitka (2004a) further recommends that researchers and other key stakeholders in southern Africa reflect critically on the adoption of the neo-liberal model of economic development and progress which is promoted by the Millennium Development Goals, since this model is critiqued for being responsible for unsustainable development practices and the environmental crisis in the first place.

2.8 CONCLUSION

This research project is firmly rooted within the context of rural education. Rural Education is a complex education concept which is enjoying a resurgence of interest among educational researchers and policy makers in South Africa and the rest of the world. This chapter provided an overview of the different meanings associated with the terms 'rural' and 'rural education.' The chapter also looked at the two types of rural schools in South Africa, namely farm and community schools. Differences in their origin and history from urban schools have contributed to their neglected status in post-apartheid education policy-making. This chapter documented colonial and post-colonial struggles with 'ruralisation' of the curriculum in Africa, and showed how racist policies helped to shape a particular form of rural education for blacks in South Africa. The chapter also analysed the main ideas behind the resurgence of interest in rural education and ended with a brief description of three major international initiatives that are driving forward this resurgence worldwide.

Support for rural education is rooted in the need to provide teaching and learning experiences which are responsive to the specific needs of rural learners and those of their communities. Hence the issue of curriculum, especially as it relates to relevance should be of special interest to researchers and practitioners in rural education. The next chapter discusses curriculum since it forms a major research focus in the study.

CHAPTER 3

CURRICULUM

3.1 INTRODUCTION

In Chapter 1 the need to focus on curriculum as a strategy towards improving the quality of rural education in South Africa was highlighted. This chapter explores the concept of curriculum in more detail. It also provides an overview of past and present debates concerning curriculum as a concept, and curriculum approaches in South Africa. The aim is to illustrate how these debates have influenced classroom practices at South Africa's rural under-resourced schools, especially those which relate to environmental learning processes.

3.2 DEFINING CURRICULUM

Any useful contribution to curriculum discourse needs to start off with a definition of the concept of curriculum. This has as much to do with the field's relatively short history as with its ever-widening area of interest and coverage (Carl, 2002). Barrow (1984) writes of the need for clarity, coherence, consistency and relative specificity in the curriculum field. He says:

... if we are to make claims about how to implement, evaluate and design curriculum, then [it is] important to have a clear, consistent definition so that we know ... what counts as curriculum (Barrow, 1984, p.7).

This view is also supported by Graham-Jolly (2003) who notes that understanding the key processes of curriculum design, development, management and evaluation hinges on first clarifying what is meant by curriculum. One result of the search for clarity on curriculum as a field of human endeavour has been a plethora of curriculum definitions in published academic literature, not to mention those in the public arena, as various curriculum theorists strive to provide the much needed clarity. For example, Marsh and Willis (1995) recorded over 120 different curriculum definitions in their survey of education literature. No doubt this number has changed since then, with some definitions becoming redundant, and new ones being added, in response to changing socio-political contexts, coupled with new insights into learning and teaching processes. A major challenge facing curriculum researchers then, is selecting which curriculum definition to use in informing one's project. Closely associated with this dilemma is the question of which criteria to apply when judging one curriculum definition over another (Barrow, 1984). This is in addition to conceptualising how curriculum

relates to contextual aspects of the research project, such as issues associated with rural education (see Chapter 2), and environmental education/natural resource education (see Chapter 4), in the case of this study.

Two major schools of thought seem to dominate the curriculum definition debate. At one extreme there are researchers who advocate for one specific definition that can adequately capture all the various dimensions of curriculum. At the other end are those who are looking for a more generic and inclusive definition. A third group could be added, comprising of those who regard the whole curriculum definition debate as a waste of time, in that it draws attention away from what they regard as more important curriculum issues. However, it seems that for most writers on curriculum, clarifying what is meant by curriculum is a necessary initial step towards better understanding of curriculum inquiry and curriculum change processes.

It is widely accepted that how one defines curriculum is greatly influenced by worldview or philosophical orientations which are not detached from history. Cornbleth (1990, p.12) stresses this point and reminds us that conceptions about curriculum are never neutral, and that they reflect personal assumptions and experiences about the world. A similar view is held by Carr (1998, p.326) who contends that the conflicting views or beliefs about curriculum are a reflection of different political ideologies among competing key stakeholders in curriculum discourse. Yet according to him, the political ideologies that inform curriculum thinking are generally taken for granted and rarely come up for close scrutiny in open debate. He calls for curriculum ideologies to be made more visible and more problematic. Cheung and Wong (2002, p. 226) make two more important points regarding curriculum conceptualisation. The first one concerns the lack of standard terminology, with the interchangeable use of terms such as curriculum orientation, curriculum ideologies, curriculum approaches or curriculum perspectives being common practice in literature. The second point raised by Cheung and Wong (2002) concerns the failure among curriculum theorists to reach a common agreement as to which classification scheme best captures the major forms of curriculum thinking and practice (assuming this is possible). Hence it is useful first to take a look at the different orientations that underpin curriculum, and how they influence curriculum conceptualisation, policy and practice.

One of the objectives of this study was to investigate classroom practices regarding the teaching and learning of natural resource management within the Grade 10 Life Sciences curriculum at four rural under-resourced schools in the Eastern Cape Province of South Africa (see Chapter 1). There is a close relationship between curriculum orientations and approaches to environmental teaching and learning (see Chapter 4). Furthermore curriculum orientations are dynamic and respond to changes in a country's socio-political and education landscape (see O'Donoghue, 2007). Hence it was deemed necessary to first map out the curriculum orientation field before embarking on analysing the trends in approaches to environmental learning.

3.3 CURRICULUM ORIENTATIONS

Cheung and Wong (2002, p. 226) define curriculum orientation as 'a collective set of beliefs about curriculum elements such as curriculum intent, content, teaching strategies and instructional assessment'. In Carr (1998, p. 327) each curriculum orientation is explained as expressing a definite interpretation of the role of education in society, and as being associated with a set of educational principles on which issues such as curriculum content and organisation, as well as pedagogy and assessment are based. Various curriculum orientations are described in literature, and their categorisation ranges from simple dichotomies to continuums. Although there is a tendency to view the various orientations as mutually exclusive, Vallance (1986) reminds us that in practical terms this is rarely the case, since they often overlap and merge into one another. For Vallance (1986) it is important not to view curriculum orientations as static and prescriptive. Moreover, according to Ornstein and Hunkins (2004) many educators rarely ascribe to one particular orientation, preferring instead to shift from one type to another as the situation demands. For Carr (1998), curriculum orientations are in fact products of particular historical, cultural and social contexts, with new ones emerging as others fall out of favour. The relatively recent view of curriculum from a technological perspective is a case in point, due to the growing use of computer technology in the classroom. Vallance (1986) attributes the decline in importance of viewing curriculum from a social reform perspective to the loss of momentum in social activist movements since the 1970s.

In his review of curriculum orientation schemes, Jackson (1992) notes that there is a certain degree of similarity between the various attempts, although this is sometimes masked by the use of different terms. For example, one of the better known curriculum orientation

typologies is that by Eisner (1992) who views curriculum through the lens of: developing cognitive processes in learners (cognitive curriculum); learner reaching their full potential (humanistic curriculum); initiating social reform (social reconstructionist curriculum); transmitting society's intellectual heritage (academic-rationalist curriculum); and technology (technological curriculum). This is very similar to the classification scheme in McNeil (1981), although it gives recognition to only four different curriculum perspectives: academic, technological, humanistic, and socio-reconstructionist. Jackson (1992) notes that despite the large number of definitions of curriculum that are found in literature, only between two and six curriculum perspectives exist. He believes that while the original dichotomy of curriculum perspective (psychological and social) is not broad enough for contemporary curriculum discourse, schemes consisting of up to four curriculum perspectives are enough to adequately describe the discourse. Jackson (1992) argues that what may appear to be new categories are more to do with the individual preferences of the various authors than with the emergence of new curriculum perspectives. McKernan's (2008, p. 27) attempt which distinguishes six curriculum perspectives is a good example of this. These perspectives are: intellectual-rationalist, theo-religious, social-romantic, technical-behavioural, personal caring, and critical-political. McKenna (2003) stresses that what should be important is not which curriculum orientation is the best, but rather to examine the assumptions behind each type, and how they affect work with curriculum. For this study, this orientation to curriculum thinking is necessary because of shifting ideological changes in South Africa's education history, which have influenced approaches to environmental teaching and learning in classroom, as discussed in O'Donoghue (2007).

3.4 CURRICULUM ORIENTATIONS IN SOUTH AFRICA

Frame's (2003) typology of curriculum orientations resonates well with South Africa's education context. He draws on the ideas advanced by curriculum theorists such as Schubert, Cornbleth and Grundy. An initial step towards this approach to curriculum involves making explicit one's basic assumptions about: the nature of reality (ontology), the nature of knowledge (epistemology), and the ways of researching and constructing knowledge (methodology). Thus curriculum orientation typology is closely aligned to the three modernist research paradigms of positivism, interpretivism and critical theory, which are traceable to Habermas's theory of knowledge interests (Grundy, 1987). Frame (2003) explains that curriculum thinking and actions are shaped by the underlying assumptions associated with each approach to research. These assumptions influence what types of

questions are asked about curriculum, how questions are researched, and the nature of conclusions that can be drawn from investigations on curriculum.

The three orientations to curriculum that are recognised within this schema are: the technical or empirical-analytic; the practical or historical-hermeneutic; and the critical or emancipatory (Frame, 2003). The technical approach to curriculum is influenced by positivist views of reality that operate within the natural sciences. In this approach, curriculum is believed to take the form of a physical object such as curriculum documents, which exist in isolation from those who develop and implement curriculum, and from the context within which it is implemented (McKenna, 2003). It is also believed that the truth about curriculum is best researched using objective methods such as experimentation, measurements and observation, to identify any generalisable laws about curriculum. This often involves the study of curriculum documents rather than of curriculum as it is experienced. However, it is the impact of positivism on the nature and organisation of knowledge within the curriculum that is of special relevance to this research project (see Chapter 5). According to Frame (2003), in the technical approach, knowledge is compartmentalized into separate subjects or disciplines. Within the curriculum, the subjects or disciplines are allocated separate spatial or temporal slots that allow limited or no cross exchanges between them, or between them and life outside school (Frame, 2003). Teaching, under this curriculum approach, involves transferring factual disciplinary knowledge to learners who are expected to learn it for assessment purposes (see Section 4.11 & 4.12). Frame (2003) informs us that it is this approach to curriculum that dominates schooling in South Africa. A more detailed discussion of this approach to curriculum is provided in Section 3.6 below.

Unlike the technical approach which views curricular knowledge as being external to the knower and context, the practical or interpretivist approach views it as being socially constructed (Frame, 2003). Frame explains that social construction of knowledge occurs when a group of people reach a consensus as to what constitutes curriculum knowledge in their context. As such, under this approach, curriculum knowledge is not only value laden, but is also context specific. According to the practical curriculum approach, the aim of research is to unravel the decision-making processes that take place during curriculum construction and the context within which it occurs. Hence, in addition to the curriculum content, the context of the curriculum and the people experiencing the curriculum, especially the teachers and learners, form the central core of the research project. As for the nature of

knowledge, the practical approach to curriculum sees it as provisional and subject to contestation. Rather than being constructed from traditional disciplinary knowledge, within this approach the curriculum consists of learning opportunities which learners are expected to make use of to construct disciplinary knowledge and their own meanings. Frame points out that it is here that inter-disciplinary knowledge serves the useful purpose of promoting understanding. The aim of teaching is to provide learners with opportunities by which they can socially construct knowledge (see Section 4.13), rather than to mechanically transfer already constructed curriculum meanings to passive learners.

The critical approach to curriculum shares a number of basic assumptions with the practical approach (Frame, 2003). These include the beliefs that knowledge is socially constructed, is contestable, context dependent and value laden. What distinguishes the critical approach is its focus that goes beyond the education field to include the socio-economic and political context of the curriculum. Another distinguishing feature of the critical approach is the promotion of active learning through which learners are expected to question their own ideologies and those that underpin curriculum, and use curricula as a means of promoting social justice (see Section 4.14). Hence critical approaches to curriculum take on an emancipatory role (Frame, 2003). Critical approaches to the curriculum have been popularised under the general umbrella of 'education for the environment' (Lotz-Sistka, 2004b).

3.5 POST-MODERNIST CURRICULUM ORIENTATIONS

The traditional approaches to curriculum as outlined above have been critiqued by writers such as Doll (1989), and Slabbert and Hattingh (2006), who call for their replacement by post-modernist approaches. Some researchers such as McKenna (2003) give recognition to post-modernism as a fourth curriculum approach. This renders incomplete any discussion on curriculum approaches that omits reference to post-modern curriculum approaches. Frame (2003, p. 30) sees the emergence of post-modernist perspectives of curriculum as a general sign of unhappiness with the domination of modernist approaches to curriculum. This anti-modernist stance stems from the fact that all the above three approaches are grounded in modernism which includes the belief that absolute truth is achievable, and that human rationality is the best means of doing this (Frame, 2003, p. 30). The three main axes of tension between the modernist and post-modernist curriculum perspectives and their impacts on curriculum thinking are discussed in Doll (1989) and in Lotz-Sisitka (2004b).

The first axis of tension concerns the structure of the curriculum system. According to Doll (1989), the modernist view is that curriculum operates as a closed system that rigidly adheres to pre-determined aims and means to achieve them. Post-modernists refute this perspective of curriculum, contending that curricula operate as open systems that are susceptible to external forces and influences. The implication for curriculum thinking and practice is that curriculum designs should be flexible enough to allow learners to explore and experiment with the unknown, instead of restricting them to the memorisation of pre-determined content (Lotz-Sisitka, 2004b).

Another modernist view of curriculum that is questioned by post-modernists is the perception of the world as simple and orderly (Frame, 2003). Post-modernists believe in world complexity, chaos and interacting forces, of which all of us are part (Doll, 1989). They reject reductionist approaches by which curriculum knowledge is atomized into separate subjects or disciplines to maximize management and technical efficiency. The implication for curriculum as explained by Frame (2003, p. 30) is for teachers to ‘... celebrate the complexity, and multiplicity of meanings arising out of the constructions and interpretations of multiple languages, cultures and contexts’.

The third axis of tension between modernist and post-modern curriculum approaches relates to the nature and role of change. Both perspectives appreciate that change is part of the world’s operating systems. Where they differ lies in the modernist’s view of change as an undesired and often accidental occurrence, whereas post-modernists regard it in an entirely different light (Doll, 1989, p. 249). According to post-modernism, knowledge is not certain, and neither is it stable. Curriculum is liable to change as changes occur in its contextual conditions. What this implies is that although curriculum goals need to be sensitive to context, at the same time they should not be rigidly set, since this would give learners the false impression that knowledge is unchanging (Lotz-Sisitka, 2004b).

3.6 THE TECHNICAL APPROACH TO CURRICULUM

The technical approach to curriculum is also variously referred to as a behavioural, technist, logistic-positivist, technocratic, rational-scientific or scientific. It is regarded as the oldest form of curriculum approach, and despite its numerous limitations still dominates curriculum policy and practice worldwide (Cornbleth, 1990). It is discussed in detail here because of its dominant position in South Africa’s poorest schools (NMF, 2005), such as the four rural

schools which took part in this study (see Section 6.5.4), and its influence on pedagogical approaches to environmental learning (see Section 4.10). For details on the technical approach to curriculum in South Africa, see Section 3.7.

Darling-Hammond and Synder (1992, p. 42) describe the technical approach to curriculum as encompassing ‘all empirical research methods that systematically examine curriculum, teaching, learning and their relationships.’ They see such an approach to curriculum as generating two major types of advantages. The first set of advantages relate to the provision of guidelines and knowledge about the nature of learning and teaching, and curriculum making decisions. Darling-Hammond and Synder (1992) point out that before the emergence of this curriculum orientation, decisions as to what and how to teach for example, depended mostly on philosophical or humanistic considerations. Ornstein and Hunkins (2004, p.82) state that with the advent of a scientific approach to curriculum, curriculum ceased to be seen as merely a collection of subjects, and more as a science with principles and methodology. The scientific approach to curriculum also contributed to the processes of learning, and teaching becoming more precise and scientific (Darling-Hammond & Synder, 1992). Another positive effect noted by Darling-Hammond and Synder (1992) is that this approach contributes to the generation of quantitative data on schooling, which enjoys enormous mass appeal and political clout in education, South Africa’s Education Management Information System (EMIS) being one good example of such a database.

The origin of the technical approach to curriculum has been traced to the growing influence of psychology not only in education, but in other spheres of life such business and industry. In their review of the history of this curriculum approach, Ornstein and Hunkins (2004) explain that in the 1890s there was growing interest in the US in strategies that could be used to improve efficiency in business and industry. Fredrick Taylor’s solution to this challenge involved sub-dividing the industrial job tasks into smaller units, which were then expressed in precise behavioural terms. Taylor’s suggestions represented a new and scientific approach to management in business and industry, which he believed improved job precision and lowered operational costs (Ornstein & Hunkins, 2004). Doll and Gough (2002, p. 36) regard Taylor’s approach to management as emphasizing external control, and the division of responsibilities between workers on the floor and managers. During the major part of late the 20th century, Taylor’s theories not only informed management of factories and industries, but also the development and designing of curriculum (Doll & Gough, 2002). Schools came to be viewed

as factories, and learners as raw materials to be shaped into finished products (Doll & Gough, 2002, p. 35). Early curriculum theorists such as Franklin Bobbitt, Werrett Charters and Ralph Tyler supported the extension of Taylor's scientific management approach to the education field, arguing that atomising of learning and teaching would result in these processes becoming more precise and objective (Doll & Gough, 2002). Positivist influences such as increased objectivity and precision in education were seen as contributing to better instructional and evaluation strategies (Ornstein & Hunkins, 2004).

Although several branches of psychology helped to shape thinking in the education field, it was behaviourism that created the most impact. As explained in Doll and Gough (2002) the thinking among early behaviourists was that the basic purpose of education was to change human behaviour. Behaviourism's main contribution to curriculum came in the generation of learning theory, which improved knowledge and understanding of how learning and effective teaching take place, thus providing a base from which curriculum could be constructed and researched. Adherents of behaviourism interpreted learning as a process of reacting to external stimuli (McNeil, 1981, p.43). How to create the necessary stimuli which result in the desired responses (learning), and how to assess that learning has taken place, became major topics for early researchers into learning. Although Pavlov's experiments on conditioned learning provided the initial insights into human learning, it was only after Watson's conceptualisation of learning as observable behavior, and Skinner's quantitative and experimental approach to behavioural studies, that behaviourism gained a firm foothold in curriculum studies (Ornstein & Hunkins, 2004). Doyle (1992, p. 489) had this to say about the effect of behaviourism on curriculum:

The focus was on precise measurements of specific behavior and the use of controlled conditions to verify scientific laws. These laws, in turn ... define precisely what teachers must do in order to cause student learning.

Dewey, however, rejected this narrow stimulus-response approach to human learning, regarding it as overly mechanical and simplistic (Doyle, 1992, p. 490). However, the growing popularity and influence of behaviourism was such that its influence on curriculum prevailed.

Although there might have been differences of opinion among supporters of the behavioural approach, there was general agreement on the basic tenets of curriculum construction (Doyle, 1992). The early model of curriculum construction came to be known as the Tyler Rationale

(Doyle, 1992). It is described as a linear model of curriculum construction, and consists of three major steps. The first step involves pre-specification of curriculum objectives in precise behavioural terms, followed by the selection of appropriate content and activities. The last step is an assessment process to determine the extent to which the specified objectives have been met. This has been the dominant approach to curriculum construction over the last 100 years (Ornstein & Hunkins, 2004).

Reviews of the key features of the technical approach to curriculum are a common topic in literature. For example, this approach is commonly associated with the notion of division of labour (Cornbleth, 1990) and systematic planning (Cheung & Wong, 2002). Other features of this approach to curriculum include the treatment of learners as raw materials that need to be moulded, passive learning, a lack of teacher participation during the curriculum designing and development processes, emphasis on measurable learning objectives, and on formal instructional assessment (Cheung & Wong, 2002). This approach to curriculum is equated with testable knowledge, and the instructional processes that are promoted under this approach aim at providing the most efficient means of delivering this knowledge, hence the use of technology is encouraged to improve instructional efficiency and efficacy (Cheung & Wong, 2002). Lastly, advocates of the technical orientation to curriculum regard education as preparation for future career prospects (McKernan, 2008), thus allocating an instrumentalist role to education.

The technical curriculum model is ideologically convenient in cases where education is viewed as an instrument of social control, as was the case in Bantu Education under apartheid South Africa (Christie, 1985). Otherwise the domination of this model of curriculum is puzzling given its major flaws as outlined by numerous curriculum theorists such as Cornbleth (1990), Scott (2008), McKernan (2008) and many others. Cornbleth (1990) is critical of the treatment of curriculum as a product under this approach. What this means is the practice of restricting the interpretation of curriculum to the end products of the learning experience, the pre-determined behavioural objectives. Although one of the cited attractions of a technical curriculum is its seemingly neutral and scientific approach to curriculum construction, Cornbleth (1990, p. 16) sees it as a major flaw since it creates the false impression that curriculum construction is a neutral and value free process, and that curriculum developers are disinterested specialists. A second major flaw that is identified by Cornbleth (1990) is the separation of the process of curriculum construction from those of

curriculum policy development and implementation. She refers to this as conceptual decontextualisation. Cornbleth (1990) argues that this practice results in the curriculum constructors relinquishing their responsibility of curriculum implementation to other people such as teachers. Teachers on the other hand, not having been involved in the development of the curriculum in the first place, are less inclined to accept responsibility for its successful implementation at classroom level (Frame, 2003, p.22). Alternatively, this curriculum approach may contribute to a tendency whereby curriculum reform efforts are concentrated at the curriculum construction level, with teacher development and what goes on inside the classrooms receiving less attention, as happened in the case of South Africa's post-apartheid curriculum reforms (Taylor & Vinjevoold, 1999). Despite the adoption of a stakeholder model of curriculum reform, the division of responsibilities between curriculum designers and implementers was very distinct in the case of South Africa's first major curriculum framework, Curriculum 2005 (C2005), and resulted in curriculum reforms which were not rooted in the realities of the majority of South Africa's schools (Christie, 1999; Jansen, 1999b). (see Section 3.7.5).

Another set of fallacies promoted by a technical curriculum is the assumption that curriculum operates in a vacuum and it is therefore free from the influences of its social settings. This assumption arises as a result of perceiving curriculum merely as a document, rather than involving interplay between the document, teachers and learners and their social settings (Cornbleth, 1990). For example, during apartheid, curriculum revision in South Africa took the form of regular revision of the core content of different subjects, while the country's first post-apartheid curriculum reform was limited to the removal of racist, sexist and outdated content from subject syllabi (Jansen, 1999a) (see Section 6.6). Cornbleth (1990) advises that structural and socio-cultural factors need to be taken into account when considering or implementing curriculum reforms, rather than restricting attention to documents, as is promoted by the technical curriculum. The lack of engagement with contextual factors at the majority of South Africa's poor schools, such as teachers' poor content knowledge of their subjects and the lack of educational resources, was highlighted by Jansen (1998, 1999b) as one of the reasons why C2005 was doomed to fail.

McKernan (2008, pp. 70-81) provides an extensive critique of the technical approach to curriculum. The 26 shortcomings he identifies can be conveniently grouped into three major areas. The first category of critiques targets the very nature of the curriculum objectives as

outlined under this approach. McKernan (2008) argues that objectives are abstract concepts and should not be seen as the only alternative available for curriculum building. In addition, McKernan maintains that objectives do not capture all the complex interactions that take place inside the classroom. Thus the pre-specification of objectives limits the learning opportunities that can occur inside the classroom to those which are observable and measurable. Furthermore, the approach is wrong in assuming that teachers will always agree with all the specified objectives, and will willingly work towards achieving them.

The second category of McKernan's critiques focuses on the limitations the approach creates for the learning situation. He explains, for example, that the atomisation of learning that occurs under this approach disrupts the internal logic of disciplinary knowledge, let alone interdisciplinary knowledge. The last category of McKernan's critiques looks at the impact the approach has on education in general. He cites the promotion of an instrumentalist view of education, the lack of democracy in the education process, and promotion of the values and interests of the political elite through the education system as big drawbacks of the technical approach.

3.7 TRENDS IN CURRICULUM THINKING AND PRACTICE IN SOUTH AFRICA

3.7.1 The pre-1994 period

Some of the earliest definitions of curriculum in South Africa are to be found in the books, reports, and government publications of the 1970s and 1980s (Graham-Jolly, 2003). Inspection of these early definitions reveals a narrow and positivist view of curriculum. For example, in the de Lange Report of 1981, as quoted by Graham-Jolly (2003, p. 3), curriculum is referred to as 'a course of study' or 'a group of subjects which are offered in a school course or a field of study.' The same report defined the curriculum of a subject as 'the total content of a subject for a particular phase, course or field of study ... as well as matching study guides, manuals and guidelines' (as quoted in Graham-Jolly, 2003, p. 3). This technical view of curriculum persisted in South Africa well into the 1990s, although internationally the trend had started to shift towards a more inclusive view of curricula. For example, during the dying days of apartheid, the National Party released a discussion document entitled *A curriculum model for South Africa*, in which curriculum was defined as:

... the collection of subjects, instructional offerings, their structuring, and related requirements, with which provision is made for the pursuit of an aim with a particular

target group (Committee of Heads of Education Departments, 1991, as quoted in Graham-Jolly, 2003, pp. 3-4).

It comes as no surprise then, that the earliest post-apartheid attempts at curriculum reforms which were implemented immediately after the first democratic elections were limited to a revision of subject syllabuses. They were aimed at the elimination of offensive content rather than introducing substantive change. According to Jansen (2001), the first post-apartheid syllabus revision exercise earned the national ministry of education political legitimacy, but failed to make substantive change to pedagogy and content.

3.7.2 Curriculum under Christian Nationalist Education

Education in South Africa in the period preceding the country's first general democratic elections of 1994 was characterised by the domination of what was known as Christian Nationalist Education. Christian Nationalist Education was described by Ashley (1989, p. 7) as the 'educational expression of apartheid.' The Christian Nationalist Education movement has a long history in South Africa, having started as early as the 1870s with the establishment of schools in South Africa based on the Calvinistic Christian doctrine (Ashley, 1989). However, it was after the National Party's assumption of political power in 1948 and the 1967 promulgation of the National Education Policy Act, that education for all whites and non-whites came under the influence of Christian Nationalist Education. Christian Nationalist Education was based on the philosophy of *Fundamental Pedagogics*, which drew from Dutch and German education philosophy. In South Africa the philosophy of *Fundamental Pedagogics* had its roots in the traditionally Afrikaans universities, and later spread to the institutions in the black homelands that were dominated by Afrikaners and were under state control (Ashley, 1989). *Fundamental pedagogics* is based on a world view which perceives children as being deficient and in need of adult guidance for proper development. Education is based on strong Christian principles, and children are instilled with a respect for authority, and a strong sense of nationalism. *Fundamental Pedagogics* preached and practised an authoritarian approach to teaching, and suffered from a lack of critical and innovative teaching strategies (Taylor & Vinjevold, 1999) in the classroom. The doctrine was especially strong in the education department of the University of South Africa, which trained large numbers of South Africa's black teachers. Ashley (1989) explains that the apartheid government used Christian Nationalist Education as a vehicle to promote Afrikaner nationalism and segregationist policies according to religion and ethnicity. Christian

Nationalist Education is described by Ashley (1989) as being technist, rigid, authoritarian and conservative. The often quoted features of Bantu Education such as a rote learning, content-based and teacher-centred classroom practices, learner passiveness, positivist approach to knowledge, lack of teacher and parental involvement in curriculum development, and curriculum evaluation through high stakes examinations reflect the grip of the technical curriculum approach on Christian Nationalist Education and ultimately on South Africa's black education.

According to Jansen (1998), it had been the common practice in South Africa for the state to initiate curriculum change through its state controlled education authorities. By 1918, the responsibility to draw up the core syllabus for different subjects had been relegated to the Joint Matriculation Board, whose composition consisted of government officials, subject committees, and university academics. Jansen (1998) states that the mid-1970s saw the beginnings of NGO curriculum reform initiatives that were specifically aimed at black schools, such as the Science Education Project, the Molteno Project and the Fort Hare Project. Their success, however, was limited, mainly due to their failure to take into account other contextual factors that were affecting black education at that time. The end of apartheid and the onset of democracy found black education still under the influence of Christian Nationalist Education, and there was an urgent need to release the country's education system from the firm grip of this legacy of apartheid.

3.7.3 Curriculum in the People's Education movement

From the mid-1980s onwards, there was great uncertainty and confusion in South Africa's education policy circles as numerous highly contested policies and programmes were put forward, debated and trialled to help steer education reform (Kraak, 1998). In the first five years alone after 1994, four White Papers, six Acts of Parliament, and 19 government notices were put in place to effect education reforms in South Africa (Manganyi, 2001). There are three policy discourses whose interplay has had a tremendous influence on post-apartheid curriculum thinking and practice in South Africa: people's education discourse; the systemic discourse and the OBE discourse (Kraak, 1998, p. 1).

The people's education movement curriculum approach is described by Kraak (1998, p. 4) as a radical conceptualisation of curriculum, being driven as it was by the ideals of self-empowerment, political liberation and democratization of education. According to McKay

and Romm (1992), as quoted in Graham-Jolly (2003, p. 10) under the ideologies of the people's education discourse, curriculum was defined as 'a construction that relates to the way in which educational practices are organised through an ongoing experiment both in the classroom and in the wider society'. Graham-Jolly has this to say about this conceptualization of curriculum:

The 'experiment' implied, among other things, the democratisation of education and the adoption of a socially critical approach to curriculum in order to focus on issues of power and domination and the development of a critical consciousness (2003, p. 10)

In his analysis of the influence of the peoples' education movement on curriculum thinking and practices in South Africa, Kraak (1998, p. 3) reports that the movement made very little impact during the late 1980s. He blames this on the repression of curriculum reformist initiatives by the apartheid government, and also on the lack of clarity on the part of the movement's education agenda. Kraak (1998) gives more prominence to the role played by the people's education movement in the growth of the integrated curriculum movement in South Africa. He reports that ideas which are central to curriculum integration, such as the need to bridge the gap between theoretical and practical life, and between mental and manual labour, formed part of the underlying ideology of the movement. In his comparison between apartheid curriculum and that envisaged by people's education, Kraak (1998) writes that the former was set in a rigid subject-based approach, while in the latter, there was mention of integrated studies, and the need to replace rote learning with learner-centredness and the development of critical thinking skills. Unfortunately, before these curriculum ideals could be developed further, the people's education discourse was overtaken by political events and the rise of the systemic discourse that soon followed.

Kraak (1998) reports that only a few ideas of the people's education movement such as the need for integration, persisted into the less radical systemic discourse. He points out that some of the movement's radicalism and curriculum ideas were, however, later to re-emerge under the guise of the OBE discourse (Kraak, 1998, p. 3).

3.7.4 Curriculum in the systemic discourse

Kraak (1998) describes the systemic discourse as having evolved from five major initiatives that were tasked with the development of legislation and policies to support post-1990 structural changes to South Africa's education and training systems. The African National

Congress (ANC) and its ally the Congress of South African Trade Unions (COSATU) played a leading role in the early stages of the evolution of the systemic discourse. A number of policy documents were published as part of this discourse, one of them being the ANC's (1994) discussion document entitled *A policy framework for education and training*. In this document, the ANC education department advanced its vision for the structure of the education and training systems in the post-apartheid era. Kraak (1998) sees the major thrust of this document as being the ANC's proposal to integrate the education and training systems together, culminating with the establishment of a National Qualifications Framework. However, Chapter 13 of this discussion document is devoted to curriculum, pedagogy, assessment and certification. In this chapter, the ANC reiterates its view of the curriculum as being more than subject syllabi.

Within this document, the ANC refers to curriculum as '... all of the teaching and learning activities that take place in learning institutions.' Attached to this definition was a list of criteria to provide more elaboration on this form of curriculum conceptualisation. The criteria included the usual references to aims and objectives of teaching and learning; content; skills and attitudes to be acquired; and strategies to ensure curriculum delivery (ANC, 1994). The criteria also referred to educational resources, the organisation of learners; and the relationship between teachers and learners. The same document also stated that:

... the curriculum must promote unity and the common citizenship and destiny of all South Africans irrespective of race, class, gender or ethnic background. It must be relevant to the needs of the individual as well as the social and economic needs of society (ANC, 1994).

Thus in addition to conventional curriculum roles, the ANC's vision of curriculum included novel roles such as spearheading the removal of the apartheid legacy in the education and training systems, and the promotion of democracy, social justice, relevance and economic development (Kraak, 1998, p. 11). It is also within this document that a core curriculum was suggested for the General Education and Training (GET), and the Further Education and Training bands, the establishment of a National Institute of Curriculum Development to oversee the development and research into curriculum policy and subject curricula in the country. Perhaps more important is the fact that this document also refers to the need to express learning aims in terms of learning outcomes, thus planting the first seed of what was later to develop into an outcomes-based approach to curriculum.

3.7.5 Curriculum in the outcomes-based education (OBE) discourse

The period between 1994 to the present witnessed the demise in importance of the systemic discourse as OBE discourse took hold (Kraak, 1998). Jansen (1998) traces the immediate origins of the OBE discourse in South Africa to the adoption of competency-based approaches to education and training by South African industry during the mid-1980s. Two other sources which contributed to the growth of the OBE discourse in South Africa were the adoption of the ‘outcomes’ model from Britain and New Zealand into the policy discussions of the ANC and COSATU, and the re-emergence of the radicalism and political rhetoric of the People’s Education Movement (Kraak, 1998, p. 22). What was formed when contributions from these vastly different sources came together, was what Kraak (1998, p.22) calls a ‘hybrid educational methodology’, which was progressive in its approach to pedagogy (from people’s education), but at the same time was still steeped in traditional behavioural approaches (from the outcomes model).

As in the case of the systemic discourse, numerous publications played a leading role in the evolution of the OBE discourse in South Africa. Examples of these publications include: the *Curriculum Framework for General and Further Education and Training* (South Africa. DoE, 1995b), *Lifelong learning through a National Qualifications Framework* (South Africa. DoE, 1996), and the first official publication on OBE, *Curriculum 2005: Lifelong learning for the twenty-first century* (South Africa. DoE, 1997). The shift from systemic discourse to OBE discourse was accompanied by a radical change in the way curriculum was conceptualised, and expected to be designed, delivered and implemented (Kraak, 1998; Botha, 2002). The change in curriculum conceptualisation can be seen in the definition of a curriculum framework and curriculum that are contained in some of the publications released as part of OBE discourse. For example, in the document *Curriculum Framework for General and Further Education and Training* (DoE, 1995b), the definition given for a curriculum framework is:

... a set of principles which provides both a philosophical base and an organisational structure for curriculum development initiatives at all levels, be they nationally, provincially, community or school-based (DoE, 1995b, p. 5).

In the same document the curriculum is defined as ‘... term which includes all aspects of teaching and learning such as the intended outcomes of learning, learning programmes assessment and methodology’ (South Africa. DoE, 1995b, p. 41).

Hargreaves and Moore (2000) write that OBE emerged in the United States in the early 1990s, although the Review Committee on C2005 (South Africa. DoE, 2005) note that in South Africa the approach was not completely new, since some of its principles such as progressivism and learner-centredness had been trialled before in earlier curriculum reform initiatives. What is new, however, is the name and shape that the approach took in post-apartheid educational reforms. In Spady (1994, p. 6), OBE is defined as: ‘... focusing and organising everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences.’ In the document entitled *Assessment Policy in the General Education and Training Band, Grades R to 9 and ABET* (South Africa. DoE, 1998b), OBE is defined as:

... learner centred, results-oriented approach to education and training that builds on the notion that all learners need to and can achieve their full potential, but that this may not happen in the same way or within the same period (p. 9).

For most people, OBE is synonymous with defining learning outcomes. Learning outcomes are clear learning results that define what learners should demonstrate at the end of a learning experience (Spady, 1994, p. 13). They are referred to as verifiable statements of performance by Smyth and Dow (1998, p. 291). They represent what should be the end result of a learning process, and relate to what learners can do with what they have learned. Spady (1994) emphasises that learning outcomes do not refer to values, beliefs, attitudes or other psychological states of mind. Neither do they relate to nebulous notions of knowing, understanding, thinking or believing. Instead, they are tangible in the sense that they are actions and performances demonstrated by the learner at the end of learning. As such, learning outcomes are usually expressed in terms of action verbs, such as describe, explain, construct or design (Spady, 1994).

Various models of OBE exist. Countries such as the US, Canada, England, Australia and New Zealand have adopted and adapted OBE to suit their own unique contexts. Drawing on an amalgam of Spady’s ideas and internal transformation ideals, South Africa opted for ‘transformational’ OBE, which represents the most complex form of OBE. This form of OBE aims to radically change the way schooling is structured and operates. Disciplinary knowledge becomes subservient to learning outcomes whose aim is to equip learners with the knowledge, competences and orientation deemed necessary for their success once they leave school (Fakier & Waghid, 2004, p. 59).

The rationales for OBE are many and varied. OBE promotes progressive approaches to teaching and learning, which de-emphasize rote learning and competitive assessment (Donnelly, 2007). The reasons given by Hargreaves and Moore (2000) for the adoption of OBE by schools is that the approach promotes cooperation among teachers, facilitates learner participation in the teaching and learning process, as well as that of their parents. Janse van Rensburg and Potloane (1998, p. 27) contend that the approach helps to guide the teaching and learning processes, while Lubisi, Wedekind, Parker and Gultig (1997, p. 10) believe it helps teachers to develop contextually relevant programmes of learning.

In South Africa, following the end of apartheid, the roles attributed to OBE took on a special significance in the quest to institute reforms in the education system. Todd and Mason (2005) write that in addition to getting rid of the apartheid legacy, OBE was introduced in South Africa's schools as a strategy to enhance learning, and to prepare learners for a globally competitive and technologically sophisticated economy. That the introduction of OBE in South Africa had more to do with political symbolism than inducing practical changes at classroom level has been the topic of numerous articles (see for example, Jansen, 2001; Christie, 1999).

As mentioned before, the adoption of OBE in South Africa has had a tremendous impact on curriculum thinking in the country. Janse van Rensburg and Potloane (1998) discuss how OBE differs from the traditional curriculum approaches that have been employed in South Africa in the past. The first difference concerns how curriculum is developed. Whereas in the past, that responsibility fell on a group of experts who designed a national syllabus for all schools in the country, under OBE, the process calls for the participation of key stakeholders such as teachers, academics, teachers unions and community members. A second difference is that whereas in the traditional curriculum approach, content to be taught was prescribed in subject syllabi and textbooks, under OBE, curriculum frameworks only act as guidelines which help the teacher to select content and activities which are appropriate to the learning outcomes and contexts of the learner. The learning outcomes selected under OBE apply to all learners in the country, and are public knowledge. This differs from what used to happen in the past, when the public had restricted access to what was taught and why it was being taught. Under OBE, learners are expected to be assessed on a continuous basis using a variety of assessment strategies as a means of monitoring their progress towards achieving the

specified learning outcomes. This is unlike in the past where assessment was done to determine how much learners could remember, using once-off high stakes forms of assessment. At the classroom level, OBE demands significant changes to teaching strategies, from those that involve transmission of knowledge to those that facilitate learning. This entails a constructivist view of learning and the use of teaching strategies such as project work and group learning (Donnelly, 2007).

Criticisms levelled against OBE originate from two main sources: the philosophy which underpins OBE and OBE implementation. In South Africa the debate around OBE has been dominated by the latter (see Chapter 5). McNeir (1993) believes that the key to successful OBE implementation lies in drafting workable outcomes, setting manageable goals, adopting transitional measures, allowing time for real change to occur, and a unified and sustainable vision by school leaders. In South Africa, most of these factors are yet to be fulfilled. For example, the Review Committee on C2005 (see Section 6.6) found that the implementation of C2005 was constrained by the structural and design flaws in the curriculum framework; insufficient training provided to educators, lack of good quality teaching and learning materials, and inadequate support given to teachers (South Africa. DoE, 2000, p. 25). It is not only in South Africa that OBE has run into implementation problems. In the United States for example, OBE has been replaced by a standard approach to curriculum that places more emphasis on disciplinary knowledge (Donnelly, 2007). With the review of C2005 over, and its revised version, the National Curriculum Statement firmly in place (see Section 6.6), South Africa still shows a commitment to OBE. Despite the streamlining of C2005, scepticism still remains over the suitability of OBE to the South African education situation (Pudi, 2006).

In South Africa, analytical studies of the philosophical underpinnings of OBE have been less forthcoming than studies of its implementation. An earlier paper by Steyn and Wilkson (1998) pointed to the potential tension in OBE as a result of competition between its various philosophical assumption positions. According to these authors, the four major philosophical assumptions that inform OBE, namely behaviourism, social constructivism, critical theory and pragmatism take on opposing positions on key aspects of curriculum.

It is feared that the radical constructivist approach to teaching and learning that is promoted by OBE, reflected in its central tenets of knowledge integration, group work, learner-

centeredness, and unspecified content, is actually denying learners in South Africa's poor schools epistemological access to high order knowledge and skills, thus contributing to the reproduction of social inequity, the very problem this curriculum approach was supposed to solve (Harley & Wedekind, 2004; Taylor, 2000). This is mainly due to the lack of the appropriate cultural capital in the form of adequate content knowledge, adequate skills and resources among the majority of South Africa's black teachers, unlike in the case of the historically advantaged schools (Harley & Wedekind, 2004). This explains the mounting evidence of superficial and narrow interpretations of constructivism in South Africa's poor and under-resourced classrooms, such as everyday knowledge obscuring formal school knowledge (Taylor, 2000), and group discussions with no teacher guidance or conceptual development passing as group work (Harley & Wedekind, 2004; Taylor & Vinjevold, 1999). Taylor (2000, p. 9) concludes under the poor teaching and learning conditions which exist in the majority of South Africa's schools, radical constructivism in the form of OBE is 'widening existing inequalities in our society.'

The behavioural underpinnings of OBE have been specifically targeted by various critics of OBE. For example, Fakier and Waghid (2004) regard OBE's deep entrenchment in behaviourism and instrumentalism as its major flaws. These authors question the validity of presenting learning outcomes as a finished product to be unequivocally accepted by learners. Waghid (2003) wonders whether learners' ability to be creative and exploring in order to create their own meanings will not be curtailed by the predetermined learning outcomes of OBE. Education should be guided by intrinsic reasons, not by learning outcomes, which represent extrinsic justification for education (Fakier & Waghid, 2004). Writers such as Muller (2000) and Young (2008) critique OBE for its social constructivist approach to knowledge which rejects the distinction between everyday knowledge and discipline-based knowledge. Other criticisms levelled against OBE include what some writers see as over emphasis of affective goals at the expense of academic knowledge, the lack of standardised assessment strategies, the time, effort and costs involved in switching to OBE, and the lack of a comprehensive research base on its implementation and effects as a reform strategy (McNeir, 1993).

Taylor (2000) highlights the urgent need for systematic collection of information on curriculum implementation at different levels of the education system as a means of ascertaining whether the visions expressed in official curriculum policy are being fulfilled or undermined in practice. This is where the research undertaken in this study becomes useful by providing insight into the curriculum interpretation and implementations processes in South Africa's rural and under-resourced education sector.

3.8 CURRICULUM TYPES IN SOUTH AFRICA

An overview of curriculum thinking in South Africa would be incomplete without a discussion of types of curricula. The need to distinguish curriculum types assumes special significance in South Africa, given the country's disparity in school and education quality, first as a legacy of apartheid, and now increasingly as a result of socio-economic imperatives, and the failures of the OBE as a reform model.

The debate on curriculum types in South Africa is usually traced back to two articles on curriculum which appeared in the early 1980s. In the first one, entitled *The curriculum in the decade of the eighties*, Tunmer (1981) took a narrow view of curriculum as the planned activities presented in national syllabus documents. Syllabus documents represent what is usually referred to as the official or intended curriculum. Other documents which form part of the official curriculum include 'national public statements of goals and intent, the legal and administrative framework of the school system, official calendar and time allocations, official lists of prescribed books, and the content and style of the final and intermediate examinations' according to Hawe (1971) as quoted in Buckland (1982, p. 170). In Jackson (1992, p.9) the official curriculum is simply referred to as 'what a school plans to accomplish.' Buckland argued that if the conceptualisation of curriculum is limited to official curriculum documents, it could then be concluded that since in the past, all schools in South Africa were using basically the same national syllabus documents, then all learners were more or less experiencing the same curriculum. The same conclusions could be reached with regard to the centrally produced official National Curriculum Statement documents that all schools throughout South Africa are currently working with.

This conclusion was rightly rejected by Buckland (1982) in his response article to Tunmer, entitled *Curriculum and reality in South African schools*. Basing his arguments on the view that that curriculum represents selections of culture that we want our children to learn,

Buckland (1982, p. 171) wrote that what aspects of culture are actually selected depends on such factors as teacher quality, school facilities, teaching and learning materials availability, and how learners engage in the learning process. It is a well-known fact that despite concerted effort by the post-apartheid government, the majority of schools attended by black learners remain under-resourced and under-serviced (NMF, 2005). The disparity in schools touches on almost every aspect of education service delivery, including teacher training, resources at school and support materials (Naicker, 2000, p. 1). Thus, although South Africa's schools may be working with the same official curriculum documents, individual schools and even individual learners experience curriculum differently. The form in which the curriculum is experienced by the learners represents the actual curriculum. In Jackson (1992) this type of curriculum is called the delivered or enacted curriculum. Buckland (1982) noted that little research had been done to determine the nature of the actual curriculum facing South African children. Since then some progress has been made in this area, for example NMF (2005), Taylor and Vinjevold (1999), and Hoadley (2005). However, apart from the NMF (2005) study, the rest of the studies were based on isolated case studies, which points to the need for more extensive systematic longitudinal studies into South Africa's rural classroom practices.

Apart from official and actual curriculum, Ornstein and Hunkins (2004, p. 15) note the existence of other types of curriculum that operate in schools. They are the: recommended curriculum (that which is recognised by scholars and professional organisations); supported curriculum (that which includes resources such as textbooks and computers which support the implementation of the official curriculum); the learned curriculum (that which learners actually learn); assessed curriculum (that which is tested and evaluated); and hidden curriculum (that which is implicitly taught). This list of curriculum types does not recognise the 'null' curriculum, which according to Jackson (1992), includes course offerings and experiences that are not offered by schools. Jackson (1992) observes that if one follows the trajectory of curriculum within a school, its size seems to shrink until all that is left are the knowledge and skills retained by the learner. Ornstein and Hunkins (2004) express similar views in their conclusion that it is the learned curriculum that is the real curriculum, and that all other types are of secondary importance, although they shape and influence the learned curriculum.

In the context of Eastern Cape rural under-resourced schools, examples of studies which demonstrated differences between the learned and the official curriculum include Ruhinda (2004) whose study showed the absence of environmental learning at two rural under-resourced schools in the Lusikisiki District of the Eastern Cape, despite the fact that 'Environment' was one of the phase organisers (see Section 6.6). Studies by researchers such as Jenkins (2007), Mazingisa (2008) showed that lack of scaffolding and the inadequate OBE-related content in curriculum design and assessment knowledge impeded the ability of teachers to use school gardens as a means of integrating environmental education into the school curriculum. Mbelani (2007) found that lack of educational resources and the poor educational background of her learners hindered effective teaching of visual literacy to her rural class of Grade 10 learners.

3.9 CONCLUSIONS

This chapter started with an overview of curriculum orientations in an attempt to provide clarity on current curriculum thinking and practices. There is much disagreement among various writers as to which typology of curriculum orientations best covers the field. Hence various typologies of curriculum approaches co-exist in literature. The chapter provided a historical overview of curriculum approaches and definitions in South Africa. The dominant curriculum approach in South Africa and the rest of the world is the technical approach, also referred to as the behavioural, technicist, scientific, or logistic-positivist among many other terms. The chapter traced the historical origins of the technical curriculum approach in behaviourism, and discussed the influence of this curriculum approach on how teaching and learning are viewed. The chapter reviewed the emergence of post-apartheid's hybrid curriculum model, OBE. The adoption of this curriculum model instigated major changes to how curriculum is conceptualised, developed, delivered and evaluated. However, OBE is far from being the perfect replacement for the technical approach in South Africa's poorest schools. This stems as much from the problems associated with the implementation of OBE in these schools, as from the contradictions and tensions that arise between and within its major theoretical underpinnings. The chapter ended with a discussion of curriculum types. The distinction between the official and actual curriculum is especially pertinent to South Africa's education context given the great disparity that exists in the learning experiences that is provided to learners.

The next chapter provides an overview of the third major concept that framed the study, namely, natural resource education.

CHAPTER 4

NATURAL RESOURCE EDUCATION

4.1 INTRODUCTION

In Chapter 1 the five major concepts which framed the study were introduced. Chapters 2 and 3 discussed the concept of rural education and curriculum, respectively. This chapter discusses the third major concept which framed the study, namely, that of natural resource education. The chapter begins with a background review of environmental education as education's response to the environmental crisis. The chapter differentiates natural resource education from other variants of environmental education, and provides a rationale for its existence. It outlines various approaches to environmental education and how these have had an impact on how natural resource education is interpreted and implemented in schools. Lastly, the chapter discusses the implications that the concept of Education for Sustainable Development holds for natural resource education.

4.2 THE ENVIRONMENTAL CRISIS

The negative impact that human activities are having on the world's natural environment is a major issue on the world's political agenda. This impact, which is popularly referred to as the 'environmental' or 'ecological crisis', threatens the future survival of the human species and other life forms on Earth, due to the unprecedented levels of disruption and degradation caused to the Earth's life supporting systems (UNEP, 2007). Documented examples of the nature of the environmental crisis highlight common issues across different regions of the world, but also reveal unique regional differences, which require unique regional responses (UNEP, 2007). In the southern African context, environmental problems are generally linked to poverty caused by under development, and take the form of land degradation, loss of soil fertility, decline in water quality and quantity, wildlife depletion, deforestation, and coastal zone degradation, exacerbated by drought or floods, the spread of HIV/AIDS and political instability (Lotz-Sisitka, 2004a).

Irwin and Lotz-Sisitka (2005) trace the roots of modern day concerns over human-induced environmental deterioration to the industrial revolution in Britain during the mid-19th century. Fears were expressed then over the resultant combined effects of mass production of consumables and wasteful demand on Britain's natural environment, as well as over the

spread of social ills such as urban squalor and disease (Irwin & Lotz-Sisitka, 2005). The concern over environmental quality spread to the rest of Europe, the United States and Asia. In South Africa, concern for the environment reached its first peak during the early decades of the 20th Century, fuelled by degradation of the veld, loss of soil fertility and dwindling wildlife as a result of commercial farming (Beinart, 2003). The period after the Second World War witnessed an increase in public interest worldwide in environment quality and management amid calls for a new world order. The mass media of the 1960s and popular writings such as *Silent Spring* (Carson, 1962), *The Tragedy of the Commons* (Hardin, 1968), *The Population Bomb* (Ehrlich, 1968), and *Limits to Growth* (Meadows, Meadows, Randers & Behrens, 1972) did much to raise public concern over the importance of protecting the natural environment.

Political and civic concern over the quality of the Earth's natural environment is reflected in the numerous organisations that have been established at all levels of governance to foster the protection of this unique heritage, which is also central to human well-being. Examples of international environmental organisations which have played a leading role in the re-examination and management of the relationship between humans and the natural environment include the World Conservation Union (IUCN), the World Wildlife Fund (WWF) and the United Nations Environmental Programme (UNEP). South Africa has established national and provincial departments that oversee the use and management of the country's natural environment, for example the departments of water, forestry and fisheries, partnered by parastatal bodies such as the South African National Parks (SANParks), and the South African National Biodiversity Institute (SANBI). Concern over the state of the world's natural environment is also reflected in the number of local, regional and international conferences that have been held over environmental issues. Notable are the United Nations sponsored conferences which include the 1987 Stockholm conference on Human Environment, the 1992 Earth Summit held in Rio de Janeiro, and the 2002 World Summit on Sustainable Development held in Johannesburg. Numerous documents have been produced to shape human interactions with the natural environment, for example the *World Conservation Strategy* (IUCN/UNEP/WWF, 1980), *Our Common Future* (WCED, 1987), *Agenda 21* (UNCED, 1992), the *Earth Charter* (Earth Charter homepage, 2008) and the *Johannesburg Implementation Plan* (UN, 2004). In addition various legal and non-legal frameworks have been put in place to protect the Earth's natural environment. At a global level these include conventions on international trade in endangered species, desertification, and biodiversity.

South Africa is party to all these conventions. South Africa's Constitution not only guarantees all her citizens the right to a healthy environment, but also promotes the protection of the country's natural resources (RSA, 1996d). Recent legislation which has been enacted to protect South Africa's natural environment includes the National Forests Act 84 of 1998, the Marine Living Resources Act 18 of 1998, the Protected Areas Act 57 of 2003 and the Biodiversity Act 10 of 2004, all of which emphasise the important role of education in environmental conservation (see Section 4.6).

4.3 THE NATURAL ENVIRONMENT AND NATURAL RESOURCES

The root cause of the environmental crisis is directly linked to the impact that human populations are having on the world's natural environment. The world's natural resources are a major component of its natural environment, the rest being the natural habitats, ecosystems and their associated ecological processes. In Naidoo (2004) natural resources are referred to as the 'natural capital' from which humans derive various products and services. Natural resources can be categorised in various ways. For example, Rees (1985) distinguishes two major natural resource types: stock/non-renewable resources; and flow/renewable resources. He describes stock resources as those that take millions of years to form, and therefore, from a human perspective, are of fixed supply, for example mineral ores and fossil fuels. Flow resources, on the other hand are naturally renewable within a relatively short time span, and include biological resources such as forests, fish, plants and animals, and non-biological ones such as water, wind and air. However, Jones and Gareth (1997, p. 28) point out that a distinction of resources based on their renewability is not applicable in all contexts. There are other qualities of resources, such as their diversity, ecological harmony, and aesthetic appeal for example, which need to be taken into account (O'Riordan, 1971). For Jones and Gareth (1997), the Earth's natural resources are better placed on a continuum, with clearly non-renewable types such as fossil fuels at one extreme end, and renewable types such as solar energy, landscapes, and tidal power, whose quality but not quantity is affected by human activity, on the opposite end of the continuum. They place the rest of the natural resources such as plants, soils, land, forests and fish along the gradient between these two extremes. Rees (1985) regards the distinction between renewable and nonrenewable resources as useful, since unlike the latter, most renewable resources are not subject to private ownership. For these natural resources, institutions and policies need to be put in place to control their usage, for example, through allocation of access rights and use rights (Rees, 1985). Rees places renewable resources which depend on biological reproduction for their regeneration in a

special group, the critical zone resources. He notes that these resources can be changed into stock resources if the regenerative capacities are disrupted by human activities. Alexander and Fairbridge (1999) point out that the various natural resources, (whatever their type) are all part of the Earth's physical and ecological systems and that their exploitation will always have some effect.

4.4 SUSTAINABILITY, SUSTAINABLE DEVELOPMENT AND NATURAL RESOURCES

The growing influence of environmentalism in the political economy has seen the emergence of new concepts to deal with the challenges posed by the environmental crisis, perhaps the most notable of which are sustainability and sustainable development. From small beginnings in 17th century Europe, and mid-19th century, sustainability and sustainable development, respectively, now not only occupy a prominent position in the environment discourse, but also influence almost every sphere of human endeavour. For example, references to sustainable businesses, sustainable uses, sustainable agriculture, sustainable livelihoods, sustainable tourism, sustainable universities, sustainable cities and now education for sustainable development, are now so common place that it is feared the concept may have been reduced to a mere catch phrase (Lele, 1991).

The various interpretations of sustainability are due to the fluidity associated with the concept, making its operationalisation subject to individual or organisation ideologies, interests and contexts. Right from the earliest conceptualisation of sustainability in Europe, the natural environment, in the form of forest resources formed the central concern of this concept (Vehkamaki, 2003). This concern was later extended to other natural resources such as fisheries and wildlife. According to Lele (1991), when environmentalists talk about sustainability, they are in fact referring to ecological sustainability, which is their core concern. For Lele this approach is concerned with the ecological issues of ecological sustainability. He defines ecological sustainability as 'the existence of the ecological conditions necessary to support human life at a specific level of well-being through future generations' (Lele, 1991, p. 609). This approach to sustainability lays emphasis on the opportunities and constraints that the natural environment presents to human activities, and is thus dominated by issues related to the biophysical dimension of the environment.

However, over time, the concept of sustainability has grown to encompass other aspects of the human environment. The need to adopt this approach to sustainability is reaffirmed by Vehkamäki (2003) who notes that the key elements of sustainability should be about the continuity of not only nature but of human societies as well. This approach to sustainability is also evident in *Caring for the Earth* (IUCN/UNEP/WWF, 1991), the document credited with creating the resurgence of interest in sustainability in modern times, and which extends the concept beyond ecological concerns, to include those of a social and economic nature, and the relations between them.

Lele (1991) makes an important clarification about the inclusion of social aspects into ecological sustainability. While he does not dismiss socio-economic conditions altogether, he writes of the need to distinguish between the social roots of ecological sustainability, and social sustainability. He gives an example of marginalization of the poor as a social cause of cultivation of marginal land, resulting in soil erosion, which is a form of ecological unsustainability. Other examples of social roots of ecological unsustainability would include gender issues, access to education and respect for human rights. Lele (1991) contends that in order to clarify our thinking, such issues need to be distinguished from social sustainability, which relates to the maintenance of desired social characteristics such as values, traditions and institutions.

Despite the gradual shift in focus away from natural entities to social and cultural norms (Loukola & Kyllönen, 2005), the link between the continuity of human well-being and sufficient natural resources and operating ecosystems remains undisputed. This was reaffirmed in the recent Millennium Ecosystem Assessments (2005), which were an international study of the effect of the ongoing environmental degradation on ecosystem services and human well-being. The overriding conclusion of this study was that unless there is radical change in the manner in which the natural environment is treated, the sustainability of ecosystem services on which human well-being depends cannot be guaranteed into the future (Millennium Ecosystem Assessments, 2005). The nine general principles of a sustainable society in *Caring for the Earth* have either a direct or indirect link to the natural environment. They include: the maintenance of ecological processes and life support systems; preservation of genetic diversity; ensuring sustainable utilisation of species and ecosystems; minimization of the depletion of natural resources; and keeping human numbers and life styles within the Earth's carrying capacity (IUCN/UNEP/WWF, 1991). It is apparent that

despite ongoing reconceptualisation of sustainable development, renewable natural resources continue to occupy a central position in this concept. In addition, the limited stocks of most natural resources and the limited capacity of the natural environment to assimilate the wastes of human economic activities remain major incentives for striving towards sustainability.

Closely allied to and often substituted for sustainability, is the concept of sustainable development. Compared to sustainability, sustainable development is a relatively young concept, having surfaced in the mid 20th century, although it achieved fame only in the late 1980s after the publication of the Brundtland report (Lele, 1991). Like sustainability, the exact meaning of sustainable development is a highly debated issue (Mebratu, 1998), and has been a topic for various conferences, articles and books. This arises mostly from the fact that its widely accepted definition as ‘development that meets the needs of present generation without compromising the ability of future generations to meet their needs’ (WCED, 1987, p. 43) is difficult to put into practical terms. Various attempts at redefining and interpreting the concept abound in literature, and Mebratu (1998) advises that the key to understanding this concept lies with the challenge of overcoming the influence of individual or organizational world views. One attempt at operationalising sustainable development is that by Lele (1991, p. 609) for whom sustainable development is ‘a form of societal change that in addition to traditional development objectives, has the objective of a construction of ecological sustainability.’ According to him, it is this definition which dominates the current sustainable development discourse. This concern with ecological issues can also be seen in Goodland and Daly (1996, p. 1002) who define sustainable development as ‘development without growth in throughput matter and energy beyond regenerative and absorptive capacities.’

Sustainable development was the central focus of the 1992 Earth Summit in Rio de Janeiro, Brazil, and the concept formed the basis of all this conference’s major outcomes. For example, *Agenda 21* (UN, 1992), the action plan to hasten world progress towards sustainable development has a strong focus on the protection of the world’s natural environment and ecological processes. This is evident in for example, protection of the Earth’s atmosphere (Chapter 9), land (Chapters 10, and 12), water resources (Chapter 18), and species and habitats (Chapter 15). The series of agreements signed at the Rio conference, for example, the Forest Principles, the Biodiversity Treaty, and the Convention on Climate Change also reflect the natural environment protection undertones that are associated with the original mainstream interpretation of sustainable development. In addition to reaffirming world

commitment to sustainable development, the *Johannesburg Declaration on Sustainable Development* highlights the need for environmental protection and natural resources management as a means of reducing risks to world prosperity, security and stability (UN, 2004). Chapter IV of the *Johannesburg Implementation Plan* (UN, 2004) is devoted to outlining strategies and targets for protection of the Earth's natural base through sustainable development, although not all researchers support the view that emerged from the Johannesburg Summit that neo-liberalism and market forces should be the main driving forces behind these initiatives (see Section 2.7).

4.5 SUSTAINABILITY, NATURAL CAPITAL, AND NATURAL RESOURCES

In the past, economists tended to consider only three forms of capital: human capital (individual knowledge, skills, health and education etc.); social capital (institutional and cultural norms etc.); and human-made capital (buildings and infrastructure etc.). This was mainly due to the fact that until relatively recently human capital and human-made capital were the main limiting factors to economic production (Costanza & Daly, 1992). In addition, there was a general lack of techniques by which environmental services, and environmental degradation due to economic activities (externalities) could be monetized. The world is now in a new era where natural resources are rapidly becoming the limiting factor to economic development. One way natural resources have been conceptualized is as a form of capital which fuels economic activities (Akerman, 2005). This view of natural resources has been promoted by the emerging field of ecological economics, which seeks to bridge ecology and neoclassical economic thinking, and has been adopted by various NGOs and organisations including the World Bank.

According to Akerman (2005), this approach to natural resources was initiated in 1988 by David Pearce who believed that the world's natural resources could be thought of as a form of natural capital from which humans derive a flow of goods and services. In Naidoo (2004, p. 80) natural capital is described as resource stocks that provide beneficial flows of goods and services, and includes those that are potentially renewable such as forests and fish stocks, as well as non-renewables, for example oil and precious metals. Together they form the basis of any economic system. Gough (2005) regards the notion of natural capital as a useful conceptual device for focusing and simplifying human and the natural environment interactions in terms of neoclassical economic theory.

There are certain advantages to perceiving natural resources as a form of capital. Firstly, Costanza and Daly (1992) maintain that conceptualising nature as a form of capital has helped to bring natural environmental concerns and issues into economic thinking and decision-making. Secondly, the approach has contributed to the development of new evaluation techniques and environmental policies which foster the integration of environmental degradation into key economic indicators. An example is the replacement of gross national product (GNP), as a measure of national wealth, with Net National Product (NNP) which takes into account the degradation of a nation's natural environment (Kunte, Hamilton, Dixon & Clemens, 1998). Thirdly, it has helped to clarify understanding and operationalisation of sustainability and sustainable development (Gough, 2005).

Based on this approach to the natural environment, sustainability can be seen in terms of maintenance or non-decline of capital (Goodland & Daly, 1996, p. 1002). Degrees of sustainability vary between weak and very strong depending on how much substitution one believes should be allowed to occur between the different capital types. Under weak sustainability, some of the natural capital can be consumed, i.e. environmental degradation is allowed to occur, as long as it is offset by an increase in the stock of human-made capital. This is unacceptable to supporters of ecological sustainability for whom the different capital types are not perfect substitutes, although they are complimentary (Goodland & Daly, 1996). Researchers such as Costanza and Daly (1992) believe that the minimum necessary condition for sustainability is the maintenance of natural capital at levels which ensure a steady flow of valuable goods and services into the future. According to Gough (2005), there exists a critical natural capital responsible for important environmental functions which cannot be carried out by human-made capital. Therefore, ecological sustainability demands that the current stock of natural capital be maintained or enhanced for future generations, by living off 'interest' rather than off the capital stock. In the southern African rural context, this approach places the protection of key natural resources such as water, forests, fishery resources, wild species, arable and grazing land right in the centre of the sustainability equation.

However, not all writers support this approach to the conservation of the natural environment. For example, McCauley (2006) argues against the use of market-based strategies to protect the natural environment. He contends that such strategies imply that nature is only worth conserving when profits accrue from its human use. McCauley (2006) believes that rather

than adopting approaches which lead to the commodification of nature, effort should be directed towards instilling a love of nature for its own sake among the world's citizens.

4.6 EDUCATION'S RESPONSE TO ENVIRONMENTAL DEGRADATION

The threats to the future survival of life on Earth caused by the degradation of the natural environment have spurred a search for strategies that can be used to counteract, reduce or even remove their root causes. Chief among the recognized strategies is that which involves educating the public, other examples being inter alia policy development, infrastructure provision, good governance and regulation compliance (Lotz-Sisitka, 2004a). The central role of education in addressing the world's environmental challenges has been stressed at numerous environmental conferences. For example, it was at the 1972 Stockholm Conference that the use of education as a means of protecting the environment was first formally recognized, leading to the formation of the International Environmental Education Programme (IEEP), which was mandated with coordinating international efforts aimed at developing environmental education (Gough, 1997). The need for education to help steer the world towards a more sustainable nature-human relationship is also highlighted in many of the key documents that are shaping national and international environmental policies. For example, *Caring for the Earth* speaks of the need for information to be disseminated through formal and informal education so that actions needed to live sustainably are understood (IUCN/UNEP/WWF, 1991, p.8). *Agenda 21* (UN, 1992) devotes the whole of Chapter of 36 to outlining how this can be achieved under the general themes of basic education, education reorientation, public awareness, and training. In addition all the 39 chapters that constitute this document have an education, public awareness and training theme running through them. The role of education in the protection of the environment through sustainable development was strengthened further at the 2002 World Summit on Sustainable Development. In the *Johannesburg Implementation Plan* (UN, 2004) governments are urged to promote education as a key agent of change and to use it as a tool in the various forms of human endeavour such as rural development and health care. In addition, the Johannesburg conference recommended that a decade of education for sustainable development be proclaimed. In December 2002, the United Nations General Assembly proclaimed the period 2005-2014 as 'The UN Decade of Education for Sustainable Development.' The role of education as a driver of change towards sustainable living lifestyles was reaffirmed at the Fourth International Conference on Environmental Education that was held in 2007 at Ahmedabad, India (UNESCO, UNEP & Government of India, 2007).

4.7 THE EVOLUTION OF ENVIRONMENTAL EDUCATION

The emergence of a new field called environmental education and its growing influence in the environmental agenda and in other fields beyond is proof of the role that has been allocated to education as a basis for improving understanding of, and interaction with the natural environment. Fien and Gough (1996, p. 201) describe environmental education as an essential component of the resolution of environmental problems, while for Le Grange (2002, p. 83) environmental education represents education's response to environmental issues and risks. Lotz-Sisitka (2004a, p. 15) sees the role of environmental education as lying in strengthening individual, public and institutional capacities for participation in environmental management.

Concern over the natural environment has been a major driving force behind the development of the field of environmental education. Gough (1997) suggests that the 1960s writings of authors such as Carsons and Ehrlich were in fact a form of education to improve public awareness of the growing ecological crisis. This direct link of environmental education to the natural environment is also confirmed by Irwin and Lotz-Sisitka (2005, p. 38) who note that modern environmental education arose out of concern over increasing and wasteful demand of natural resources during Europe's Industrial Revolution era. Fields that are regarded as being forerunners to environmental education, such as Nature Study, Outdoor Education and Conservation Education, all had the natural world as their core area of interest.

The bias towards the natural environment is reflected in the numerous attempts that have been made to define environmental education. William Stapp's definition of environmental education, which represents one of the first attempts to clarify the field, describes the aims of environmental education as the production of citizens who are '... knowledgeable concerning the *biophysical* environment and its associated problems, aware of how to help solve these problems, and motivated to work towards their solutions' (Stapp, 1969, pp. 30-31, italics mine). The bias towards the quality of the natural environment is also present in the IUCN definition of environmental education, which in addition to being one of the earliest definitions, is also among the most widely accepted (Irwin, 1990). Here environmental education is defined as:

... the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man,

his (*sic*) culture and his (*sic*) *biophysical surroundings* ... (IUCN 1971, italics mine, as quoted in Palmer (1998, p. 7).

The scope of environmental education has gradually broadened over the years (Le Grange, 2003) especially in response to changes to how environment is conceptualized. While in the early years the field focused mainly on issues about the natural environment and human population growth, by the 1900s the scope had widened to include the economic, social and cultural. The first decade of the 21st century is witnessing another change in focus as environmental issues related to global warming come to the fore on the world agenda. At the Fourth International Conference on Environmental Education which was held in 2007 in Ahmedabad, India, achieving sustainable livelihood strategies was highlighted as one of the key aims of environmental education. In one of the conference's documents called *Ahmedabad Declaration 2007: A Call to Action* (UNESCO, UNEP & Government of India, 2007), nations are called upon to reconsider the purpose of education and how it relates to human lifestyles. Among the specific recommendations made to governments is the need to give greater priority to education as an effective tool for inducing long lasting change in people's lifestyles, and a call for environmental education process that are relevant and responsive. The use of the local environment for exploration, and as a source of environmental knowledge and skills is also acknowledged. In the context of the rural under-resourced schools of the Eastern Cape (see Section 6.5), such an approach to environmental education entails the use of teaching and learning approaches that build capacity among learners for critical reflection on the cultural, social, economic and political factors that influence the use and management of local natural resources, and that promote action towards their sustainable utilisation.

4.8 APPROACHES TO ENVIRONMENTAL EDUCATION

The above-mentioned definition of environmental education is only one of the many definitions that exist in literature. Although most environmental education researchers and practitioners share a common belief in the importance of environmental education, they hold widely differing views over not only its definition, but also over its core elements and social purposes (Marsden, 1997). These debates have had a profound effect on the types of approaches and methods seen to be the most appropriate to deliver or implement environmental education programmes. This in turn has influenced how educational issues around natural resources are perceived, approached and pedagogised. Sauvé (2005, p. 2)

speaks of ‘a multiplicity of theoretical and practical possibilities that exist within environmental education’, while Marsden (1997) writes about an ideological gulf between proponents of different approaches to environmental education. Among the better-known typologies of environmental education is the Arthur Lucas’ (1995) education in/about/for the environment model, which corresponds to educational processes, educational content and social purposes, respectively (Marsden, 1997). Robottom and Hart (1993) distinguish positivist, interpretive and socially critical approaches to environmental education based on the type of curriculum models driving the environmental education processes (see Section 3.3).

One of the most comprehensive typologies of environmental education is that by Sauvé (2005), who recognises 15 different variants of what she calls ‘currents’ of environmental education (see Box 4.1 below). Sauvé (2005, p. 12) defines ‘currents’ of environmental education as ‘general ways of envisioning and practicing environmental education’. Each of the 15 environmental education currents recognized by Sauvé is associated with particular conceptions of the ‘environment,’ aims, dominant approaches and major strategies, although there is some overlap across the different environmental education ‘currents.’ Each current contains a variety of specific trends, rather than being a monolithic category (Sauvé, 2005, p. 12). Due to its comprehensive nature, Sauvé’s typology of environmental education provides an effective vantage point from which to analyse trends in environmental education, and how they have played out in the various forms of environmental education that have emerged. Alternatively, the same typology can be used to examine how perceptions of natural resources or the natural environment have helped to shape environmental education trends.

According to Sauvé’s typology (shown in Box 4.1) the naturalistic and the conservationist currents are two of the major approaches to environmental education which focus on the natural environment. While not totally dismissing the natural environment altogether, the majority of the currents take a more relational view of environmental education, and adopt approaches that either take a holistic view of the environment (for example, the systematic and holistic currents), or relegate the natural environment into the background in favour of other constituents that make up the human environment (for example, the feminist and value-centred currents).

Environmental education currents	
1. Naturalist	9. Bioregionalist
2. Conservationist/Resourcist	10. Praxic
3. Problem solving	11. Socially critical
4. Systematic	12. Feminist
5. Scientific	13. Ethnographic
6. Humanistic	14. Eco-education
7. Value-centred	15. Sustainability/Sustainable development
8. Holistic	

Box 4.1 A typology of environmental education approaches (after Sauvé, 2005).

4.9 DEFINING NATURAL RESOURCE EDUCATION

Natural resource education, which is sometimes referred to as natural resource management education or resource use education may be defined as a form of environmental education that focuses on natural resources, their uses and management. Since natural resources are part of the natural environment (see Section 4.3), natural resource education falls under Sauvé's (2005) naturalist current of environmental education (it can also fall under the resourcist current). Natural resource education has been identified as one of the basic concepts and principles needed to explore and engage with in the quest for enhancing human well-being while at the same maintaining or enhancing ecological sustainability (Fien & Gough, 1996). According to these authors, natural resource education can help learners to develop a sound understanding of natural resources, their characteristics, distribution, status, and both present and potential uses. Natural resource education can help learners to make informed decisions on natural resource consumption. It also helps learners to understand the structure and functioning of the natural world, as well as the way different cultures perceive and use resources. Lastly, natural resource education helps to learners to appreciate the effect the use of natural resources have on the biophysical world, and the structure and operation of the political and legal systems that control use of natural resources (Fien & Gough, 1996).

However, the boundaries that delineate the various educational responses that specifically focus on the natural environment, for example, natural resource education, conservation education and nature study are blurred, and what counts as conservation education, nature study or natural resource education may be based more on semantics than on content, approaches or underlying philosophies. For example, soil conservation efforts in South Africa during the mid-twentieth century could easily fall under any of the aforementioned educational initiatives. The situation is further complicated by various offshoots of natural

resource education which target specific natural resources, an extension to the prevailing sectoral approach to natural resource management practices in South Africa.

The sectoral approach to natural resource management is common practice not only at the various levels of South Africa's education system, but also within its informal and non-formal education sectors. What this means is that different bodies run their own environmental education initiatives targeting specific natural resources. For example, the National Department of Water Affairs runs a school-based educational programme called Vision 2020 which trains learners in water conservation and management. The education programmes within the Cape Action Plan for the Environment (C.A.P.E.) are directed at the conservation of biodiversity in the Cape Floristic Region (Raven, 2005). This explains why references to natural resource education (in general) in South Africa's education literature are hard to come by, unlike the case in the US education literature. This does not imply the absence of natural resource education in South Africa's formal education context, but rather that either natural resource education is integrated into other currents of environmental education which take a holistic approach to the environment, or it takes the form of other educational responses to specific natural resources, for example, water education, forest education, biodiversity education and so on. Taken together these various natural environment-related educational initiatives fall under the general umbrella of natural resource education.

4.10 METHODOLOGIES IN NATURAL RESOURCE EDUCATION

4.10.1 Introduction

O'Donoghue (2007) uses the term methodologies to refer to pedagogical approaches in environmental education. His critical historical review of environmental education practices in South Africa reveals the existence of divergent methodologies, which range from top-down communication strategies to those which are more local, critical and participatory (O'Donoghue, 2007, p. 147). He explains the emergence of the various environmental education methodologies in South Africa as being responses to changes in the social, political and environmental risk climate in the country. Approaches to environmental education in South Africa also evolved in response to changes in the country's educational ideologies, especially those which relate to the democratization of the curriculum development process, curriculum approaches, learning theories, and the role of education in South Africa's society (Lotz-Sisitka, 2002). A detailed overview of the major influences which shaped curriculum

development work and other environmental education processes in South Africa during the first ten years after apartheid has been provided by Lotz-Sisitka (2002). Lotz-Sisitka reports that these influences included the NGO Forum Principles (due to their concern for social justice, equity, democracy and social transformation) and the socially critical orientation (due to its empowerment and emancipation undertones). The adoption of the OBE curriculum model (see Section 3.7.5) also introduced major changes in how teachers were supposed to work with the environmental education curriculum, and approaches to teacher professional development. Chief among these changes were the replacement of the behavioural approach to learning with one which is learner-centred and constructivist, and the adoption of a cross-curricular approach to environmental education.

The main aim of the following five subsections is to illustrate how changes in environmental education thinking and in curriculum and pedagogical approaches have impacted on natural resource education practices, especially in the classrooms.

4.10.2 Natural resource education as conservation messages

Natural resource education in the form of conservation messages represent one of the earliest approaches to the field, and involves top-down media and extension campaigns to get a conservation message across to a target group (O'Donoghue, 2007, p. 145). This approach to natural resource education falls under Sauvé's (2005) conservation current of environmental education. In South Africa, conservation messages from governmental and non-governmental conservation agencies during the mid-twentieth century played a pioneering role in rallying support against the extinction of wild game, the destruction of natural habitats, and soil erosion (Irwin & Lotz-Sisitka, 2005). This approach to natural resource education is based on the premise that natural resource degradation is the result of unawareness among the populace, and that increasing the level of awareness will cause the required changes in attitude, values and behaviour (O'Donoghue, 2007, p. 145). The use of conservation messages as a form of natural resource education is based on the technical or behavioural curriculum model (see Section 3.6), which has dominated environmental education thinking in the past. This curriculum approach involves the pre-specification of learning objectives in the form of expected behavioural outcomes to be achieved, and the instructional strategies to achieve them (Hudson, 2001). This curriculum approach is evident in the Belgrade Charter, one of the key documents that shape environmental education practices worldwide, in which the objectives of environmental education are given as: the fostering of environmental

awareness; promotion of environmental knowledge and skills; and the creation of new patterns of behaviour (UNESCO/UNEP, 1976).

Commenting on the impact that the technical curriculum model has had on environmental education practices, O'Donoghue (1986, p. 18) notes that the central goal of environmental education is reduced to an awareness communication process. Within this approach, the aim of environmental education/natural resource education is to reinforce positive behaviour concerning natural resources through the transmission of what is deemed as necessary knowledge and its acquisition by learners. In Janse van Rensburg and Lotz-Sisitka (2000, p. 30) for example, it is reported that the teachers who participated in the *Learning for Sustainability Project* viewed the lack of awareness as the cause of environmental problems, and regarded environmental education as the means by which this deficiency could be addressed. Critics such as O'Donoghue (1993) question the behavioural modification approach to learning that is evident in this approach, arguing that it based on a wrong assumption that directly links information acquisition to required behavioural changes. Hence there has been a shift away from pedagogical approaches that emphasise top-down communication strategies to those that help to integrate social justice and ecological sustainability into the education process (O'Donoghue, 1993). For example, activities of the Biodiversity Conservation Education Programme which operates under C.A.P.E (see Section 6.8) include capacity building among local communities, resource material development, and providing support to schools (Raven, 2005).

4.10.3 Natural resource education as Science education

This approach to natural resource education represents what Sauvé (2005) calls the scientific current. It is also underpinned by the technical approach to curriculum, and places emphasis on the development of knowledge and skills deemed essential for effective decision-making. According to Schulze (2005), the preferred knowledge is that which is factual or is of a simple procedural nature, and that which is objective and easily assessed (Stevenson, 1993). Basic principles in ecosystem structure and functioning fall under these categories of knowledge. This explains the rapid increase in the number of institutions and courses offering ecology as a subject at all levels of formal education (Le Grange, 2003). According to Le Grange, ecology first became part of the formal schooling system in South Africa in the 1970s. The preferred methods of pedagogy within this approach to environmental learning include experiments, objective observation and scientific quantification (Kyburz-Graber,

1999). The inclination towards positivism so apparent in this approach ensured that the natural sciences became the home of environmental education, including natural resource education, which approach was still dominant in South African schools in the 1990s (Le Grange, 2003). Biology was seen as the natural home of ecology, and agriculture that of soil conservation knowledge. Le Grange (2003) points to the disregard for qualities normally associated with environmental issues, such as emotions, beliefs, aesthetics and political factors, that is promoted by this approach. By ignoring the link between environmental quality and issues of social justice, this approach to environmental learning fails to address the real social, economic and political causes of environmental degradation, and unintentionally promotes the maintenance of the status quo (Hudson, 2001). At the same time the approach regards expert-produced knowledge as the only form of valid knowledge. Another limitation of this approach has been the tendency for natural resource education (environmental education) knowledge to be produced by external experts, with minimal input by local schools and communities. It is then packaged into teaching and learning materials such as text books and teaching guidelines, to be transmitted to learners, who are assumed to receive it through rote learning (Hudson, 2001).

4.10.4 Natural resource education as nature experiences

Another early approach to natural resource education is that which is based on the interpretivist or practical curriculum model, which values experiential learning (see Section 3.4). This approach to natural resource education developed as public interest in ecology grew, and alienation from nature was seen as contributing to environmental degradation (O'Donoghue, 1986, 1993). Natural resource education as experiential learning is similar to conservation messages in that it aims to create environmental awareness. However, unlike conservation messages, this approach to natural resource education creates hands-on learning opportunities for learners to engage with wild nature, as a strategy to help urban-based learners reconnect with nature (O'Donoghue, 1986, 1993). Under Sauv e's typology of environmental education, natural resource education as experiential learning falls under the naturalist current (Sauv e, 2005). The purposes of the nature experiences are to develop an understanding and appreciation of the natural environment through first-hand observation, and to stimulate a reconsideration of attitudes and behaviour towards nature (Stevenson, 2007). Sauv e (2005) explains that the nature experiences can be of a cognitive, affective, spiritual, or sensualist nature, and involve the use of various strategies such as immersion, interpretation, sensorial games and discovery activities. The range of nature experiences on

offer to learners has gradually broadened to include local audits of environmental quality, and inquiry and problem-solving. This was in response to criticisms that nature experiences alone were not enough to cause the desired behavioural changes, and to South Africa's post-apartheid experimentations with constructivist approaches to learning (O'Donoghue, 2007, pp. 147-148).

In addition to natural resource education, there are other educational approaches that have developed to provide nature experiences. Among the better known are nature study, outdoor education, rural education, environmental studies, and adventure education (Palmer, 1998). However, the boundaries between these various education initiatives are not always clear cut, and it is difficult to discern for example, where nature study and natural resource education start and end. In Palmer (1998, p. 23) nature study is referred to as a field which involves learning about plants and animals, together with physical systems that support them, a description which can also be applied to natural resource education. Nature study first emerged in Europe in the mid-1850s from where it spread to United States and the rest of the world (Fazio, 1975), including South Africa. According to Fazio (1975), the roots of a number of key ideas associated with modern interpretations of environmental education, such as experientialism, and interdisciplinary and interpretivist approaches can be traced back to nature study. However the field came under increasing criticism over what was seen as faddism, superficiality and emotionalism, and by 1920 had gone into decline (Fazio, 1975).

The link between natural resource education and outdoor education is less direct than is the case with nature study. Both nature study and outdoor education (and natural resource education) provide nature experiences, although they are driven by different philosophies and processes (Irwin, 1990, p. 4). Outdoor education was seen as a means of enhancing learning and teaching outside the classroom, and was closely associated with adventure activities such as climbing, canoeing and hiking which were meant to encourage appreciation and respect for nature (Palmer, 1998). Outdoor education originated in the 1940s as a form of resistance to the prevailing political influences and holistic approaches in environmental education, and its programmes were usually delivered at specialist centres rather than formal schools as is the case for nature study (Irwin & Lotz-Sisitka, 2005). By the mid-seventies, in some of the black homelands of South Africa, for example KwaZulu, KaNgwane and Boputhatswana, outdoor educational programmes jointly run by the departments of education, conservation NGOs, and provincial conservation agencies were on offer to rural communities and learners. Other

outdoor education initiatives in South Africa involved the National Environment Awareness Council (NEAC) and learners residing in Soweto, South Africa's largest black township, and the Veld schools which were set up by the Transvaal Department of Education to cater for white learners. In South Africa, outdoor education gradually lost favour after 1982, and became increasingly overshadowed in national policies and practices by the developing field of environmental education which offered a broader take on environmental issues (Irwin & Lotz-Sisitka, 2005). This is unlike in Europe and in the United States where outdoor education still constitutes a dominant form of environmental learning (Irwin & Lotz-Sisitka, 2005).

4.10.5 Natural resource education as socially critical education

Stevenson (2007) notes that the above traditional approaches to environmental education are relatively easy to accommodate in schools since they do not challenge the existing socio-economic and political structures, and are thus compliant with the traditional role ascribed to schools, namely that of maintaining existing social order. To overcome the 'head and heart' approach associated with the above-mentioned approaches to environmental learning, since the 1980s there has been a call for approaches that go beyond passive reception of environmental information or nature experiences, to those that actively involve learners in solving real environmental issues in their communities (White, 2004; O'Donoghue, 1993). Such approaches to natural resource education are based on socially critical theory, and constitute what Sauv  (2005) calls the socially critical undercurrent of environmental education. This approach to natural resource education is based on a critical approach to curriculum (see Section 3.4) which seeks to empower learners to question existing power relations and ideologies, and to take action towards solving environmental problems in their local communities. This approach became increasingly popular in post-apartheid South Africa, as education took on a transformation of society agenda, and environmental education in the form of participatory action research studies was seen as promoting social and environmental justice (O'Donoghue, 2007; Lotz-Sisitka, 2002).

Schulze (2003) identifies two important ideals of critical environmental education: social justice for all and transformation of society. This view of environmental learning is also supported by Kyburz-Graber (1999) who maintains that only by questioning the nature of underlying dominant social and political practices can the root causes of environmental degradation be understood and mitigated. Thus in critical environmental education, the

emphasis shifts from curriculum content to the processes (Huckle, 1990). In Firth and Plant (1996, p. 199) critical environmental education is defined as ‘... a process of developing capacities for intelligent social action, rather than one of transmitting discrete elements of knowledge.’ Factual knowledge transfer is replaced by real life environmental problems in the community, which the learners investigate and solve. As a result learners develop reflexive and critical thinking skills and political literacy capacities as they critique the ideological and social dynamics which contribute to environmental problems (Firth & Plant, 1996).

However, critical environmental education has been difficult to implement in schools and has met limited success, not only in South Africa, but worldwide as well (Stevenson, 1993, 2007). O’Donoghue (1986, 1993) reported that didactic teaching and experiential learning still form the cornerstone of environmental learning approaches in South Africa, and Gough (1997) found little evidence of learner engagement with socially transformative education in Australia. Among the criteria identified by Walker (1997, p. 156) as being essential for successful critical environmental education in schools are inter alia suitably qualified teachers, committed teachers and communities, financial support, and problems that are solvable by learners. The majority of rural under-resourced schools in the Eastern Cape seem to be predisposed against this approach to environmental learning, due to their isolated nature from centres of political influence, lack of resources and under-qualified teachers. According to Greenall (1987), teachers would rather teach students about politically safe topics such as ecological principles, than engaging them in the transformation of community power structures. In addition funding of activities related to critical environmental education such as information gathering and reporting can place a strain on the schools’ financial resources. In the *Learning for Sustainability Project* report (Janse van Rensburg & Lotz-Sisitka, 2000) it was noted that teachers’ lack of environmental knowledge and lack of access to information compromised the quality of environmental learning that took place in their classrooms. Kyburz-Graber (1999, p. 160) places the blame on the nature of critical theory itself, which the author argues does not provide learners with viable strategies for social action. At the same time there are researchers such as Scott and Outlon (1999) who are critical of the dominance of critical approaches in current environmental education thinking, and although they regard it as a valuable tool, doubt whether it is appropriate in all contexts. Such researchers call for multiple approaches to environmental learning.

4.10.6 Natural resource education as education for sustainable development

In Sauv  (2005) education for sustainable development falls under the sustainable development current. The growing interest in education for sustainable development has come about mainly as a result of the adoption of sustainable development as the common goal of environmental protection and socio-economic development, its reaffirmation and strengthening at the 2002 Johannesburg Summit, which culminated in the declaration and adoption of the UN Decade of Education for Sustainable Development. In addition, the drive towards achieving the Millennium Development Goals targets (especially Goal 7) and those of Education for All (see Section 2.7) have increased support for educational approaches that address social and economic considerations when dealing with environmental issues. Education for Sustainable Development is described as:

... a dynamic concept that utilizes all aspects of public awareness, education and training to create or enhance our understanding of the linkages among the issues of sustainable development and to develop the knowledge, skills, perspectives and values which will empower people of all ages to assume responsibility for creating a sustainable future (UNESCO, 2002).

The overriding goal of the UN Decade of Education for Sustainable Development, as stated by UNESCO, its main implementing agency is:

To integrate the principles, values and practices of sustainable development into all aspects of education and learning. This education effort will encourage change in behavior that will create a more sustainable future in terms of environmental integrity, economic viability and a just society for present and future generations (UNESCO, 2002).

During the Decade of Education for Sustainable Development, governments have been called upon to integrate sustainable development into all levels of education, and into national Education for All plans, as well as to provide their citizens with lifelong learning opportunities in education for sustainable development (Lotz-Sisitka, 2004a, p.18).

The relationship between environmental education and education for sustainable development remains a hotly debated topic. Some environmental education practitioners such as Sauv  (2005) and Rose and Bridgewater (2003) argue that environmental education and education for sustainable development are the same thing under different names. Lotz-Sisitka (2004a, p. 59) maintains that education for sustainable development is not new in the southern Africa context, and lists various practices that are common to both environmental

education and education for sustainable development practices in the region, such as the focus on social issues, and the application of holistic, social critical and reflexive approaches. However the above authors acknowledge that sustainable development provides a rich opportunity for the various education initiatives to work together towards a common goal. Other environmental education practitioners such as McKeown and Hopkins (2003) who write from a North American perspective see environmental education and education for sustainable development as totally different concepts, driven by different philosophies and goals, but which are capable of existing side by side, each enriching the other. These researchers see education for sustainable development's holistic approach to sustainable development as a means of overcoming the limitations of the North American ecological focus in environmental education, a perspective which is dismissed by environmental education researchers elsewhere as offering a narrow view of environmental education. Yet others like Knapp (2000, p. 34), writing from a Western European perspective, acknowledge the major flaws inherent in current environmental education pedagogic practices, such as the lack of sequential learning, the over-reliance on activity guides and the failure of the infusion strategy, and see them as valid reasons for sidelining environmental education. A major issue of contention around education for sustainable development that is noted by Jickling and Spork (1998), and McKeown and Hopkins (2003), centres around the instrumentalist approach to education that education for sustainable development promotes. This point is elaborated on by Scott (2002) when he argues that learners should be given the opportunity to critically explore sustainable development and its implications for their lifestyle decisions, instead of simply accepting the concept at face value, which is tantamount to educational indoctrination.

What comes to the fore in the various definitions and clarifications of education for sustainable development by its proponents is the foregrounding of sustainable development as the premier solution to the world's environmental and socio-economic problems, and the promotion of education for sustainable development as the better strategy towards achieving that goal. Doubts have been expressed over the wisdom of basing the world's education system on a loose and context-dependent concept such as sustainable development. Sauvé (2002) as quoted in Lotz-Sisitka (2004a, pp. 50-51) questions the logic of promoting education for sustainable development as the universal solution in all environment versus development contexts. As Lotz-Sisitka (2004a, p. 22) comments, '... the ambiguous nature of education for sustainable development extends to its application as a goal of education.' She

further comments on the rising influence of neo-liberalism in the education for sustainable development discourse, and with it the increasing threat that natural environmental concerns will be subsumed by those that are of economic and social origin. She is concerned that this could eventually lead to a complete reconceptualisation of sustainable development, and with it that of education for sustainable development, to the detriment of natural environment protection. Jickling and Spork's (1998) main concern with education for sustainable development stems from the prevalence of education for sustainable development interpretations that are shallow, a fact to which Lotz-Sisitka, Olvitt, Gumede and Pesanayi (2006, p.3) allude when they refer to the lack of a deep engagement with sustainable development in the southern African region. They further note that education for sustainable development activities in the region are hampered by inadequate research and knowledge about sustainable development and its implications within the southern African context.

What implications does the ongoing education for sustainable development debate have for practitioners of natural resource education in the rural schools of the Eastern Cape? What insights into sustainable development or education for sustainable development gained from this debate can be used by natural resource education practitioners to inform and improve their practices on the ground, as well as advancing their field? Firstly, given the heavy reliance on natural resources and ecological systems that exists in South Africa and the rest of southern Africa, and the over ambitious all encompassing nature of education for sustainable development, the need for educational approaches that specifically address ecological integrity is unlikely to go away. Hence, education for sustainable development and natural resource education are likely to co-exist, in the same way that environmental education or any other form of environmental education, such as nature study and conservation education co-exist. Teachers at rural schools in the Eastern Cape need to be encouraged to view natural resource education and education for sustainable development as complimentary, rather than opposing forces. This will be in accordance with the view expressed in the *Ahmedabad Declaration* (UNESCO, UNEP & Government of India, 2007) that environmental education processes should be seen as supporting and championing education for sustainable development. Secondly, natural resource education practitioners need to be aware of the contextual nature of sustainable development, to critically engage with it, and to realign their natural resource education objectives and principles accordingly. It is unlikely that natural resource education practices will be uniform for all contexts. The effectiveness and success of education for sustainable development or natural resource education in a specific context will

depend on the availability of the necessary knowledge and skills in that context. This is where research on the use and management of local natural resources in rural Eastern Cape becomes important. Such research needs to be coupled to innovative ways by which local schools and their communities can get actively involved. Lastly, natural resource education stands to gain by collaborating more with other education initiatives such as peace education, health education and gender education since they are working around the same goal of sustainability, and each has expertise and strengths to enrich others. However, natural resource education practitioners need to guard against the loss of natural resource education strong points such as its emphasis on the natural environment, its foundation in the strong model of sustainable development (see Section 4.5), and its contribution to education quality in rural areas of South Africa (see Section 1.3.3).

4.11 CONCLUSIONS

This chapter looked at natural resource education as one of the major concepts that framed this study. The chapter started with a description of the nature of the environmental crisis. Environmental education has evolved as the major education response to the environmental crisis. Despite the broadening of the concept of 'environment' to encompass sociological, political and economic dimensions, the protection of the world's natural environment remains a key area of concern. Ecological sustainability seeks to protect the world's natural capital, of which natural resources are a major component. Natural resource education, conservation education, and nature study are examples of forms of environmental education which make the natural environment their core area of concern. Natural resource education is a form of environmental education which focuses on the management and sustainable use of the world's natural resources. Given South Africa's sectoral approach to natural resource management, natural resource education exists as, for example, water education, forest education, biodiversity education and so on. There have been shifts in emphasis on how natural resource education should be taught in schools, parallel to changes which have taken place in environmental, social, political and educational thinking. Like other forms of environmental education, natural resource education practices are characterized by transfer of factual knowledge, and the provision of natural experiences due to the dominance of the technist and interpretive curriculum models in schools. Despite much rhetoric about critical theory, the critical approach to natural resource education is yet to have a major impact in formal education, mainly as a result of its incompatibility with current school organization and perceived school roles. The chapter ends with a discussion of the relationship between

education for sustainable development to natural resource education. Given the central position of natural resources in the economies of southern Africa, especially in the survival of the region's rural poor, the need for natural resource education in this region is unlikely to diminish, despite the increasing marginalisation of environmental education by education for sustainable development. Due to the fluid nature of sustainable development, there is a need for natural resource education practitioners to engage critically with this concept, before jumping on the education for sustainable development bandwagon. Nevertheless the two approaches to environmental learning can co-exist, each enriching the other.

The next chapter discusses the fourth major concept that framed the study, namely that of curriculum integration. It provides an in-depth look at curriculum integration as a backdrop to the analysis of how this central tenet of OBE is being implemented in rural under-resourced schools in Eastern Cape. .

CHAPTER 5

CURRICULUM INTEGRATION

5.1 INTRODUCTION

As explained in Chapter 1, the overriding goal of the study was to analyse the extent to which natural resource management is integrated into school documents, practices and activities that are produced/conducted at different levels of pedagogic discourse in a rural disadvantaged educational context. Hence curriculum integration was one of the major concepts which framed the study (see Section 1.3). This chapter provides an overview of the concept of curriculum integration. The chapter begins with a brief discussion of the importance of curriculum theory in guiding curriculum thinking and practice regarding South Africa's rural disadvantaged education sector. This is followed by a mapping of the curriculum field in order to locate the position of curriculum integration as a study area, and to illustrate how it relates to the rest of the curriculum field. Next the chapter reviews the major issues in curriculum integration discourse, as well as trends in curriculum integration policies in South Africa's schooling system. The chapter ends with a discussion on research in the curriculum integration field.

5.2 ON CURRICULUM THEORY

The formulation of school curriculum policy in post-apartheid South Africa still remains top-down despite attempts to democratise the process by making it more transparent and participatory (Jansen, 1999b; Christie, 1999). As mentioned earlier, much of what is going on in terms of curriculum implementation at South Africa's rural under-resourced schools remains uninvestigated. What research exists points to a general misfit between curriculum policy and practice at most of South Africa's poor schools (Taylor, 2000). There is a dire need for curriculum theory to guide the development and implementation of curriculum reforms in this sector of South Africa's education system. Research projects such as this study serve the useful purpose of generating more understanding of the curriculum interpretation and implementation processes at South Africa's rural and under-resourced schools, thereby helping to bridge the gap that exists between the official and the enacted curriculum at these schools (see Section 3.8).

Curriculum theory as defined by Beauchamp (1982, p. 24) is ‘... a set of related statements of propositions that gives meaning to phenomenon related to the concept of curriculum, its development, its use and its evaluation.’ Beauchamp (1982) believes that the development of curriculum theory involves three processes: defining, describing and predicting. Together the three processes contribute to the generation of knowledge and betterment of practice in the curriculum field. Beauchamp sees curriculum theory as playing a guiding role to curriculum theorists in that it provides them with a means by which to organize their thoughts and work. Another role of curriculum theory is to facilitate the generation and analysis of data, the organization of concepts and the formulation of new ideas and relationships. Without curriculum theory it is unlikely to understand the dynamics of curriculum fully, for example as they relate to curriculum development, the types of stakeholders involved, and the nature of their involvement (Ornstein & Hunkins, 2004). Another writer who supports the creation of curriculum theory is Short (1985, p. 241) who believes that curriculum theory helps to organise curriculum knowledge into a useful and meaningful form which can be used to inform curriculum research, thought and practice. Another role attributed to curriculum theory concerns the facilitation of communication among researchers and practitioners within and outside the curriculum field (Beauchamp, 1982). Beauchamp regards this communication as necessary to overcome the confusion that is caused by different viewpoints, and the lack of adequate knowledge that prevails in the curriculum field. However, Ornstein and Hunkins (2004) believe that the complexity of the curriculum field precludes the generation of precise answers, and suggest that what we should instead aim for is a better understanding of the field.

5.3 CURRICULUM DOMAINS

Despite the important roles attributed to curriculum theory, Beauchamp (1982, p. 24) described the state of curriculum theory development as being in a ‘shambles.’ Almost 25 years after Beauchamp’s observation, Ornstein and Hunkins (2004) note that curriculum theory is the least appreciated foundation of curriculum, and that it is treated with suspicion by most educators, who doubt its usefulness to curriculum delivery and implementation. Ornstein and Hunkins (2004) identify two major sources of curriculum theory. The first source is comprised of what they call foundation areas of curriculum. These are areas of knowledge which are external to the curriculum field but which act as a source of theories and ideas that are relevant to the curriculum field. Among the examples named by Ornstein and Hunkins as belonging to this group are philosophy, sociology, psychology and

economics. The second source of curriculum theory comprises what are called domains of curriculum knowledge. Ornstein and Hunkins (2004, p. 16) define curriculum domain as ‘...the significant and indispensable curriculum knowledge necessary to conduct research and make theoretical and practical decisions about curriculum’. They explain that whereas the curriculum foundation areas form the external boundaries of the curriculum field, the curriculum domains define its internal boundaries.

Ornstein and Hunkins’ definition of domains is in line with that of Behar (1994, p. 101) who refers to them as content areas within a discipline that are studied in order to improve the knowledge base within the field as well as its practices. There is deviation among the various curriculum researchers as to the exact number of domains that constitute the curriculum field. Not only do the numbers of recognized curriculum domains differ among the various researchers, but also the terminology used to label them. For example, according to Beauchamp (1961) cited by Behar (1994, p. 102) only three curriculum domains are recognized, namely, planning, implementing and evaluating. Another example cited by Behar (1994, p. 102) is that by Foshay and Beilin (1969) whose curriculum domains are: theory, design, and change. Behar’s own project to identify curriculum domains involved the analysis of curriculum textbooks that were published between 1970 and 1990. He lists over ten curriculum domains among which are philosophy, research, design, history, change, development, implementation, evaluation, and curriculum as a field of study (Behar, 1994, pp. 103-107).

Ornstein and Hunkins (2004, p.19) attribute the lack of consensus on the number curriculum domains to the use of different methodologies by various theorists to identify them, and the lack of an agreed-on theoretical base in the curriculum field. Ornstein and Hunkins advise that the best individual researchers can do is to declare their preference for a curriculum domain model that they wish to promote. However, they maintain that of all the various curriculum domains, the two that are most crucial in any discussion on curriculum, are those of curriculum development and curriculum design.

5.4 CURRICULUM DEVELOPMENT

Curriculum development is one curriculum domain that is widely recognised by most curriculum theorists, and analysing curricula in terms of development is one of the most common approaches to researching curricula (Ornstein & Hunkins, 2004, p.16). Unlike most

other curricular issues, there is a common agreement as to what constitutes knowledge and practice in the curriculum development domain. According to McKernan (2008, p. 32) curriculum development is a systematic and critical process, which usually involves several steps or stages, such as planning, implementation, and evaluation of courses of study and patterns of educational activity. Behar (1994, p. 105) describes the domain of curriculum development as being concerned with the procedures necessary for developing curriculum plans, and addresses questions such as who is involved in making decisions over issues such as the selection of subject matter and learning experiences, and the structure and organisation of the curricula. Ornstein and Hunkins (2004) agree with this view of practices within the curriculum development domain. They also explain that the aim of conducting research on the curriculum development domain is to show how curriculum evolves or is planned, implemented, and evaluated, as well as identifying the stakeholders and the various procedures that form part of the process. Recent examples of work reporting on curriculum development in South Africa include Lotz-Sisitka (2002) for environmental education, Chisholm (2005) for the Revised National Curriculum Statement (Grade R-9), and Bertram (2008) for the National Curriculum Statement for Grade 10-12 History.

5.5 CURRICULUM DESIGN

Unlike the domain of curriculum development, that of curriculum design is still being openly debated as to its boundaries, knowledge base and practices (Ornstein & Hunkins, 2004). Johnson (1969) describes this domain as characterised by disagreement and confusion. Part of the confusion stems from the mix-up between definitions of curriculum development and those of curriculum design. The mix-up stems from the fact that both domains essentially deal with the same curricular variables, such as curricular plans, objectives, subject matter and learning experiences. This unclear delineation between curriculum design and curriculum development is evident in some definitions of the curriculum design domain. For example, Kimpston and Rogers (1987, p. 466) regard curriculum design as the specification of curriculum ends and structure, and the selection of purposes, goals and objectives. Another source of confusion that is identified by Behar (1994, p. 235) is the fact that curriculum design can be used both as a noun and a verb. He explains that when used as a verb, curriculum design refers to the actual process of creating a curriculum with a particular organisation of key elements, and is synonymous with curriculum development. This approach to curriculum design is evident in Kimpston and Roger's definition of curriculum design cited above.

An increasingly more accepted view of curriculum design is to treat the concept as a noun. In such cases curriculum design is synonymous with curriculum organisation (Ornstein & Hunkins, 2004, p. 235). This approach is evident in Johnson's (1969, p. 3) definition which refers to curriculum design as the organic arrangement of curricular elements. Another writer who holds the same view of curriculum design is Short (1985, p. 3) for whom the concept refers to the important components of curriculum as well as the pattern of their relationship to each other. For Ornstein and Hunkin (2004, p. 235) curriculum design is the actual arrangement of the parts of a curriculum plan.

According to the latter view of curriculum design, the major curriculum components whose arrangement determines the nature of curriculum design are goals and objectives, subject matter, learning experiences and evaluation processes (Ornstein & Hunkin, 2004, p. 236). These authors also contend that questions such as "What are schools for?" "What should be taught in schools?" and "What learning theories should be used?" lead to decisions about curriculum design. In addition Ornstein and Hunkin state that answers to these questions are rooted in one's worldviews, beliefs and value systems. The issue of curriculum conceptualization (see Section 3.2) is especially pertinent to curriculum design decisions. The implication of this is that the process of determining which curriculum design is more of a value-laden process than a clear-cut technical or scientific exercise (McKernan, 2008, p. 57). Prevailing socio-economics, political, cultural and educational factors also play contributory roles (Ornstein & Hunkin, 2004; O'Donoghue, 2007; Lotz-Sisitka, 2002) (See Section 3.7).

5.6 ARRANGEMENT OF CURRICULAR CONTENT

Goodlad and Su (1992, p. 323) make the observation that although there is abundant literature on curriculum design or organisation, most of it is either conceptual or descriptive, and is rarely based on empirical research. Of the various curricular elements whose nature and organisation determine curriculum designs, that of content or subject matter has stirred much debate among curriculum theorists and practitioners. The bias towards the mastery of factual knowledge by learners that characterised schooling in the past has contributed to the popularity of curriculum designs that give prominence to content over other curricular design elements (see Section 3.6). However, increasing interest in other approaches to schooling has seen the dominance of the content-centred curriculum design being questioned, and calls made for other alternatives, such as learner-centred and problem-centred designs as is

embodied by OBE (see Section 3.7.5), although these are yet to be widely accepted or effectively implemented.

Curriculum theorists use concepts such as scope, sequence and continuity (which Goodlad & Su call common places of curriculum organisation), to describe curriculum design. Ornstein and Hunkin (2004, p. 240) divide these curriculum design features into two groups. Sequence and continuity are used to refer to the vertical organisation of a curriculum, which is the longitudinal arrangement of its elements. Curriculum design features such as integration and scope describe the horizontal organisation of a curriculum, which is the side by side arrangement of the curricular elements. Ornstein and Hunkin (2004, pp. 244-245) state that of the features that constitute curriculum design, *integration* has received considerable attention, and will continue to do so in the future.

5.7 CURRICULUM INTEGRATION

This section looks at curriculum integration in general. For a perspective on curriculum integration in South Africa see Section 5.8 below.

The concept of curriculum integration enjoys much attention from curriculum theorists and practitioners. This is especially so in the environmental education movement where this approach to curriculum is seen as most appropriate for addressing the multifaceted nature of environmental challenges and risks. While an integrationist approach to environmental education is now widely accepted, the debate over which form of curriculum integration to adopt persists, although the cross-curricular approach seems to have received wider acceptance than other integration approaches (Lotz-Sisitka, 2002).

More confusion around curriculum integration stems from the various ways the concept is interpreted by different writers and schools. Venville, Wallace, Rennie, and Malone (2001) commented on the wide array of projects that fall under the general term of *integrated*, while Case (1994) fears the concept has been reduced to an empty slogan. Case (1994) blames the vastly different interpretation of the concept on the ambiguous and open way it is defined. This not only causes uncertainty among teachers on how to implement the ideas associated with the concept (Kysilka, 1998) but also leads teachers to (wrongly) assume that they are already implementing curriculum integration (Venville et al., 2001). Case (1994) and

Venville et al. (2001) call for clarification of what is meant by curriculum integration so that the concept can be effectively operationalised.

An example of a basic definition of curriculum integration can be found in Ekpenyong (1997, p. 269) where the concept is defined as “...when we begin to move from teaching isolated subjects to forging linkages with other subjects or knowledge areas.” Another similarly general definition is that in UNESCO/UNEP (1985, p. 5) where interdisciplinary teaching is defined as ‘... teaching in which two or more disciplines are expressed in terms of interrelationships’. Beane (1995) regards the above definitions and many similar others where the subject or discipline boundaries are retained, as pretenders to curriculum integration. He believes that only when knowledge is used without regard for its disciplinary origin does true integration take place. Thus he takes a broader view of curriculum integration, and defines it as the ‘... search for self and social meaning’ (Beane, 1995, p. 616). Another example of a similarly broad view of curriculum integration can be found in Gehrke (1998, p. 248) where curriculum integration is defined as:

... a collective term for those forms of curriculum in which student learning activities are built, less with concern for delineating disciplinary boundaries around kinds of learning, and more with notions of helping students recognize or create their own learning.

It is obvious from the four examples quoted above, that curriculum integration like many other terms associated with curriculum, has many facets. The above approaches to curriculum integration represent opposing ends of the curriculum integration interpretation spectrum, with many others occupying the space in between. To help organize the different curriculum integration interpretations into a coherent framework, various categorizing schemes have been put forward by different writers (Nikitina, 2006). The various schemes differ in the number of curriculum integration models they recognize, and in the terminology they use to refer to the various models of curriculum integration. In her review of various curriculum integration models, Kysilka (1998) noted that they are either based on what happens to the affected disciplines after they have been integrated, or on the nature of their relationship between the affected disciplines. Gehrke (1998) distinguishes two approaches to curriculum integration: those in which the various disciplines retain the integrity and form the organisational structure of the curriculum, and those which centre around life experiences and learners’ and society’s needs. However, the author points out that integration approaches

which are based on life experiences, learners' needs and so on represent only a small fraction of the curriculum integration movement, and are more difficult to understand and implement given the current school institutional structures (Gehrke, 1998, p. 256).

A more recent attempt at categorizing curriculum integration approaches is that by Nikitina (2006) who bases his approach on the nature of the disciplinary knowledge itself. A useful approach that has been applied by some writers is to place the different integration models on a continuum to reflect different levels or types of integration. Using such an approach Jacobs (1989) and Fogarty (1991) described five and ten curriculum integration models, respectively. Under Jacob's scheme the integration models range from the parallel discipline model where the disciplines are still kept separate (although some attempt is made to teach related topics and ideas concurrently), to complete integration which allows individual learners to structure their curriculum depending on their needs and interests (Kysilka, 1998). The ten integration models listed under Fogarty's classification scheme range from the fragmented approach which represents the traditional subject-based curriculum approach at one end of the continuum to the highly sophisticated network integration model at the opposite end, with other integration models such as connected, nested, and shared models occupying the space in between.

Although Fogarty's continuum is often quoted in published literature, it seems to be too fine grained for the average educator who might require specialist training to distinguish between the ten different models that the author recognises. An easier continuum to work with is that suggested by Kysilka (1998) which is based on only four integration models, namely the separate discipline approach, the discipline-based approach, the inter-disciplinary approach and the total integration approach. Kysilka (1998) bases her differentiation between the four models on the roles allocated to the disciplines or subject, and to teachers and learners during the curriculum development and implementation processes.

According to Kysilka's curriculum integration model, the separate discipline approach represents the traditional subject-based approach to curriculum. The subjects or disciplines are kept separate and the teacher is not obliged to forge any links between them or between them and the world outside the school. If any integration occurs it is unplanned for and is left to the learner to establish. The shortfalls of this approach to curriculum are well-documented in literature. They include the misrepresentation of knowledge as atomized bits and pieces, a

lack of relevance to real life issues, a view of subject matter as ends rather than a means, which all contribute to rote learning and increased alienation of learners from schooling (Relan & Kimpston, 1991; Venville et al., 2001). This was the approach to curriculum integration in South Africa during apartheid (see Section 3.7).

At the second stage on Kysilka's curriculum integration continuum is the discipline-based approach. Although subjects or disciplines still form the basis of the curriculum, the teacher makes a concerted effort to relate them to each other and to the outside world. This approach involves collaboration between different teachers as they identify natural connections between the different subjects around which learning activities can be planned. This approach to curriculum integration informed South Africa's second major curriculum framework, the National Curriculum Statement (see Section 6.6). The third stage of Kysilka's continuum is occupied by the inter-disciplinary approach. In this approach, the artificial boundaries between subjects or disciplines are no longer recognized as natural relationships between them are identified and used to make learning more meaningful and relevant for the learner. Skills, concepts, ideas and themes become the central foci around which the curriculum is structured. In addition there is no specified content since this will depend on the themes, ideas, and topics that are being studied. This approach to curriculum integration was adopted in C2005, South Africa's first major post-apartheid curriculum framework (see Section 5.8), hence the criticism that the framework was strong on integration and weak in content.

The last stage of Kysilka's continuum is the integrated curriculum. In this integration model, knowledge is treated as one entity since no subject divisions are recognized. Under the teacher's guidance, the learner has to identify the knowledge, activities and strategies necessary to study the chosen topic, theme or concept. Thus the structural pillars of the curriculum are the ideas, themes or topics that the learner has chosen to study. All content knowledge is regarded as being useful depending on the topic, concept or idea that has been chosen. The teachers' role becomes that of a facilitator. A summary of Kysilka's continuum of curriculum integration is provided in the table below.

Table 5.1: A summary of curriculum integration models

Name of model	Curriculum content	Role of teachers	Role of learners
1. Separate disciplines	Separate subjects	Separate individual teaching	Passive receivers
2. Discipline-based	Sequenced correlated ideas, focused themes,	Separate individualized teaching	Receivers/doers
3. Inter-disciplinary	Broad themes, interests/needs of learners	Paired / teamed	Doers/creators/decision makers
4. Integrated	Needs and interests of learners	Teamed facilitators	Decision makers/creators/independent investigators

Adapted from Kysilka (1998)

However, viewing curriculum integration models from a continuum perspective is not without its deterrents. In Venville et al. (2001), the approach is criticized for not only failing to capture the full complexity of what curriculum integration entails, but also for implying that some forms of curriculum integration are better than others, and for giving the wrong impression that the more the integration, the better the learning and teaching. Similar feelings are expressed by Kysilka (1998, p. 206) who thinks that no curriculum integration model should be judged supreme over the rest. She believes the success of a particular integration model depends much on the context in which it is applied, especially the teacher's willingness and capacity to experiment with different models. Nevertheless the continuum approach serves to expose teachers to the range of curriculum integration models that are possible, and to help them identify the types that are best suited for the context in which they are working. Kysilka (1998) believes that the integration continuum helps teachers to reflect on their teaching approaches while at the same time providing them with guidelines on how they might improve them.

Examples of alternatives to the continuum approach are common in literature. For example Case's (1994) typology of curriculum integration types lists the fusion, insertion, correlation and harmonisation approaches, while that of Nikitina (2006) contains contextualising, conceptualizing, and problem-centring approaches. Two South African researchers who have worked with the curriculum integration concept are Bertram (2005) and Hoadley (2005). Both these authors refer to three forms of curriculum integration models: between different

subjects or disciplines (inter-disciplinary), within a topic in a given subject or discipline (intra-disciplinary), and between everyday and school knowledge (inter-discursive).

5.8 CURRICULUM INTEGRATION IN SOUTH AFRICA

References to the early history of curriculum integration in South Africa are rare. Nevertheless the approach seems to have a relatively shorter history in South Africa as compared to the US. According to Kruss's (1988) review of People's Education, curriculum integration discussions were already taking place during the 1980s. The People's Education guidelines as outlined by Kruss made reference to ideas that are central to the integrated approach movement. These include, for example, the need to: develop democratic teaching approaches; replace individualistic values with those which promote cooperative work and active participation; develop creativity and critical thinking in learners; and to choose literature set books that are relevant to the learners' experiences (Kruss, 1988, pp. 19-26).

Kraak (1998) gives more prominence to the role played by People's Education in the growth of the integrated curriculum movement in South Africa (see Section 3.7.3). He reports that key ideas associated with curriculum integration, such as the need to bridge the gap between theoretical and practical life, and between mental and manual labour formed part of the underlying ideology of the movement. In his comparison between apartheid curriculum and that envisaged by People's Education, Kraak (1998) reports that the former was set in a rigid subject-based approach, while in the latter, there was mention of integrated studies, and the need to replace rote learning with critical thinking skills. As noted earlier, before the ideas of People's Education could fully take root, the People's Education discourse was replaced by what Kraak calls a 'systemic' discourse (see Section 3.7.4).

The second source of interest in integrated approaches came from curriculum innovations that were implemented at some independent schools in South Africa. These innovations started in the 1970s, following a trend popular in the UK and elsewhere, and were a form of resistance to prevailing educational policies from within the system (Basson, 2004). Teachers at these independent schools combined subjects such as history, geography, languages and many others under the general umbrella of "integrated studies" in a bid to overcome what they saw as limitations to learning created by the subject-based approach. Integrated studies also aimed at stimulating learners' interest in academic studies through collaborative learning, real life experiences and outside classrooms (Basson, 2004).

The third source of interest in integrated approaches came by way of the increasing view of schooling as preparation for life and work. Two important steps in the development of this discourse in South Africa were the publication of the ANC education manifesto *A Policy Framework for Education and Training* (ANC, 1994) and the *White Paper on Education and Training* (South Africa. DoE, 1995a). These two documents stressed the importance of lifelong learning, and the need for it to be promoted through the integration of education and training, and through the establishment of a unified assessment system, the National Qualification Framework (NQF), to facilitate transfer of qualifications between different learning settings. For example, in the *White Paper for Education and Training* (South Africa. 1995a) it is stated that:

Education and training are each essential elements of human resource development. Rather than viewing them as parallel activities, the Ministry of Education believes that they are in fact closely related ... the Ministry is committed to an integrated approach to education and training ...

The document further stipulates that:

An integrated approach implies a view of learning which rejects a rigid division between "academic" and "applied", "theory" and "practice", "knowledge" and "skills", "head" and "hand" ... Successful modern economies and societies require the elimination of artificial hierarchies, in social organisation, in the organisation and management of work, and in the way in which learning is organised and certified. They require citizens with ... the desire and ability to continue to learn, to adapt to and develop new knowledge, skills and technologies, to move flexibly between occupations (South Africa. DoE, 1995a).

The commitment to lifelong learning and curriculum integration was carried on into South Africa's first major post-apartheid curriculum reform, C2005, where curriculum integration was one of the major design features (see Section 6.6). The foreword in *Curriculum 2005. Lifelong Learning for the 21st Century* (South Africa. DoE, 1997) reflects the White Paper discourse on integration and speaks of the need for flexible and appropriate curricula that cut across the traditional divisions of skills and knowledge. Teachers working with C2005 were expected to make use of its 12 Critical and Developmental Outcomes, the 66 Specific Outcomes, Learning Programmes, Phase Organisers and Programme Organisers to facilitate integration within the framework and between the framework and everyday life (see Section 6.6).

The commitment to OBE (see Section 3.7.5) following the review and revision of C2005 helped to ensure that the emphasis on curriculum integration was maintained in its revised

version, the National Curriculum Statement (see Section 6.6). *The National Curriculum Statement for Grade 10-12 Life Sciences (General)* has this to say about integration:

... integration is achieved within and across subjects and fields of learning. The integration of knowledge and skills across subjects and terrains of practice is crucial for achieving applied competences ... In adopting integration and applied competences ... the National Curriculum Statement Grade 10-12 (General) seeks to promote an integrated learning of theory, practice and reflection (South Africa. DoE, 2003, p. 3).

Following the review and revision of C2005 (see Section 6.6), one of the recommendations made was for the Phase Organisers and the Programme Organisers to be scrapped (South Africa. DoE, 2000), thus reducing the interconnectedness between different subjects, or in Bernstein's language, strengthening the boundaries between the various subjects in the National Curriculum Statement framework. However, teachers are still required to make use of the framework's Critical and Developmental Outcomes, Learning Outcomes and Assessment Standards to enhance integration within and across the eight Learning Areas that are recognised under this curriculum framework, and between school knowledge and everyday knowledge.

There has been strong interaction between the integrationist discourse within South Africa's post-apartheid education policy and that of environmental education. Three major national environmental education initiatives contributed to the formulation of policies to integrate environmental education into the emerging post-apartheid education policy. The first initiative was the Environmental Education Policy Initiative (EEPI), which was formed in 1992 as a venture between the Environmental Education Association of Southern Africa and South Africa's Department of Environmental Affairs and Tourism (Lotz-Sisitka, 2002). This initiative represented the environmental lobby at the national debates over the shape and contents of the new curriculum, thus helping to ensure that environmental education considerations were included in the new curriculum. The Environmental Education Policy Initiative paved the way for future participatory curriculum development processes in the country. A major outcome of the contribution of this lobby group was the inclusion of environmental education in the *White Paper on Education and Training* (South Africa. DoE, 1995a). The lobby group also put forward different environmental education integration policy options for consideration for adoption into the new curriculum, which included local

problem-solving curriculum action, integration within subjects, specialist/distinct courses, and components within subjects (Lotz-Sisitka, 2002, p. 106).

The sudden emergence of the OBE discourse in South Africa's education policy saw the formation of a new lobby group called the Environmental Education Curriculum Initiative (EECI) in 1996 to help re-orient environmental education to the new discourse. This lobby group involved an alliance between civil society and officials from the Ministry of Environmental Affairs and Tourism, and from the provincial departments of education (Lotz-Sisitka, 2002). As a result of contributions from the Environmental Education Policy Initiative, Learning Outcomes with an environmental focus were identified for each of the eight Learning Areas which constituted C2005. Further contribution by the Environmental Education Curriculum Initiative to the development of C2005 resulted in the identification of 'environment' as one of the six 'phase organisers' that teachers were expected to work with to enhance cross-curricular integration. This lobby group also took on the task of improving teachers' capabilities in designing learning programmes with an environmental focus through teacher professional development (Lotz-Sisitka, 2002).

Two projects which contributed to the integration of environmental learning into South Africa's schools were the *Learning for Sustainability* pilot project and the *National Environmental Education Project for General Education and Training* (NEEP-GET). The *Learning for Sustainability* pilot project was a donor-funded project which operated between 1997 and 2000 in two of South Africa's nine provinces (Gauteng and Mpumalanga). This project pioneered the use of a cluster-based spiral model of teacher professional development in environmental education to improve teachers' environmental knowledge, and skills in preparing and conducting lessons with an environmental focus (Janse van Rensburg & Lotz-Sisitka, 2000; Lotz-Sisitka, 2002). This project also provided insight into the classroom practices of teachers regarding environmental teaching and learning. The most important project concerning environmental learning in post-apartheid South Africa has been the *National Environmental Education Project for General Education and Training* (NEEP-GET). This was a large donor-funded initiative which operated throughout South Africa from 2000 to 2006. It aimed at providing professional development to curriculum advisors and teachers to enhance environmental integration at school level. The NEEP-GET also participated in the streamlining of C2005 and the subsequent formation of the Revised National Curriculum Statement (see Section 6.8).

5.9 CURRICULUM INTEGRATION RESEARCH

What is clearly evident in published literature is the unparalleled attention that the integrated curriculum movement enjoys worldwide. For example, Kysilka (1998) notes that the number of published journal articles and books on curriculum integration increased significantly during the 1990s. However, the extent by which this popularity has been converted into appropriate classroom practices is still open to debate. Kysilka (1998, p. 207) reports that apart from isolated cases of teachers working together on themes, or schools trying to implement integrated curricula, the integration movement has had little impact in the US, and is 'more rhetoric than activity.' She reports that this is especially so in the middle and high school levels. Gehrke (1998, p. 253) describes a United States study by Arredondo and Rucinski in 1995 in which only 37% of interviewed middle school principals admitted to using integrated curriculum approaches at their schools. A similar study of 3 380 United States high school by Cawelti in 1995 also quoted in Gehrke (1998, p. 253) reported that only 20% of them had integrated their curricula. Gehrke further comments that although higher levels of curriculum integration were recorded in elementary schools in the United States, there was no evidence that this was an improvement on the pre-1900s period. Writing in a similar vein to that of Gehrke (1998) and Kysilka (1998), are Venville et al. (2001) who note that despite popular support of the integrated curriculum movement, subject-based approaches still reign supreme in most Australian schools. Their survey of integrated curriculum approaches in a number of Australian schools showed that not only were the teachers implementing the concept in divergent ways, but also that most of them were unable to clearly articulate the rationale behind their chosen integrated approaches. This existing gap between curriculum integration policy and practice leads Gehrke (1998) to conclude that integrated curriculum might be more of a popular abstract concept than a practical classroom practice. She calls for more relevant research to help inform curriculum integration at classroom level.

Other writers have commented on the lack of adequate research on which to base curriculum integration decisions. For example, Relan and Kimpston (1991, p. 6) contend that to date there have been no long-term systematic investigations on the effect of integrated approaches. Instead, there are mostly anecdotal reports of integration success stories from individual teachers or researchers. Kysilka (1998) states that the abundant literature on integrated curriculum approaches is not matched with similar stories of classroom level curriculum integration practices. This point is also noted by Ellis and Fouts (2001) who describe the

current status of integrated curriculum research as rudimentary and exploratory, with few cases of carefully crafted research. Ellis and Fouts (2001) also raise the question of validity around claims of impacts resulting from curriculum integration research. For these authors, such claims are derived from hypothesis rather than being empirical. They had this to say:

If advocates of integrating the curriculum wish to substantiate their enthusiastic ... claims with empirical data, additional carefully crafted studies ... will have to be done ... At this stage, the number of thoughtful empirical studies ... remains so small that any kind of meaningful meta-analysis that might point to some generalized findings is precluded (Ellis & Fouts, 2001).

Ellis and Fouts (2001) express the view that currently decisions on whether to adopt integrated approaches seem to be informed by factors other than empirical evidence. In addition to a call for more carefully crafted empirical research, the authors suggest the establishment of a centre to coordinate this research.

Various factors have been identified as impeding empirical research on curriculum integration. Those described by Ellis and Fouts (2001) include the large number of variables that need to be controlled before one can make a direct link between integration and particular effects. According to these authors this makes classical research methods based on cause and effect relationships unsuitable for conducting research on integrated approaches. The second obstacle identified by Ellis and Fouts (2001) is the fact that curriculum integration is often packaged with other education reform initiatives. Hence it becomes problematic to isolate the impacts of curriculum integration from the rest of the reform initiatives. The third factor identified by these authors is the lack of suitable strategies to assess learner achievements in integrated programmes. In this, Ellis and Fout are supported by Venville et al. (2001) who state that the traditional assessment systems are based on theories and methodologies which have a disciplinary perspective, and are thus in conflict with integrated approaches.

Despite the obstacles that have been described above, there is some work that has been done on integrated approaches. What has been done in the United States is reviewed in Lake (1994), Ellis and Fouts (2001), and Applebee, Adler and Flihan (2007). The review by Lake (1994) has three main groupings. The first grouping consists of reports by teachers or researchers documenting their experiences teaching or collaborating on thematic units.

According to Lake, this type of research forms the bulk of research reports on integrated approaches in the US. The second largest research reports are also written by teachers and researchers and relate to lessons learned for successful implementation of integrated approaches in schools. Lake (1994) found that research which compares learner achievement in contexts where integrated and traditional curriculum approaches were used, accounts for only a small portion of the total research that was carried out on integrated approaches in the US. Like Lake (1994), Ellis and Fouts's (2001) caution and reminds us that results from these studies should be treated with caution since they come from a small sample base, and are influenced by other difficult-to-control educational variables.

Various authors have outlined what they regard as basic research questions concerning integrated curriculum. Although these questions generally differ among the different writers, they all act as important reminders of the impending danger of rushing into curriculum integration without the necessary research on which to base actions. For Relan and Kimpston (1991, p. 6) the key research questions on integrated curriculum relate to the factors which contribute to the success of a particular integration model; the basic means of implementing curriculum integration; and the identification of constraints to the adoption of integrated approaches in schools. The questions listed by Ellis and Fouts (2001) as being legitimate integrated curriculum questions relate to the theoretical or philosophical foundations underlying particular curriculum integration models; the efficacy of different models; and evidence emanating from large-scale application of the models in schools. At the end of her review of the status of research on integrated approaches, Lake (1994) highlighted what she considered were major knowledge gaps in understanding these methods. She identified these gaps as key focus areas for future research. They include: the effect of integrated approaches on subjects within an integrated curriculum; alternative forms of assessing learners taught through integrated approaches; the best strategies for teachers' professional development in integrated methods; and contexts that are conducive to integrated approaches.

5.10 BERNSTEIN ON CURRICULUM INTEGRATION

One theorist who has made major contributions to the theoretical base of curriculum integration is Basil Bernstein. Bernstein (1971, 1996) approaches the analysis of integration of subjects or knowledge within curriculum from a sociological perspective (see Section 7.7). Such an approach is different from those which are based on philosophical or epistemological perspectives, in that it seeks to unearth the sociological principles which underpin curriculum

organisation. He postulates that rather than being intrinsically determined, curriculum organisation is in fact a social construction (Bernstein, 1971, p. 49). Bernstein maintains that how knowledge is organised within curriculum is a manifestation of the interests, power and control differentials that exist in the wider society. He writes:

How a society selects, classifies, distributes, transmits and evaluates the educational knowledge it considers to be public, reflects both the distribution of power and the principles of social control (Bernstein, 1971, p. 47).

Bernstein bases his sociological analysis of the organization and structuring of educational knowledge on the nature of the relationships that exist between and within the different categories that occur in educational contexts. Curriculum is an example of such a category, other examples being discourses, agents, spaces and practices. In the case of curriculum organisation, Bernstein is interested in the nature of the relationships that exist between the subjects or disciplines that constitute the curriculum. He seeks to answer questions such as: What determines the status of a particular subject within a given curriculum? How is that status maintained, strengthened or resisted? What are the educational and sociological implications of changes to subject status?

According to Bernstein (1971) one way of analysing the relative status of different curricular contents is to compare the number of units (for example, time and space) that are allocated to individual contents, and whether it is compulsory or optional for learners to study those contents. However, Bernstein (1971) points out that such studies do nothing more than provide a rough indication of the relative status of subjects within a curriculum. He believes it is the boundaries between the curriculum contents that hold the key to understanding the nature of the relationship between them. Bernstein believes that analysis of the nature of the boundary that exists between the curricular contents is crucial to understanding the power relations that exist between them. He writes:

We can ask about any given content whether the boundary between it and another content is clear-cut or blurred. To what extent are the various contents well insulated from each other. If the various contents are well insulated from each other, I shall say that the contents stand in a *closed* relation to each other. If there is reduced insulation between contents, I shall say that the contents stand in an *open* relationship to each other (Bernstein, 1971, p. 48, italics in the original)

Bernstein's perspective on curriculum organisation is also supported by Diaz (2001) when he writes:

Boundaries are the object of struggles between unequal power positions. Boundaries create fields of struggle, a whole geography of positions. In essence, boundaries are the critical point for definitions of knowledge, and practices, as well as the subject (Diaz, 2001, pp. 84-85).

Bernstein (1971) uses the concept of *classification* to refer to the nature of boundary between the contents i.e. the degree of isolation between the contents. He notes:

... classification refers to the nature of differentiation between contents. Where classification is strong, contents are well insulated from each other by strong boundaries. Where classification is weak, there is reduced insulation between contents for the boundaries between the contents are weak or blurred (Bernstein, 1971, p. 49).

Based on the nature of the boundary between curricular contents, Bernstein (1971, p. 49) distinguishes two broad types of curriculum: collection type (where the curriculum contents are clearly demarcated from each other) and integrated curriculum (where the contents are in a close relationship with each other). According to this classification scheme, curricula during the apartheid era were of the collection type, while post-apartheid's two curriculum frameworks, namely C2005 and the National Curriculum Statement (see Section 6.6) are of the integrated type.

In his analysis of the integrated type of curriculum, Bernstein was careful to define exactly what he meant by integration. For him the process involves more than the borrowing of theories across different disciplines or subjects, or when different subjects focus on a common problem. Bernstein (1971, p. 53) restricts his notion of integration to cases where there is '... some relational idea, a supra-content concept, which focuses upon general principles at a high level of abstraction'. He further elaborates:

Integration refers minimally to the *subordination* of previously insulated subjects *or* courses to some *relational* idea, which blurs the boundaries between different subjects. (Bernstein, 1971, p. 53, emphasis original)

Bernstein (1971, p. 55) further divides the integrated curriculum type into sub-types and varieties depending on the number of teachers and subjects involved. In teacher-based integration, for example, a single teacher who is responsible for teaching all the subjects to a group of learners may opt for a blurring of boundaries between the subjects. Bernstein regards this form of integration the easiest to implement since it involves individual teachers working on their own. Another type of integrated curriculum is what Bernstein calls the

teacher's integrated type. This form of curriculum integration recruits other teachers into the teaching relationship, which presents a harder challenge to implement. In such a situation, the teachers involved may belong to the same subject, or different subjects, united by the need to achieve a common educational task (Bernstein, 1971).

It is easy to make the superficial conclusion that the differences between collection and integrated curriculum types lies in the nature of the boundaries between their constituent subjects. However, Bernstein (1971, 1996) digs deeper than this in his analysis. For him, the differences in subject organisation in the collection and integrated curriculum types are a reflection of the different power and control relationships that are embodied by different educational codes. He argues that it is through different education codes that power and control are realised and used to shape the consciousness of the learners. Thus for Bernstein, inter-subject relations are based on deeper sociological principles, rather than say simple economics or personal preferences.

According to Bernstein (1971, 1996), the differences in boundary strengths that exist in the collection and integrated codes have implications that go further than curriculum structure and organisation. He describes other key characteristics that distinguish collection and integrated codes. These relate to inter alia authority structures, educational identities, orientations to pedagogy and assessment, learning theories, knowledge construction and transmission, and social relationships between teachers, learners, and between teachers and learners. For example, Bernstein (1971) maintains that the strict subject isolation within the collection code is likely to promote oligarchy, and the development of strong subject loyalties by teachers, who will tend to identify themselves through the subjects they teach. In comparison, under the integrated code there will be more cooperation between teachers of different classes and subjects, which will tend to weaken the strict subject allegiance of the collection code. Under the integrated code, individual subjects become less significant as the concepts or themes uniting them take precedence. In the collection code, emphasis will be on the acquisition of factual knowledge through didactic approaches as opposed to the exploration of the general principles that underlie knowledge that is commonly associated with the integrated code. Bernstein contends that because individual teachers work in isolation under the collection code, there is likely to be more heterogeneity in their teaching and assessment approaches than what would normally occur under the integrated code where teachers work cooperatively (Bernstein, 1971).

According to Bernstein (1971), the differences between the collection code and integrated code also extend to the power relations between teachers and learners, with learners under the integrated code having more power and control over their learning than those under the collection code. The differences also affect social relations between learners, those under the collection code identifying more with specific subjects than those taught under the integrated code (Bernstein, 1971, pp. 56-61).

What Bernstein is telling us is that there is more to changes in curriculum organisation than meets the eye. What can be deduced from Bernstein's sociological analysis of curriculum integration is that changes to curriculum codes are not about subject relations alone. The process is also about disturbances to existing educational, sociological and cultural structures, which are underpinned by particular forms of power distribution and control, hence the resistance and hot debates that normally accompany proposed changes to curriculum codes.

5.11 RESEARCHING CURRICULUM INTEGRATION IN SOUTH AFRICA

There is paucity of data on integrated approaches within South Africa's schooling system. This should be of no surprise given the poor research tradition on schooling during the apartheid era (Taylor, Muller & Vinjevold, 2003). Surprisingly, this was as true for black schooling as it was for white schooling, with the end-of-year Grade 12 examination results being the only major source of such information. However, since the 1990s, there has been an upsurge in research on South Africa's schooling system, although Taylor, Muller, & Vinjevold (2003) note that most of it has remained unpublished and unavailable to policy makers. How much of this research deals specifically with curriculum integration is yet to be ascertained.

Research on curriculum integration within the schooling system may be broadly divided into two categories. The first category looks at the integration of subjects or disciplines within pedagogic texts such as curriculum documents, text books, teacher's lesson plans, assessment tasks and learners' work. Although in South Africa this type of research is still in its infancy, it represents a growing body of knowledge about curriculum integration in the schooling system. Examples of this type of research include Bertram (2005) who compared the nature and extent of the integration of History in two different national History curricula. Parker (2006) conducted a similar type of study on mathematical knowledge integration in the

Learning Outcomes and Assessment Standards of Grade 10 to 12 Mathematics. The study which is being reported on here represents further research in this area.

The second category of research on curriculum integration focuses on teachers' classroom practices. The paucity of empirical research on classroom practices in South Africa is an issue that has been commented on by numerous writers. As mentioned earlier, there have been no national, provincial or district level surveys that specifically looked at curriculum integration practices at South African schools. However, reports such as Taylor & Vinjevold (1999), and the review of C2005 (South Africa. DoE, 2000), have provided some insight into teachers' subject integration practices. More information on integration practices has been generated through case studies that targeted teaching practices in general, especially in the wake of the implementation of C2005. A closer inspection of these studies shows that a few have incorporated aspects of curriculum integration in their investigations. A good example of such research is that by Taylor, Muller & Vinjevold (2003) who analysed data on classroom practices at 20 rural schools in the Limpopo Province. Among the 18 indicators used during this analysis was one indicator which assessed the integration of everyday knowledge into classroom teaching. Some data on subject integration has also come by way of investigations into individual teacher's classroom practices as in Adler, Pournara and Graven (2000), and in Jenkins (2007).

Regarding environmental education, some insight into environmental education practices at South Africa's poor schools was generated by the *Learning for Sustainability* pilot project and the NEEP-GET project (see Section 5.8). Additional data has come by way of isolated cases of post-graduate studies in environment education practices at various rural schools in the Eastern Cape, within a broader nationally funded research programme on environmental learning and curriculum, as for example in Mbanjwa (2001), Nduna (2003), Mvula-Jamela (2006), Jenkins (2007) and Mazingiza (2009). However, this work is yet to be synthesised.

More than any other integrative aspect, the incorporation of everyday knowledge into the classroom context seems to have attracted most attention from teachers (and researchers). According to Taylor, Muller and Vinjevold Taylor (2003, p. 73), the weakening of *classification* between school knowledge and everyday knowledge was adopted in C2005 to facilitate the flow of information and skills between the two contexts. Various studies have provided illumination on how teachers serving in under-resourced South African schools are

interpreting this curriculum innovation. For example, Janse van Rensburg and Lotz-Sisitka (2000, p. 84) report how teachers' attempts to incorporate local environmental issues into various Learning Areas were reduced to the 'superficial and familiar' due to their limited environmental knowledge. Taylor and Vinjevold (1999, p. 148) cite examples of teachers' efforts to make learning relevant to their learners' lives being thwarted by the teachers' inadequate knowledge of subject content, a finding which has been reproduced in many other subsequent studies.

The debate over the divide between formal and everyday knowledge has been especially vigorous in mathematics education circles in South Africa, for example Naidoo and Parker (2005), and Adler, Pournara and Graven (2000). The general picture about curriculum integration emerging from this research is that the original noble intent has had unintentional impacts on the accessibility by South Africa's disadvantaged learners to higher forms of knowledge and skills. Yet these types of knowledge and skills are essential to the promotion of social justice, growth and development (South Africa. DoE, 2000, p. 39).

Despite the research efforts outlined above, knowledge of teachers' practices concerning curriculum integration in South Africa's schools is still lacking, and the research that has been conducted up to date barely scratches the surface. This gap in knowledge is also implied in Ensor and Hoadley's (2004, p. 86) observation that classroom research in South Africa is biased towards the regulative discourse (social relations and moral order in the classroom) rather than the instructional discourse (knowledge and competences). Another issue that is raised by Ensor and Hoadley (2004) is the need for a strong theory of pedagogy to guide research on classroom practices. Drawing on Ensor and Hoadley's line of argument, such theory will improve the validity and trustworthiness of research on curriculum integration in various ways. For example, it would help to ensure that the criteria used to analyse curriculum integration at the empirical level are valid, transparent and open to scrutiny by other researchers. But even more importantly, it would improve the specificity by which curriculum integration variations can be described, instead of relying on non-discrete and general terms such as 'high' or 'low' integration.

Bernstein's concept of *classification* provides a conceptual lens with which to analyse curriculum integration from a sociological perspective, and the language and tools with which this can be done with specificity. The Portugal-based research group, *Estudos*

Sociologicos da Sala de Aula (ESSA), which is led by Ana Morais and Isabel Neves, has done groundbreaking work in the analysis of pedagogic texts and practices using models that are based on this concept as for example, in Morais (2002), Neves and Morais (2001a, 2001b), and in Solomon and Tsatsaroni (2001). Similar work that has been done in South Africa includes that of Hoadley (2005, 2008), Ensor and Hoadley (2004), Bertram (2005, 2008) and Ensor (2004).

In his seminal paper on the *classification* of knowledge, Bernstein (1971, p. 54) gives reasons why studies which analyse changes in boundary strengths within pedagogic contexts should be of interest to sociologists. They include the need to know: the causes of such changes; how such changes are maintained; and the sociological implications of these changes. Most of these questions as they relate to the education context in South Africa are yet to be answered. There is a need for more research into curriculum integration theories, policies and practices from a sociological perspective. This is true, not only for South Africa, but for the rest of the world as well.

By analysing the extent to which natural resource management is integrated into the curricula of four rural under-resourced schools in the Eastern Cape Province, this study aimed to contribute to a better understanding of the curriculum integration practices at these schools, as an initial step towards the design of more effective and appropriate curriculum integration policies and implementation strategies that specifically address the unique context of this education sector.

5.12 CONCLUSIONS

This chapter began with a brief discussion of curriculum theory, of which there is a dire need, especially in times of rapid curriculum reform as has happened in South Africa's post-apartheid period. Although the complex nature of the curriculum field precludes precise answers, curriculum theory serves the useful purpose of providing guidance on how we think about, research and practise curriculum.

Next, the chapter looked at sources of curriculum theory. Some of the curriculum theory is from disciplines that are external to curriculum, such as philosophy, psychology, economics and sociology. Curriculum theory is also generated from within the curriculum field, by what are known as curriculum domains. The number and types of curriculum domains is still under

contention, although wide recognition is given to the existence of the domains of curriculum development and curriculum design. The domains of curriculum design and curriculum development are not clearly demarcated. If curriculum design is used as a verb, it refers to the organisation of curricular elements within a curriculum, which can be vertical (referring to sequence and continuity), or horizontal (referring to scope and integration).

Next the chapter looked at the concept of curriculum integration in detail. Much confusion surrounds this concept, mostly as result of the use of multiple terminology, and an inadequate empirical research base. The chapter provided an overview of the development of curriculum integration policies in South Africa. After a slow start in the People's Education movement, the concept is now one of the main curriculum design features in post-apartheid curriculum reforms, especially in environmental education circles. Most of the research conducted on curriculum integration has been based on individual teacher's practical experiences with the concept, although a small body of research is emerging into how disciplinary knowledge is integrated into pedagogical texts and processes.

The chapter also looked at the analysis of curriculum integration from a sociological perspective. This type of work is based on the ideas of Bernstein who believes that the integration of subjects within a curriculum is a reflection of power relations that exist between them, which is a manifestation of societal power and control relations. In South Africa, analysing curriculum integration from a sociological perspective is still in its infancy, and has mostly involved working with curriculum documents. The analysis of classroom-based curriculum integration practices from a sociological perspective remains practically untouched, with only a few studies in this area available at present.

A major part of this study involved the analysis of the extent to which four Eastern Cape rural under-resourced schools integrate natural resource management into the documents that they produce and the school activities and practices that they carry out. The next chapter presents background information on the Eastern Cape Province, and on the four schools which took part in the study.

CHAPTER 6

RESEARCH CONTEXT

6.1 INTRODUCTION

As outlined in Chapter 1 the main goal of this research project was to analyse the implementation of the Grade 10 Life Sciences curriculum with regard to the integration of natural resource management. The study was based on the premise that the relevance of education in South Africa's rural disadvantaged schools can be enhanced through a focus on natural resource management in their curriculum. Such a focus also has the potential to contribute to sustainable utilisation of the country's communally-owned natural resources (see Section 1.3.3). In the previous four chapters, the four major concepts that shaped this study were discussed, namely rural education, curriculum, natural resource education, and curriculum integration. This chapter has four major aims.

The first aim is to describe the socio-economic and educational conditions in the Eastern Cape Province. This is done by means of a contextual profile of the province and the local municipality in which the four schools which took part in the study are located. The second aim of the chapter is to describe the structural organisation of the education system in the Eastern Cape. This is done in order to locate the position of the province's education system within the larger national education system in the country, and to identify the agencies and agents responsible for the design and implementation of the Grade 10 Life Sciences curriculum. The third aim of the chapter is to provide a contextual profile of each of the four schools which took part in the study. This is done in order to illustrate the conditions under which these schools and their Grade 10 Life Sciences teachers interpret and implement the natural resource management discourse. The Chapter also provides a profile of the subject of Life Sciences as it is taught in the FET band under the National Curriculum Statement framework, and an overview of post-apartheid environmental learning initiatives.

6.2 THE EASTERN CAPE PROVINCE

The Eastern Cape is one of South Africa's nine provinces (see Figure 3.1). It is located along the south-eastern seaboard of South Africa (32°00 S' and 26°00E').

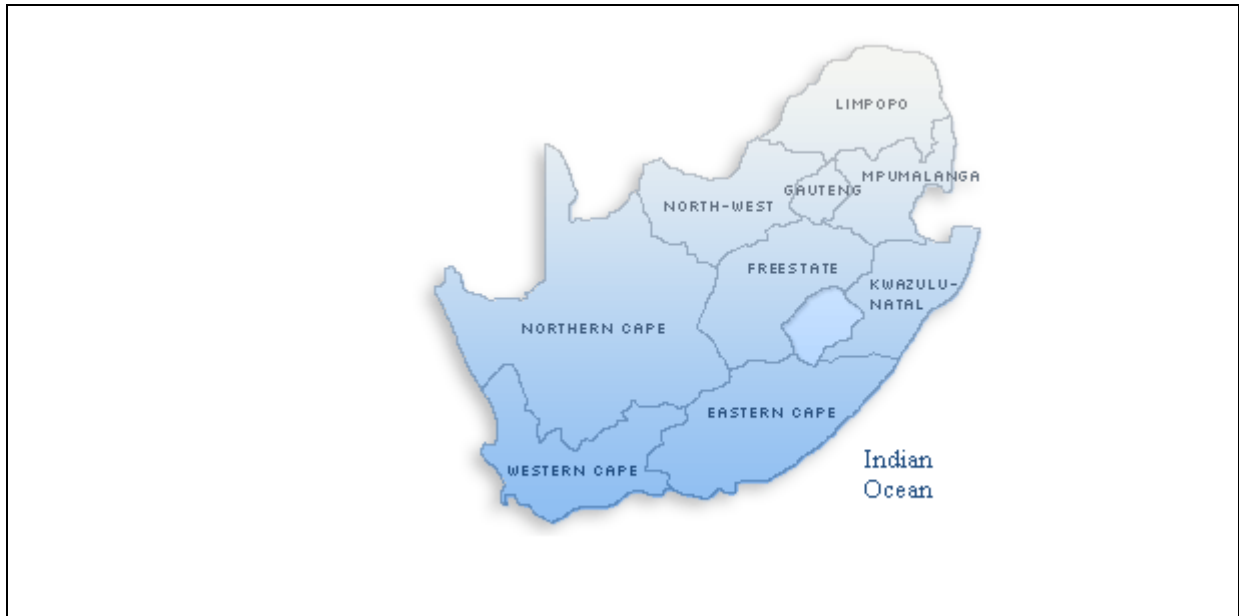


Figure 6.1 Map of South Africa showing the location of the Eastern Cape Province

This province was created from two former black homelands of Ciskei and Transkei and the eastern part of the Cape Province, following the end of apartheid in 1994. The Eastern Cape covers an area of 169 580 sq. km², or 13.9% of South Africa's total land area, making it the second largest province in the country (Statistics South Africa, 2003). The topography of the province is varied, with large sections occupied by mountain ranges, steep river valleys and plains. Three main rivers cross the province: the Great Fish, the Kieskamma, and the Kei. The climate of the province varies according to distance from the coast (CSIR, 2004). The province is generally dry and unsuitable for rain-fed cropping, with over 60% of its area receiving less than 600 mm of rainfall per annum on average (CSIR, 2004). Along the coast temperatures are mild and range between 14°C and 23°C, while those in the interior are more extreme and fall between 5°C and 23°C on average. The vegetation of the Eastern Cape consists of mainly shrub land and low Fynbos, grassland, thicket and bushland (Thompson, 1999, as quoted in CSIR, 2004).

The 2008 human population estimate for the province was 6.6 m, which formed 13.5% of South Africa's total estimate of 48.7 million (Statistics South Africa, 2008). The Eastern Cape is one of the poorest provinces in South Africa (Pauw, 2005), and its socio-economic data make depressing reading. For example, close to half of the province's potentially economically active citizens is unemployed and 91% of those who are employed earn below R6 400 per year (NMF, 2005, p. 25). In 2001 over 50% of the province's households were

engaged in agricultural activities, although they formed only a minor source of livelihood for most of these families (Pauw, 2005). The high levels of poverty in the Eastern Cape are linked to the economic neglect of the former Transkei and Ciskei homelands during the apartheid era. Social welfare grants such as old-age pension, disability and child grants are the major source of income for majority of the province's rural households (Statistics South Africa, 2003). In 2001 life expectancy in the province stood at 60.7 years, compared to the national average of 62.8 years, and only 6.3% of the province's people aged above 20 years had tertiary education (Statistics South Africa, 2003). Another 22.8% had no formal schooling whatsoever. Approximately 34% of the province's population are aged below 15 years (Statistics South Africa, 2008) which contributes to a high dependency levels in the province.

The province has one of the highest HIV growth rates in South Africa, the incidence of the virus among women attending antenatal clinics having increased from 0.4% to 23.6% during the 1990 to 2002 period (CSIR, 2004). In 2006, the number of people infected with HIV/Aids in the province was estimated to be in the region of 666 800 (Actuarial Society of South Africa, 2006). Increasing levels of HIV/AIDS infections and deaths exacerbate the adverse socio-economic conditions in the province. The high poverty levels in the region have long been a major cause of rural to urban migration within the province, and of migration out of the province to Gauteng and Western Cape provinces. Smith (2005) estimated that almost 82% of the 104 051 blacks who moved to Cape Town during the period 1997-2001 were from the Eastern Cape. The out-migration of mostly young able-bodied men from rural Eastern Cape has had a negative impact on the province's rural agricultural productivity, and on the capacity of the traditional decision-making systems to manage the province's communal natural resources (Ainslie, 1999).

6.3 NGQUSHWA LOCAL MUNICIPALITY

Ngqushwa Local Municipality, formerly called Peddie District, is one of the 46 local municipalities that dot the landscape of the Eastern Cape Province. It is located in the Amatole District Municipality, one of the six district municipalities into which the Eastern Cape Province is sub-divided.

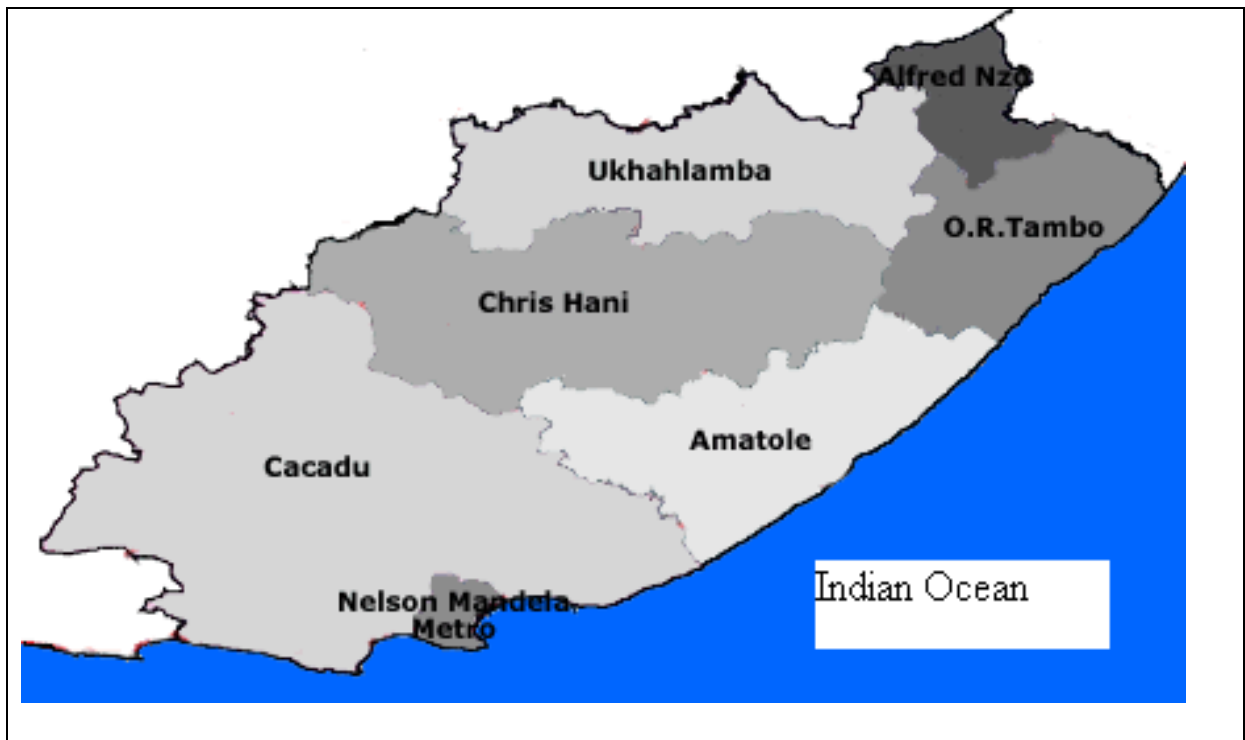


Figure 6.2 Map the Eastern Cape Province showing the location of the Amatole District Municipality

Ngqushwa Local Municipality covers an area of 2 245.79 km² (Statistics South Africa, 2003), and is enclosed by the Fish River to the west, the Keiskamma River on the east, and the Indian Ocean in the south.

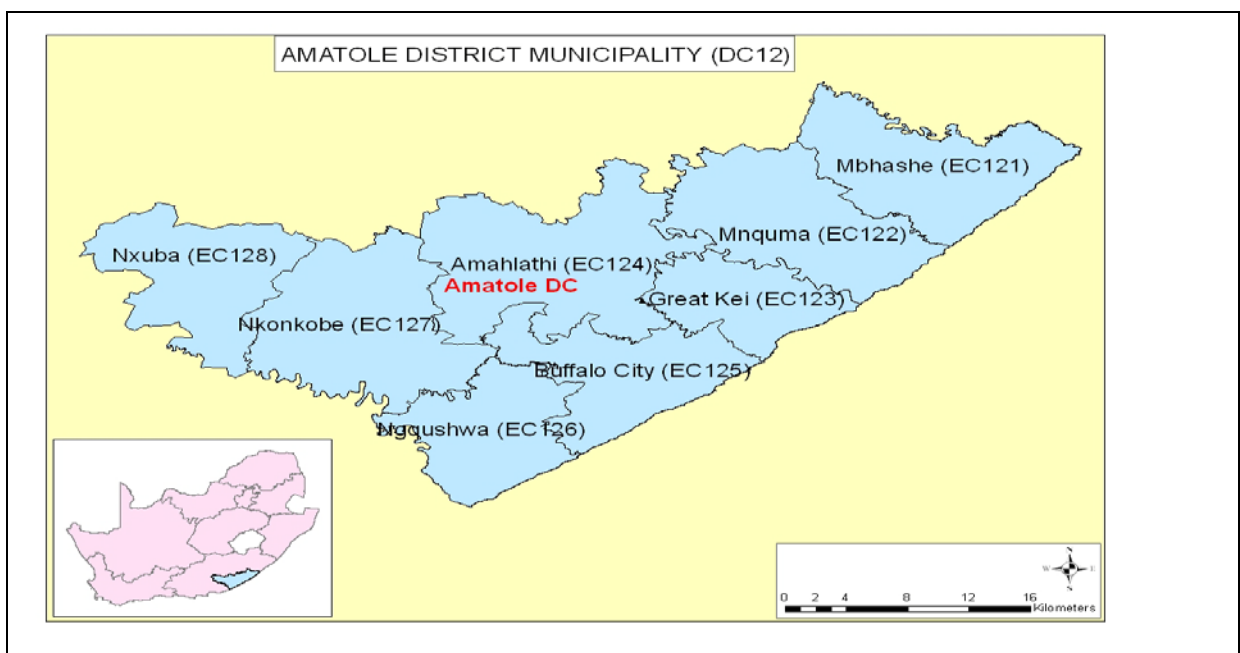


Figure 6.3 Map of the Amatole District Municipality showing the location of Ngqushwa Local Municipality.

The history of this area of the Eastern Cape Province is well documented. According to Ainslie, Cinderby, Petse, Ntshona, Bradley, Fakir, and Deshingkar (1997), ethnic Xhosa speaking people were living in this area as early as the 18th century. Gradually, these people lost their land to British settlers during the 1779-1879 Frontier Wars, as the colonial government expanded the Cape Colony northwards and eastwards. Some of the seized land was given to the Mfengu, a different ethnic group that was fleeing from the reign of King Shaka of the Zulu kingdom. The colonial government allowed the Mfengu to till their acquired land using modern farming methods such as ploughs and irrigation, and to trade in cattle, milk and grain as far as King Williams Town and Grahamstown (Ainslie et al., 1997). The levies and taxes imposed on the Mfengus by the colonial government contributed to the costs of the Frontier Wars. Ainslie et al. (1997) write that in the period 1951-1985, as white farmers resorted to increased mechanisation, there was an influx of blacks from the white surrounding farms into the then Peddie District. More influx into the district came by way of the apartheid government's settlement schemes and forced removals. The antagonism between the Mfengu and the original Xhosa inhabitants was used as a political ploy by successive governments. When the ethnic Xhosa-aligned Ciskei National Independence Party of Lennox Sebe gained control of Ciskei in 1981, the Mfengu-dominated Peddie District came under increased marginalisation in terms of economic development and social services delivery (Ainslie et al., 1997), the scars of which are much in evidence today.

Ngqushwa Local Municipality area encloses 118 villages that are scattered across tribal land and freehold abandoned white farms, together with the surrounding white commercial farms (Ngqushwa Local Municipality Integrated Development Plan, 2008). The 2001 census estimated the human population of this municipality to be 84 230, and its population density at 37.5/km² (Statistics South Africa, 2003). The municipality is overwhelmingly rural, with 95% of its residents living in rural areas (Ngqushwa Local Municipality Integrated Development Plan, 2008). There are only two major towns: Peddie Town which serves as the administrative, economic and social hub of the municipality, and which has a population of 5 086 (Amathole District Municipality, 2007), and Hamburg whose population is 3 000 (Afesis-corplan, 2004).

Ngqushwa Local Municipality is one of the most economically deprived districts in the Eastern Cape Province (Amathole District Municipality, 2007). According to Thorton (2008), unemployment levels in the municipality are as high as 70%. Agriculture is the primary

economic activity in the municipality, and is a mixture of black subsistence agriculture and white commercial farming (Shackleton, Paumgarten & Cocks, 2007). The municipality has more livestock grazing than rain-fed agriculture mostly due to the poor nature of its soils, and the unreliability of its rainfall. There is virtually no secondary industry in the Ngqushwa Local Municipality (Afesis-Corplan, 2004). Additional sources of employment are the civil and public service sectors (Thorton, 2008). In 2001, over 30% of the people in the municipality had no formal schooling, and only 4% held tertiary qualifications (Statistics South Africa, 2003). Although 70% of the households had access to electricity, only 11% used it for cooking, the rest relying on firewood and paraffin. The percentage of households with flush toilets is only 4.5%, and the prevalence of HIV/AIDS among women attending antenatal classes was estimated to range between 24-28.5%. The municipality is serviced by one hospital, 20 clinics, 22 mobile clinics, 124 primary schools and 47 high schools (all figures from Statistics South Africa, 2003).

6.4 COMMUNAL NATURAL RESOURCES IN THE EASTERN CAPE

Eastern Cape's communally owned land is a source of a wide range of natural resources that are used by local communities to sustain their livelihoods (Shackleton, Shackleton & Cousins, 2001). The reliance on communal natural resources is especially strong among the rural poor (Shackleton & Shackleton, 2006). According to Hunter, Twine and Johnson (2008) natural resources not only provide for household needs, but are also a source of income and act as safety nets during adverse socio-economic conditions. Examples of communally owned natural resources that are used by local communities include water, soil, rangelands, arable land, woodlots, wild game, wild fruits and vegetables, medicinal plants and fishery resources. The financial and socio-cultural importance of these natural resources has been demonstrated in numerous studies. For example, Cocks and Wiersum (2003) reported that households in the Ngqushwa Local Municipality used over 103 wild plant species to fulfil their domestic needs. Dold and Cocks (2002) estimated the annual trade in medicinal plants in the Eastern Cape to involve 525 tonnes of green plant material worth R 27 million (which was roughly equal to US \$ 2.5 million at that time). Other uses of communally owned natural resources at subsistence level include tree resources for fuel, building and fencing, grass for thatching and brooms, rangelands for grazing of livestock and arable land for cultivation of food.

There is increasing concern over the widespread degradation of communally owned natural resources across South Africa, especially in the former black homelands (Ainslie, 1998). The

management of these resources has also come under the spotlight as a result of post-apartheid land redistribution policies (Ainslie, 1998). According to CSIR (2004), the level of environment degradation in the Eastern Cape is among the highest in the country. The most common form of land degradation is sheet or gully erosion, and the CSIR (2004) estimated that in 2000, the province lost between 13-60 tonnes of soil per hectare. Ainslie, Cinderby, Petse, Ntshona and Bradley (1997) reported severe forms of soil erosion in the northwest region of Ngqushwa Local Municipality. Other reported forms of natural resource degradation involve loss of soil fertility, loss of vegetation cover, bush encroachment, spread of alien species, and loss of biodiversity (Ainslie, 1998; Msvoto, 2008). Kakembo, Rowntree and Palmer (2007) investigated the widespread invasion of communal land in Ngqushwa Local Municipality by the unpalatable Blue bush shrub (*Pteronia incana*). Kiguli, Palmer and Avis (1999) found more unpalatable species on communal land in the Ngqushwa Local Municipality than on surrounding white owned commercial rangeland. The consequences of the degradation of the natural base on South Africa's communal land threatens rural livelihoods through decreased levels of food security, increased levels of poverty, rural to urban migration, and climatic change (Msvoto, 2008).

There are differing schools of thought as to the underlying cause of the degradation that is occurring on the communal lands of the Eastern Cape. Ainslie (1998) divides the offered explanations for the degradation into two categories. The first category is what he terms micro level analysis, and involves explanations which are based on the failure of the traditional land tenure systems to control access to communal natural resources. Ntsebeza (2002) offers this type of explanation when he comments on the lack of formal and informal rules to govern access to resources on communal land, which renders them susceptible to unsustainable utilisation practices. The second category of explanations fall under what Ainslie (1998) called macro level analysis, and is based on colonial and apartheid expansionist and land appropriation policies, coupled with urbanisation and the failure of the regional political economy. However, Ainslie believes a combination of elements from both categories offers a more plausible explanation for the deterioration of the quality and quantity of communally owned natural resources in rural parts of South Africa. His list of probable causal factors includes apartheid policies, poverty, gender inequality, institutional chaos at district and village level, lack of incentives, apathy, conflicting stakeholder interests and adverse climatic factors (Ainslie, 1998).

Due to the increasing recognition of the ineffectiveness of state organs to effectively manage communal natural resources, the government of South Africa has drafted various policies that devolve that responsibility to local communities (Cocks, Dold & Grundy, 2001). These initiatives are collectively referred to as community-based natural resource management (CBNRM), and the Landcare programme in the Eastern Cape is one such example. This programme encourages rural communities to conserve their natural resources through sustainable use (Perret, 2001). It also promotes a participatory approach to land rehabilitation and the removal of alien vegetation (CSIR, 2004). However, Cocks, Dold and Grundy (2001) point out that the dissolution of management responsibility to local communities alone will not solve the problem of natural resource degradation. They argue that CBNRM initiatives need to be accompanied by government support in the form of funding, capacity building, and establishment of new governance systems. They also stress the need to create awareness about sustainable use of natural resources among the local communities. As was discussed in Section 1.3.3, the formal education system in the Eastern Cape has the potential to contribute to the sustainable utilisation of the provinces' communal natural resources through the integration of natural resource management into the curriculum of local schools.

6.5 STRUCTURAL ORGANISATION OF THE EDUCATION SYSTEM

6.5.1 Introduction

Education systems are complex organisations whose structural description can be approached from several vantage points. In the case of this research, I wanted a vantage point which would bring to the fore those parts of the education system which are concerned with curriculum design and implementation. I used Bernstein's theory of the pedagogic device, specifically his constructs of the fields of recontextualisation and reproduction (see Section 8.9) as the lens through which I analysed the structure and organisation of the education system in the Eastern Cape. This approach to the structure and organisation of the education system helped me to gain better conceptualisation and understanding of the connections between the various levels which make up the education system in the Eastern Cape, and to focus my attention on those parts of the education system that are concerned with the design and implementation of the Grade 10 Life Sciences curriculum. The approach also helped me to conceptually locate the four schools which took part in this study in the greater picture of the provincial and national education systems.

6.5.2 The education system at macro (national) level

South Africa's National Department of Education jointly shares the responsibility for education with nine provincial departments of education, one of which is the Eastern Cape Department of Education. In terms of the country's Constitution, the provincial departments of education are responsible for implementing the nationally set educational policies and programmes within the provinces (excluding those which relate to tertiary education). They can also initiate and implement their own education priorities and interventions, but these have to be in accordance with the national education policies and goals, and where there is a clash between the two, the latter take precedence. The relationship between the two tiers of education structures is governed by the country's Constitution (RSA, 1996d) and the National Education Policy Act of 1996 (RSA, 1996c).

The National Department of Education was set up in 1994 to deal with education and training affairs in the country at national level, in accordance with the country's Bill of Rights, and the South African Education Policy Act of 1996 (RSA, 1996a). It jointly shares the responsibility for training with the National Department of Labour. The National Department of Education, whose headquarters are located in Pretoria, Gauteng Province, is tasked with the responsibility of policy development; research and policy review; monitoring the implementation of national policy, norms and standards; and supporting provincial departments of education and higher education institutions. It carries out its mandate under seven different directorates, namely: Administration; Auxilliary and Associated Services; System Planning and Monitoring; Quality Promotion and Development; General Education and Training (GET); Further Education and Training (FET); and Higher Education. Within the FET directorate is the sub-directorate of school curriculum, which is responsible for the development of curriculum policy for FET schools and colleges, as well as for overseeing the integrity of their assessment systems.

From time to time, the National Department of Education (the FET directorate in particular) issues various texts pertaining to the teaching, learning, and assessment of Life Sciences for Grades 10-12 (General). These texts carry messages that constitute South Africa's official discourse with regard to the teaching, learning, and assessment of Grade 10-12 Life Sciences. As stated earlier, one of the research aims of this project is to analyse the extent of NRM integration within these documents, which represent the official discourse on NRM

integration within the Grade 10-12 Life Sciences (General) curriculum (see Section 1.4). For details of the analysis of the extent of NRM integration within the Life Sciences Grades 10-12 (General) official documents, see Chapter 9.

6.5.3 The education system at meso (provincial) level

On its website, the Eastern Cape Department of Education states its vision as ‘... to offer quality public education ... that transforms schools into centres of community [sic] and promotes shared moral values, good governance and sustainable development’ (Eastern Cape Department of Education homepage, 2007). One of the 13 Chief Directorates around which this Department of Education is structured is that of Curriculum Management, the purpose of which is to promote, co-ordinate and monitor the implementation of curriculum policy, teachers’ and curriculum staff professional development, and learner assessment (Eastern Cape Department of Education homepage, 2007). The Curriculum Management Chief Directorate consists of five Directorates, one of which is the FET and Adult Basic Education (ABET) directorate. This directorate is further divided into three sub-directorates, which are: FET Schools, FET Colleges and ABET, and Professional Development for FET and ABET. The FET schools sub-directorate is further sub-divided into Subject Areas, each manned by a Deputy Chief Education Specialist. For example, there is a Deputy Chief Education Specialist for Life Sciences for FET schools, whose responsibilities include inter alia:

- Establishing and maintaining curriculum support structures at district level with regard to the teaching and learning of Life Sciences,
- The management and co-ordination of the implementation of the Life Sciences curriculum in the FET schools,
- Overseeing the implementation the Life Sciences examination and assessment framework in the FET schools, and
- Professional development of curriculum staff (Eastern Cape Department of Education, 2005).

The offices of the above-mentioned curriculum bodies are located within the headquarters of the provincial Department of Education, which are situated at Zwelitsha, a township outside Bhisho, the capital of the Eastern Cape Province.

The Eastern Cape Province is demarcated into 23 District Education Offices, which are further divided into Education Circuits. In addition to being responsible for the coordination of curriculum, district education offices offer advice, and provide management and governance to institutions that fall under their control (Eastern Cape Department of Education homepage, 2007). Schools that are located in the Ngqushwa Local Municipality area fall under the jurisdiction of the King William's Town District Education Office, whose head offices are located in King William's Town, about 65 km from Peddie Town. At district education level, the FET Curriculum Directorate is represented by senior education specialists, each FET subject being handled by a different Senior Education Specialist. Senior education specialists were previously known as Subject Advisors. The duties of senior education specialists include visiting schools to mentor, support and monitor curriculum implementation in the classroom (Eastern Cape Department of Education, 2007). Although the King Williams Town District Education Office maintains a circuit office in Peddie town, this office deals mainly with GET and ABET educational matters. At the time of this research project, there were no FET curriculum staff based in the Peddie Circuit Office. This meant that monitoring or supporting the implementation of the FET Life Sciences curriculum in the Ngqushwa Local Municipality schools fell under the direct responsibility of the Senior Education Specialist for Life Sciences in the King William's District Education Office.

According to the Public Service Accountability Monitor (PSAM), an independent monitoring and research institute based at Rhodes University, Grahamstown, the vacancy rate in the Eastern Cape Department of Education is almost 65%, while at district level the figure is over 80% (Mail & Guardian, 22 October, 2008), mainly due to inadequate funding. The high vacancy rate in the department has been identified as one of the major contributors to the province's poor education record. The Senior Education Specialist for Life Sciences at the King William's Town District Education Office complained of being overloaded as he was responsible for 35 schools within the Ngqushwa Local Municipality alone, besides others in the rest of the King William's Town District Education Office jurisdiction area.

The Eastern Cape Department of Education has the largest number of schools among the South Africa's nine provincial education departments, and ranks second to the province of KwaZulu-Natal in terms of educator and learner numbers (South Africa. DoE, 2008a). In 2006, the total number of ordinary public schools in the Eastern Cape was 5 780, which accounted for 22.4% of the national total (South Africa. DoE, 2008a). The population of

learners in these schools was 2.07 million, and that of educators 62 328, which formed 22.5% and 16.4% of the national totals, respectively (South Africa. DoE, 2008a). In 2007, 37.7% of all public schools in the province were 'no-fee' schools, meaning that learners were exempt from paying school fees (Eastern Cape Department of Education, 2007). Since 1994 there has been a concerted effort in the province to address the educational injustices of the apartheid past. For example, in its 2006/2007 annual report, the education department reported the following as having been built: 1 679 toilets, 1 403 classrooms, 314 staffrooms and 68 Science laboratories (Eastern Cape Department of Education, 2007). However, the province's schooling system remains characterised by infrastructure backlog: 30% of the province's schools still lack electricity, 21% have no reliable water supply and 7% (441) had no sanitation facilities at all (Eastern Cape Department of Education, 2007). Almost 15% of the school buildings in the Eastern Cape are constructed from mud (Mkhangeli, 2006).

In terms of efficiency, the province's schooling system fares equally badly. For example, the department was unable to spend its entire R 12.9 billion budget for the financial year of 2006/2007, due to a skills shortage, fraud and corruption (Mail & Guardian, 22 October, 2008). Although, in 2006 the province recorded enrolment figures of over 98% for Grades 1-12 (Mkhangeli, 2006), grade repetition rates are high. For example, in 2004, the repetition rate for Grade 10-12 learners in some of the province's disadvantaged districts was above 20% (Mkhangeli, 2006). In 2006, the dropout rate for Grade 10-12 learners was 22%, mainly due to learners leaving the province for the better schools in the Western Cape Province (Mail & Guardian, 22, October, 2008). The province consistently comes last in the country in the national senior certificate examinations. In 2007 and 2008, only 57.1 and 50.6% respectively, of the province's learners who wrote the national Grade 12 examinations managed to pass (South Africa. DoE, 2008a). Of the 60 297 learners in the province who wrote the 2008 Grade 12 national examinations, which were the first to be written under the National Curriculum Statement framework, only 14.3% qualified for university entrance (South Africa. DoE, 2008a). Other major educational challenges facing the province include timely delivery of teaching and learning materials to schools, and provision of reliable transport to learners, effective implementation of the school nutrition programme, improving literacy, mathematics and science education, filling vacant posts in the department and schools, and professional development of staff (Mkhangeli, 2006).

6.5.4 The education system at the micro (institutional) level

6.5.4.1 *General information about the case study schools*

For the sake of maintaining anonymity, the four schools that took part in the study are referred to as School A, B, C and D. There were three main criteria that were considered when selecting the case study schools. The criteria were that the school was: located in a rural area; was under-resourced in terms of physical structures and educational resources; and under-performing in the end-of-year Grade 12 national examinations. I chose these criteria because they represent typical characteristics of the majority of schools in South Africa's rural areas (NMF, 2005). Since this study involved analysis of curriculum interpretation and implementation at rural under-resourced schools, it was important that the schools which participated in the study were typical of the majority of the rural schools in the Eastern Cape, and South Africa. The four selected schools occur in the same zone of Ngqushwa Local Municipality, although they are separated from each other by up to six kilometres. Although there is a tarmac road to the nearest town (Peddie), the roads leading to the individual schools are not tarred, and are poorly maintained. Public transport from the schools to Peddie Town and other neighbouring towns is irregular and is mainly provided by private taxi operators.

The majority of the learners at these schools come from disadvantaged socio-economic backgrounds, their guardians or parents being mostly unemployed and reliant on government welfare grants and pensions (see Section 6.2 & 6.3). The four schools lack educational resources such as libraries, and science or computer laboratories. The post-apartheid rural electrification programme has seen all the four schools being electrified in the recent past. The schools also have well-built pit latrines. The South African Democratic Teachers' Union (SADTU) has a strong influence in the running of these schools and is represented at each of these schools by a Site Steward. The government is responsible for paying the teachers at all the four schools. In addition to being no-fee schools (parents are not required to pay school fees), the four schools are also Section 21 schools, meaning that the responsibility for their financial management has been delegated to their respective School Governing Boards and School Management Teams. The three high schools in the study are under the Matric Improvement Programme, a project run by the Eastern Cape Education Department as a form of extra support to schools that have less than 50% matric pass rate. None of the schools offers residential accommodation to teachers or learners, and the majority of the teachers commute from Peddie town and other towns on a daily basis.

6.5.4.2 Contextual profile of School A

This school was started in 1989 as a community school, and was taken over by the government in 1991. According to the school's principal, the school started with a population of 98 learners and three teachers, which gradually increased until the late 1990s when learner numbers reached over 450. However, since then learner population has dwindled mainly as a result of urban migration and currently stands at 303 (123 boys and 180 girls), slightly above the 2007 figure of 294. The school only caters for Grade 8-12 learners, and has only one feeder primary school. Grades 10-12 have two streams per class: a science stream and a commercial stream. The rest of the grades have one stream each. The school's infrastructure consists of 10 permanent classrooms, one of which has been converted into a staff room. The school's two classroom blocks are in a very bad physical state, with peeling paint, broken or missing windows, doors and ceilings. Although water pipes have been installed at the school, there is no running water, and the school relies on rainwater tanks. During the interview with the school principal, he named the major challenges facing the school as lack of sufficient funds to run the school, inadequate resources such as textbooks and furniture, and irregular school attendance by learners. The school's matric performance has been steadily declining in the recent past, from a pass rate of 22% in 2005, 20% in 2006, to 14 % in 2007. The staff component of the school consists of 16 teachers, one principal and one Head of Department. The school's low enrolment figures disqualify it from having a Deputy Principal. All the teaching staff have professional teaching qualifications, and two hold post-graduate qualifications.

The Grade 10 Life Sciences class at this school has 26 learners. The Life Sciences teaching load at the school is shared between two male teachers. The current Grade 10 Life Science teacher holds a Senior Teacher's Diploma and a Further Diploma in Education, with majors in Biology and Agriculture. In addition to teaching Grade 10 Life Sciences, he was also responsible for teaching Agriculture in Grades 10-12. He has over 17 years experience in high school teaching. He cited lack of textbooks and inadequate training in the National Curriculum Statement as his major challenges to teaching Grade 10 Life Sciences. He stated that so far he had attended only one workshop on this subject.

6.5.4.3 Contextual profile of School B

Compared to the other three schools in the study, this school is a relatively new school which was started by the community only in 1997. It was originally housed in a tin shack, but has

since then moved into newly built buildings, following its merger with one of the local primary schools. Hence compared to the rest of the schools in the study, the physical structure of this school is in a much better condition. The school is fully electrified and has running water, in addition to rainwater storage tanks. Still the school lacks facilities such as flush toilets, laboratories or a library. Although the primary and secondary sections are housed together, they each have their own school principal and staff component. As of 2007, the learner population in the primary section stood at 260, while that in the secondary section was 99. In 2008, the population of the secondary school was 295. The secondary section of the school only goes up to Grade 10, after which learners wishing to attend Grade 11-12 have to move to other high schools in the neighbouring locations. Each of the grades in the secondary section has only one stream. The secondary section of the school occupies five classrooms, two of which remain unused. There is a well-built principal's office and staff room, although they both lack adequate furniture. The school has no telephone, photocopier or computer. All six teachers in the secondary section of the school have professional teaching qualifications. The Grade 10 Life Sciences class at this school had 9 boys and 14 girls. The Grade 10 Life Sciences teacher holds a Standard Teacher's Diploma, and also completed Year 1 of university Biology. She has been teaching Biology for almost 10 years. She cited work and subject overload, and lack of motivation by learners as the major challenges in her Grade 10 Life Sciences teaching. She said she had attended a workshop on the National Curriculum Statement curriculum framework where they were shown how to prepare Life Sciences work programmes. Her school principal named the major challenges facing his section of the school as truancy, inadequate furniture, and lack of parental involvement in school matters.

6.5.4.4 Contextual profile of School C

This school services a more populated and economically better off community, as can be seen from the number and nature of the dwellings that are in its vicinity. It was started by the local community and became a government school only in the mid-1980s. The school receives learners from three feeder primary schools in the location, which are all situated less than 2 kilometres from each other. The school caters for learners from Grade 8 to 12, and suffers from poor enrolment despite being located in a relatively populated area. Grade 10 had only 17 learners. Grades 8 to 10 have one stream each, while Grades 11 and 12 have two streams each. The school physical structures consist of two classroom blocks, each block having five classrooms. Three classrooms had their roof blown off and are not in current use. One of the

classrooms has been converted into a staffroom, and is burglar proofed. The school's two computers, television set and video machine are kept here. The school also has a small photocopier that is kept in the principal's office. There is no library or science laboratory, although the school offers Physical Science up to Grade 12 level. The school is fully electrified but lacks piped water. In addition to the principal, the teaching staff consist of one Head of Department and seven other teachers. The school also has a caretaker. The school principal cited teacher shortage, a high workload and late payment of school funds as some of the challenges facing this school. The Grade 10 Life Sciences teacher majored in Xhosa and History, and only started teaching Life Sciences this year. He admitted to not having received any training in the National Curriculum Statement curriculum framework.

6.5.4.5 Contextual profile of School D

This school was started by the local community in 1975, and was taken over by the then homeland government of Ciskei in 1986. According to the school's principal, this school is experiencing severe dwindling of learner numbers due to the migration of parents to Peddie Town and other urban areas. This school services a very isolated rural community and has only one feeder primary school. According to the principal, in the late 1990s the population of learners was over 500. By 2006 it had decreased to 131, which reduced further to 120 and 127 in 2007 and 2008, respectively. The teaching staff, who are all professionally trained teachers, number eight, and two were in the process of being redeployed to other schools to meet the required staff to learner ratio of one teacher to forty learners. The school used to offer Physical Science but this was discontinued when the only science teacher at the school was redeployed to another school. According to the school's principal, the shortage of teaching staff is the main challenge facing this school. With 12 classrooms this school does not have a classroom shortage, although the three classroom blocks are in a very bad state of repair. The school lacks laboratory and library facilities. It is electrified, but lacks a reliable water supply depending on three rainwater tanks, which at the time of my visits were rusted and empty. From the school funds, the school has managed to purchase one computer, and a small photocopying machine. The school's governing body was described by the principal as being active, although she also complained of non-attendance of school meetings by the majority of the school's parents. There were 19 learners in the Grade 10 Life Sciences class. One teacher who is also responsible for teaching Agriculture in Grades 10-12 handles all the Life Sciences classes at this school. He complained of having to miss the training session of one subject if workshops for both Life Sciences and Agriculture were held over the same

period. Although he had attended two workshops on the National Curriculum Statement curriculum framework, he said he was still unsure about Learning Outcomes and Assessment Standards.

As mentioned before, this study is essentially about curriculum implementation in a rural under-resourced education context, and the four schools whose profiles are outlined above were purposely selected for the adverse conditions under which they operate. All four schools are situated in poverty stricken areas, where there is heavy dependency on communal natural resources, which are rapidly being degraded (see Section 6.4). Although none of the Grade 10 classes at the four schools contained very high numbers of learners in a single class, in other respects the four schools fitted the typical profile of the majority of rural schools in South Africa (see Section 2.3). For example, all the four schools were located far from the major urban centres of the province, are insufficiently funded, have poor/inadequate infrastructure and insufficient educational resources, while their Grade 10 Life Sciences teachers have received insufficient professional training in the National Statement Curriculum framework. Under such circumstances the majority of learners from these schools enter the job market armed with only the most rudimentary form of education, as the schools' performance in the matric examinations testify. Contextualised teaching and learning through a focus on natural resource management has much to offer these schools, as a strategy towards enhancing the quality and relevance of the education that they offer to their learners (see Section 1.3.3).

6.6 POST-APARTHEID CURRICULUM REFORMS

The drive to remove the legacy of apartheid from the country's education system has characterised South Africa's post-apartheid educational reforms. Under apartheid, the curriculum, which was based on Christian National Education (see Section 3.7.2), was very prescriptive, promoted rote learning, discouraged inquiry and critical thinking, and reinforced racial injustice and inequality (Jansen, 1999a). One of the first major post-apartheid education policies, *The White Paper on Education and Training* (South Africa. DoE, 1995a), called for curriculum change and the participation of key stakeholders in the curriculum development processes. Since 1994 there have been three major curriculum reform initiatives in South Africa's schools, which have resulted in the following curriculum frameworks:

- A Resume of Instructional Programmes in School, Report 550 (2001/08),

- Curriculum 2005 (C2005), and
- The (Revised) National Curriculum Statement (Chisholm, 2005).

Jansen (1999a) writes that the period immediately after the 1994 elections was characterised by a lack of substantial change in the country's education system, partly as result of the strong hold that the conservative white bureaucracy still had on the system, but also due to the weak political leadership in the National Department of Education. Amid mounting political and social pressure for visible change in the education system, the then Minister of Education, Professor Sibusiso Bengu established the National Education and Training Forum, which was mandated with the removal of incorrect, sexist, racist and culturally insensitive content from existing syllabi, and to consolidate the various subject syllabi which had been inherited from the different racially segregated education departments (Jansen, 1999a). However, in the end only minimal change to the subject syllabi was effected, and existing syllabi were either maintained, or the changes made were limited to removal/addition of chapters, or introduction of new terminology in existing syllabi (Jansen, 1999a). The curriculum policy document which was produced was called *A Resume of Instructional Programmes in School, Report 550 (2001/08)*, or the 'interim curriculum', and informed teaching and learning throughout South Africa's schooling system in the immediate post-1994 period.

Jansen (1999a) summarised the first post-apartheid curriculum reform initiative as being overly political in nature, in that it was driven by a need for the education department to earn political legitimacy, other than for effecting real change at classroom level. More importantly, Jansen concludes that by ignoring the context of curriculum reform, the syllabi revision initiative set a dangerous precedent of future curriculum reform initiatives in the country.

The introduction of C2005 set in motion the second major post-apartheid curriculum reform in South Africa's schooling system. In introducing C2005, the National Department of Education explained that:

... in the past the curriculum has perpetuated race, class, gender and ethnic division and has emphasized separateness, rather than common citizenship and nationhood. It

is therefore important that the curriculum be restructured to reflect the values, principles of our new democratic society (South Africa. DoE, 1997, p. 1).

In addition, following the establishment of the National Qualifications Framework (NQF) to scaffold the new education and training system, there was a need for a curriculum model that echoed the NQF's emphasis on learning outcomes, lifelong learning, and integration between education and training. The goals of C2005 were described as to prepare learners for the 21st Century, in a democratic, just, caring society, based on the values of the country's Constitution (South Africa. DoE, 1997). So radical was the change in educational vision under C2005 that the curriculum has been described as revolutionary (South Africa. DoE, 2000), and necessitating a paradigm shift among teachers in the way they thought about teaching and learning (South Africa. DoE, 1997). Although plans to implement C2005 were first announced in 1995, it was not until 1998 that the curriculum was incrementally introduced into the GET band across all the country's nine provinces. According to the original implementation timetable, by 2005 all Grades (1-12) would be following this curriculum framework, hence the use of the brand name C2005.

C2005 was underpinned by three core principles, namely that of: outcomes-based education (see Section 3.7.5); an integrated approach to knowledge (see Sections 5.7 & 5.8), and learner-centred pedagogy, which signalled a distinct break from the content-based, rote learning and teacher-dominated curriculum approach under apartheid. However, it was the OBE approach to learning and teaching that came to characterise C2005. Rather than political ideology as during the apartheid era, the Constitution formed the basis of curriculum through what were called seven Critical and five Developmental Outcomes. These were generic qualities that were identified by the newly formed South African Qualification Authority as being necessary for the personal development of learners and for the social and economic development of society at large. Subjects came to be identified by Learning Outcomes, or Specific Outcomes which were derived from the Critical and Developmental Outcomes, rather than from subject matter.

A Specific Outcome outlined the knowledge, skills and values which a learner should be able to demonstrate at the end of a learning experience in a particular grade/phase. In addition to Specific Outcomes, C2005 had numerous other design features such as Assessment Criteria, Range Statements, Performance Indicators, and Phase and Programme Organisers to assist

teachers to plan lessons which were meant to promote an integrated and learner-centred approach to learning (DoE, 2000). C2005 also placed emphasis on the use of continuous assessment, and the use of different approaches to learner assessment.

C2005 was beset with problems right from the start, despite its good intentions, and wide support by the majority of South Africa's black teachers (South Africa. DoE, 2000). Some of the problems were contextual, and stemmed from the strategies that were applied to implement the new curriculum, for example hasty implementation before enough capacity both in terms of physical and human resources were put in place (South Africa. DoE, 2000; Jansen, 1999b). The curriculum framework was introduced during a period of flux involving increased political pressure for visible change in education, decreasing funding for education, and structural changes to the organisation of the education system in the country. Other implementation problems associated with C2005 stemmed from the very design of C2005 itself, especially those which relate to the OBE and integrationist approaches (South Africa. DoE, 2000). In 2000, after only two years of C2005 implementation in the GET band, and amid mounting evidence of strong disparity between policy and practice, the then Minister of Education, Dr Kader Asmal, appointed a committee to review C2005 and to recommend strategies toward its effective implementation in schools. The initial plan of introducing C2005 in Grade 10 by 2004 had to be shelved until after the C2005 review and revision process.

The Review Committee on C2005 called for changes to the structure and the design features of C2005, simplification of its terminology, relaxation of implementation time frames, closer alignment between C2005 and assessment, availability of relevant educational resources to schools, and more effective training and other forms of support for teachers (South Africa. DoE, 2000). The review and revision of C2005 provided the basis of the next curriculum initiatives which were the 'Revised National Curriculum Statement' (for the GET band), and 'National Curriculum Statement' (for the FET band).

The two revised versions of C2005 were still informed by the now more refined Critical and Developmental Outcomes, and retained C2005's core principles of: social transformation; high knowledge and skills; integration and applied competence; progression; articulation and portability; valuing indigenous knowledge systems; and credibility, quality and efficiency (South Africa. DoE, 2003). Two more principles promoting environmental and social justice

were added, and there were more specific guidelines for the subject matter to be taught to learners in each grade or phase. The only other curriculum design features which were retained were the Learning Outcomes and the Assessment Standards. The introduction of the Revised National Curriculum Statement in schools started with the Grade R-3 in 2004, and by 2005 most of the grades in the GET band were following this curriculum approach. In the case of Grades 8-12, the implementation of the National Curriculum Statement was delayed, and the 'interim curriculum' remained in place until 2006 when it was replaced by the National Curriculum Statement for Grades 8-10, followed by Grade 11 in 2007, and Grade 12 in 2008.

The National Curriculum Statement for Grade 10-12 (General) represents a policy statement for learning and teaching for schools in the FET band, and was prepared in a consultative and participatory process involving key stakeholders such as subject specialists, lobby groups and teacher unions (Chisholm, 2005). In introducing the curriculum framework to the public, Ms Naledi Pandor, the third post-apartheid Minister of Education noted that the revised curriculum framework:

... requires extensive reading and extended writing in all subjects ... requires learners to think carefully about what they learn; that they have strong conceptual knowledge and are able to apply this in a variety of situations; that they are critical and curious learners; that they are aware of the social, moral, economic and ethical issues which face South Africans and citizens around (Pandor, n.d.).

The National Department of Education admitted to spending millions of rands on the training of teachers and curriculum support staff, the provision of textbooks and other educational materials such as examination exemplars, study guides and teaching guidelines to support the implementation of the National Curriculum Statement in schools. Nevertheless, doubt still remains over the duration and effectiveness of the teacher training programmes that were provided, and the content knowledge of the majority of South Africa's teachers, which have longer historical roots. Despite repeated calls in the mass media for OBE to be scrapped, the National Minister of Education has reiterated the government's commitment to the this education approach, and to continue with its modification to suit South Africa's educational contexts. This may be because OBE is part of a wider policy framework influencing the whole NQF, not only schooling.

6.7 LIFE SCIENCES AS A SCHOOL SUBJECT

Under the National Curriculum Statement for Grades 10-12 (General) curriculum framework, the subject of Life Sciences replaced that of Biology of the 'interim' and past curricula. Le Grange (2008) identifies two major approaches to the teaching and learning of Biology in South African schools. The first approach is what he calls the 'biology as science of life approach' which focuses on the transmission of factual scientific knowledge that bears no immediate relevance to the lives of learners. It is this approach which dominated the teaching and learning of school Biology during the apartheid era, and which persisted in the 'interim curriculum,' following the first major post-apartheid curriculum reform. Le Grange (2008) reports that with the adoption of OBE as the underlying educational principle in post-apartheid educational changes, there was a shift in approach to school Biology to what he calls the 'science for living approach'. This approach to school Biology places emphasis on personal and social relevance of the subject. This can be seen in *National Curriculum Statement Grades 10-12 (General) for Life Sciences* (South Africa. DoE, 2003, p. 9), where Life Sciences is described as:

...the systematic study of life in the changing natural and human made environment...involv[ing] critical inquiry, reflecting, and understanding of concepts and processes and their application in society.

However, Le Grange (2008) warns that despite the *National Curriculum Statement Grades 10-12 (General) for Life Sciences* being an enabling framework for the 'science for living approach' major challenges still remain before what is in the official documents can be translated into appropriate classroom experiences for learners.

Under the *National Curriculum Statement* framework, Life Sciences has three Learning Outcomes which are based on the three major competencies which the subject is supposed to develop in learners. In Grade 10 Life Sciences, each Learning Outcome is linked to three or more Assessment Standards as shown below:

Learning Outcome 1: Scientific and Problem Solving Skills

- Assessment Standard 1: Identifying and questioning phenomena and planning an investigation.
- Assessment Standard 2: Conducting an investigation by collecting and manipulating data.

- Assessment Standard 3: Analysing, synthesizing, evaluating and communicating findings.

Learning Outcome 2: Construction and application of Life Sciences knowledge

- Assessment Standard 1: Accessing knowledge.
- Assessment Standard 2: Interpreting and making meaning of knowledge in Life Sciences.
- Assessment Standard 3: Showing an understanding of the application of Life Sciences knowledge in everyday life.
- Assessment Standard 4: Analysing, synthesizing, evaluating and communicating findings.

Learning Outcome 3: Life Sciences, Technology, the Environment and Society

- Assessment Standard 1: Exploring and evaluating scientific ideas of past and present cultures.
- Assessment Standard 2: Comparing and evaluating the uses and development of resources and products, and their impact on the environment and society.
- Assessment Standard 3: Comparing the influence of different beliefs, attitudes and values on scientific knowledge.

(South Africa. DoE, 2003, pp.14-15).

Life Sciences has four ‘Knowledge Areas’ which are the means by which the three Learning Outcomes are achieved. Knowledge Areas broadly specify the content and scope of what is expected to be taught to learners in each grade. The four ‘Knowledge Areas’ are:

- Tissues, Cells, and Molecular Studies,
- Structure, Control and Processes in Basic Life Systems,
- Environmental Studies, and
- Diversity, Change, and Continuity (South Africa. DoE, 2003, p. 10).

The specified core knowledge comprises only 80% of the content to be covered, and the remaining 20% is expected to be constituted from local context.

Life Sciences is commonly referred to as a gateway subject, together with Mathematics, Physical Sciences and English Language, meaning that it opens up many different career options for learners. Under the National Subject Curriculum Statement, Life Sciences is placed in the same subject grouping as Mathematical, Engineering, Computer, and

Agricultural Sciences, from which learners are required to select at least one. Le Grange (2008) reports that besides English, Life Sciences is the most commonly offered subject at Grade 12 level. Of the 588 647 learners countrywide who sat the first national examinations under the National Curriculum Statement framework in 2008, 297 417 chose Life Sciences as compared to 93 666 who opted for History (South Africa. DoE, 2008b). Only 117 789 learners (39.6%) managed to score at least 40% in the Life Sciences examination (South Africa. DoE, 2008b).

6.8 ENVIRONMENTAL LEARNING IN POST-APARTHEID SOUTH AFRICA

The most important project concerning environmental learning in post-apartheid South Africa so far has been the National Environmental Education Project for General Education and Training (NEEP-GET). This was a large initiative which was set up by the Ministry of Education in 2001 with the help of Danish funding to enhance environmental learning in curriculum policy and in schools. The removal of 'phase organisers' as design features following the review and revision of C2005 meant that 'environment' ceased to be used as a means of promoting cross-curricular integration. Chisholm (2005) reports that the environmental lobby (represented mainly by NEEP-GET), and the history and religious lobbies were some of the most vocal groups during the consultative meetings which led to the making of the Revised National Curriculum Statement (R-9). During the making of the Revised National Curriculum Statement, the environmental lobby sought for recognition of environmental issues across the curriculum, and for the raising of knowledge, skills and awareness of sustainable development in all Learning Areas (Chisholm, 2005). As a result of NEEP-GET's input, human rights, a healthy environment, social justice and inclusivity became the founding principles of the Revised National Curriculum Statement (R-9). South Africa became one of the few countries in the world where the principle of a healthy environment and social justice are enshrined in curriculum policy (NEEP-GET, 2005). The transformative socio-ecological role of the new framework resulted in environmental learning opportunities being incorporated into all eight different learning areas of the Revised National Curriculum Statement (R-9).

There was, however, growing concern over the teachers' capacity to transform the environmental learning ideals in the curriculum policy into appropriate and effective classroom practices, given that the majority of the teachers had been schooled in the old system, coupled with the complex nature of environmental issues and risks. NEEP-GET took

on the additional role of building capacity at provincial, district and school levels for environmental learning. This was done through:

- Professional development in environmental education learning processes for curriculum support staff at provincial and district levels,
- Professional development for teachers in preparing and implementing lessons with an environmental focus,
- Development of guidelines and resource materials for environmental learning, and
- Pre-service teacher training initiatives in environmental education (NEEP-GET, 2005, p. 2).

In summing up the impact of the NEEP-GET project, Lotz-Sisitka (2004c, p. 22) reported that the project had contributed to the strengthening of environmental learning in curriculum policy, but much remained to be done to support environmental learning at the provincial, district and school level, especially in the teachers' daily classroom practices. The NEEP-GET project lasted only three years, and was limited to the GET band. The introduction of the National Curriculum Statement in the FET band is yet to be supported by a similar project. This is where studies such as this become useful by providing insight into the status of environmental learning both in policy and practice in the FET band, thereby identifying possible areas of intervention.

Apart from the departments of education, there are other governmental departments (for example, the departments of Environmental Affairs and Tourism, and Water Affairs and Forestry, and Agriculture), parastatal bodies (for example, the South African Biodiversity Institute and South African National Parks) and NGOs (for example, the Wildlife and Environment Society of South Africa, and the Endangered Wildlife Trust) that support environmental learning in schools (NEEP-GET, 2005), by running environmental education projects in schools, or by producing educational resources for use by schools. However, Lotz-Sisitka (2002) reports that their efforts are uncoordinated, while the teaching and learning materials that they provide to schools are of uneven quality.

Share-Net is an example of a non-profit organisation which supports environmental education initiatives in the southern African region by developing and supplying teaching and learning

materials and by conducting courses that improve teachers' knowledge and skills in environmental education. Another initiative which supports environmental learning in schools is the Eco-Schools programme. This is an internationally recognised environmental education programme which started operating in South Africa in 2003. Schools which join this initiative are expected to carry out learner-centred curriculum-based activities which promote a healthy school and local community environment. The schools report their progress in the form of portfolios which are assessed at the end of the year, after which successful schools are awarded with a green flag. In 2007, almost 900 schools in South Africa had registered with this programme (Rosenberg, 2008, p. 6).

Under the Revised National Statement, teachers had to contend with the challenge of developing environmental learning activities within the OBE framework. Such learning activities have to be open ended in that they need to create opportunities for learners to engage and understand the complexity of environmental issues and risks (NEEP-GET, 2005), rather than merely exercises involving simple transfer of factual knowledge, or environmental campaigns. The NEEP-GET project piloted a lesson planning tool called the 'active learning framework' to help teachers design and implement lessons with an environmental focus. In Lotz-Sisitka and Raven (2001, p. 31), the 'active learning framework' is described as a scaffolding to foster learner inquiry and problem solving, and to provide guidelines to assessment in environmental learning. The framework is based on five basic questions, which act as guides to the different phases of what a meaningful environmental learning process should involve. The questions are:

- What do we already know?
- Who can we contact for help?
- How can we investigate the issue in our local environment?
- How can we do something about it?
- What have we learned and achieved? (Lotz-Sisitka & Raven, 2001, p. 31).

This model of environmental learning formed the basis of the analysis of the Grade 10 Life Sciences lessons in the study (see Section 11.7).

6.9 CONCLUSIONS

This chapter provided contextual profiles of the Eastern Cape Province and the Ngqushwa Local Municipality where the research project was conducted. The Eastern Cape is one of South Africa's most economically deprived provinces, and the inhabitants of the Ngqushwa Local Municipality are among the most disadvantaged people in South Africa. The adverse socio-economic status of the province is steeped in its colonial and apartheid past. Issues pertinent to the rural education discourse such as curriculum relevance, curriculum implementation, and learner performance, and those which relate to the environmental discourse in the province such as natural resources degradation, sustainability and the need for environmental education seem to speak with a louder and more urgent voice in this province than in most other parts of South Africa.

The chapter started with an introduction to the province's geography. The province's poor economic status owes as much to its colonial and apartheid past as its natural geography. For example, the steep topography over large areas of the province contributes to the severe problem of soil erosion and poor soil quality in the province, while the occurrence of frequent droughts preclude rain-fed agriculture in most areas of the province. Next, the chapter discussed the status of communal natural resources in the province. There is heavy dependence on these natural resources, especially among the province's rural poor. A complex web of factors including apartheid land policies, the breakdown of traditional natural resource management systems, increased population pressure, adverse weather conditions and migration from the province has contributed to the widespread degradation of communal natural resources in the province. The degradation of the natural resource base requires urgent remedial action to ensure the sustainability of rural livelihoods. The decentralisation of the responsibility to manage these natural resources to local communities needs to be supported by other programmes that empower local communities with appropriate attitudes, knowledge and skills to ensure their sustainable utilisation. The integration of natural resource management into the curriculum of rural schools in the Eastern Cape has the potential to build the capacity of rural communities in this province to manage their natural resources better, thereby contributing to a better fit between the province's formal education system and the needs of local communities.

Next the chapter discussed the structural organisation of the education system in the Eastern Cape. This was done with the aim of locating the position of this system within the larger

national education system in the country. This discussion adopted Bernstein's theories of pedagogic device and recontextualisation (see Chapter 9) as vantage points from which the positions and responsibilities of the different agents and agencies in the education systems who are responsible for the Grade 10 Life Sciences curriculum were analysed and described. At the macro level, the responsible education system consists of the Sub-Directorate of School Curriculum, a branch of the FET Directorate that is located within the National Department of Education. At the provincial level, the responsible agency is the FET (Schools) Sub-directorate, which falls under the Schools and ABET Directorate. A Deputy Chief Education Specialist is answerable for all matters pertaining to the teaching and learning of Life Sciences in the FET band across the entire Eastern Cape Province. In this, the Deputy Chief Education Specialist is assisted by senior education specialists for Life Sciences (formerly subject advisors), who are located at district education offices. The district education office that is responsible for Grade 10 Life Sciences in the Ngqushwa Local Municipality schools is located in King William's Town, which is almost 60 km away from Peddie Town, the main administrative town of the Ngqushwa Local Municipality.

As explained in Chapter 4, contextual factors on the ground shape how the official curriculum is interpreted and implemented in schools. This chapter presented the contextual profiles of the four schools that implement the Grade 10 Life Sciences curriculum. All four schools were rural and disadvantaged in terms of the socio-economic backgrounds of the learners, infrastructure, educational resources and academic achievement. The four schools were purposefully selected for these qualities. Lastly, the chapter outlined post-apartheid curriculum reforms, and the key ideas which are guiding the subject of Life Sciences and environmental learning under the National Statement Curriculum framework.

The next chapter describes the theoretical framework on which the study was based.

CHAPTER 7

THE THEORETICAL FRAMEWORK

7.1 INTRODUCTION

This study involved the analysis of various pedagogic texts, school activities and practices with the aim of finding out the extent to which they integrate NRM (see Chapter 1). Chapter 1 introduced the study's field of research as that of sociology of curriculum. The aim of this chapter is to provide a detailed description of the study's theoretical framework. The chapter begins with a discussion of the relationship between education and sociology, which is followed by an outline of major trends in the sociology of education field. This is done in order to provide a better understanding of both the sociology of curriculum field and the study's theoretical framework, and how they relate to the rest of the sociology of education field.

7.2 ON SOCIOLOGY AND EDUCATION

The study of the relationship between schooling and society has enjoyed tremendous growth since its humble beginnings at the turn of the twentieth century. Before then, little theoretical and empirical sociological analysis of schooling had been done (Hallinan, 2000). Both sociologists and educationists have played key roles in the development of this field, although their interaction has been characterised by long-standing tensions. Trent, Braddock and Henderson (1985) traced this tension to the fact that sociologists were originally reluctant to research education as a social institution, regarding it as 'soft science' which lacked objectivity. Other major issues of contention were around the aims of the sociological analysis, the subject matter, together with the appropriate approaches and methods (Trent, Braddock & Henderson, 1985). As researchers in both fields of sociology and education became disillusioned with each other, the anticipated close cooperation of early years soon disappeared, and each field turned inwards in an attempt to establish scientific and academic legitimacy (Trent, Braddock & Henderson, 1985). However, by the turn of the twentieth century, both fields were again working closely together, as education researchers realised the relevance of social theory and research to educational problems (Parelius & Parelius, 1987). Sociologists, on their part, began to see how educational experiences could contribute to the development of social research and theory building. Closer cooperation between sociologists and educationists has also been spurred on by the repeated failures of educational reforms

(Hallinan, 2000). A large body of knowledge has been built up concerning the interplay between sociology and schooling, based on a variety of research approaches. The result has been a deepened insight into the world of structures and processes that constitute schooling (Hallinan, 2000). Today, sociological analysis of education is a major component of educational research. Hammersley (1996) noted that a considerable body of contemporary education research could be categorised as sociological, while at the same time new educational issues for sociological analysis continue to emerge (Brookover, 1976).

Hallinan (2000) states that some of the earliest writings on education from a sociological perspective were by two early sociologists: Emille Durkheim (1858-1917); and Max Weber (1902-1979). According to Hallinan (2000), Durkheim's work on inter alia, the relationship between schools and other social institutions, and between schools and social change is regarded as having laid the conceptual foundations for sociology of education. Although Weber's writings did not directly focus on education, they dealt with issues such as organisation, leadership and bureaucracies, which contributed to a deeper insight into educational processes, and provided models for school structuring and administration (Hallinan, 2000). Other early contributors to the sociology of education field include Parsons, Lester, Ward, Dewey, Marx, Gintis and Waller, and some of their theories still guide and shape this field today (Hallinan, 2000).

7.3 ON EDUCATIONAL SOCIOLOGY

There are three major terms used by researchers to conceptualise the interplay between education and sociology. They are: educational sociology; 'old' sociology of education; and 'new' sociology of education. There is ongoing debate as to which of the three concepts best captures the relationship between education and sociology, and over whether the study of this relationship falls under education or sociology (Miller, 1977).

The field of educational sociology represents the first formal attempt to analyse education from a sociological perspective, and was first developed in the United States of America (USA) during the early 1920s and 1930s (Miller, 1977). During this period, the USA was under the grip of progressivism, a social reform movement that supported government intervention in the removal of societal ills (Wexler, 1976). According to Wexler, progressive reformists believed that public education systems should form the basis from which to eliminate social injustices. One of the earliest proponents of educational sociology was Elias

Payne, who in 1927 founded the *Journal of Educational Sociology* (Wexler, 1976). Under progressivism, educational sociology enjoyed great popularity in the USA, and was taught as a course at numerous teacher training colleges in the country. However, outside the USA the field failed to take root. For example, in Britain it was not until the end of the World War 2 that educational sociology began to receive more attention, by which time it was in general decline in the USA (Reid, 1984).

Trent, Braddock and Henderson (1985) report that although up to the 1930s educational sociology was a major field of study, it involved little empirical research, and most of the work done was abstract, philosophical, or even utopian (Parelius & Parelius, 1987). The field eventually split into two camps. On the one there were those who adhered to the belief that educational sociology was a sub-field of education, and should be used to solve existing educational problems. On the other hand there were those who saw it as merely another offshoot of sociology, to be used for research and theory building (Trent, Braddock & Henderson, 1985). Trent et al. explain that researchers in the second group were interested in abstract sociology ideas and theory building, while the central focus for those in the first group was practical information for problem solving. This rift contributed to the decline of educational sociology. It did not help matters that at around the same time the field of educational psychology was emerging and getting increasing support from researchers and school administrators, due to its empirical and quantitative approach to research (Reid, 1984). The demise of educational sociology in the USA became official in 1963, when the *Journal of Educational Sociology* was renamed the *Journal of the Society of Education* (Reid, 1984).

7.4 SOCIOLOGY OF EDUCATION

7.4.1 Introduction

The sociology of education field represents the second major conceptualisation of a sociological perspective of education. This field developed when researchers abandoned the educational sociology field in an attempt to compete with the more established educational psychology field (Wexler, 1976). They believed the sociological analysis of education could be improved through a positivist approach to research, and by abandoning school reform overtones. However, despite taking on these changes, the emerging field of the sociology of education still remained ill defined and poorly delimited (Hoyme, 1961).

There are numerous definitions of sociology of education to be found in literature. For Reid (1984, p. 18) sociology of education is simply the application of sociology to education. Brookover (1976, p. 13) is more elaborative when he defines sociology of education as ‘the scientific analysis of social processes and social patterns involved in the education system’. Another illustrative definition is by Miller (1977, p. 12), who states that sociology of education is ‘a particular branch of sociology that is concerned with empirical studying (of) both the macro and micro levels of educational systems’.

Banks (1982) traces the origin of the sociology of education field to Britain after the end of World War 2, during which time the field became established as a sub-discipline of sociology. The London School of Economics which was then Britain’s leading academic centre of the study of sociology played a leading role in the development of this new field (Reid, 1984). However, in South Africa, Muller (1996, p. 180) noted that before the 1970s, sociology of education was not yet institutionalised, and no university or colleges offered the subject as a separate course of study.

Despite the amorphous nature of the sociology of education field, a number of characteristics central to the field can be discerned. Firstly, the field is considered to be a branch of sociology, and is researched mainly by sociologists (Reid, 1984). Muller (1996) identifies three other features which distinguished the field in its early years. The first one was its research focus, which centred on the educational underachievement of the working class sector of society. In the early 1950s, the progressivist belief that schools should foster a well-trained workforce to drive economic development was still strong in the USA and Britain (Banks, 1982). This structural functionalist approach to education was the driving force behind the development of sociology of education as a field, and was reflected in its research concerns throughout the 1960s (Shain & Ozga, 2001). In Britain, for example, educational opportunities and social class were of major concern to researchers in this field (Banks, 1982). The primary research focus of the field became the identification of social determinants of educability in a bid to reduce the working class wastage (Hoyme, 1961; Goodson, 1995).

Like any other new field of study, sociology of education needed to develop concepts and theories, to explain the schooling processes. Hallinan (2000) notes that this has been a major let-down in the field, with researchers relying mainly on general sociology concepts and

theories to help explain and analyse the schooling processes. Examples of such concepts include social stratification, mobility processes, while the theories include structural functionalism, conflict theory, and interactionism. Without dismissing the important role these theoretical perspectives have played in improving knowledge of schooling, Hallinan is doubtful of the ability of these non-school perspectives to fully capture the distinctive nuances of schooling. Hallinan argues that while general social theories may be able to explain schooling on a broad level, they are too abstract to analyse the unique interactions within schools, or between schools and other social institutions.

7.4.2 'Old' sociology of education

There are two major approaches to the sociology of education, namely: 'old' sociology of education and 'new' sociology of education. 'Old' sociology of education is also referred to as 'traditional' sociology of education. The chief concern of this field of study is to highlight the relationship between education, meritocracy and social mobility, and to use this relationship as the basis for educational and societal reforms. The progressivist undertones in this field are self-evident. Coupled to this was faith in science and the natural scientific approach to research (Wexler, 1976). In the US where the progressivism movement lasted longer, research in 'old' sociology of education became dominated by quantitative documentation of the extent of educational under-achievement together with their causes (Shain & Ozga, 2001). Another distinguishing feature of research in this field was the high number of studies conducted on school organisation. This research interest is traced to the field's progressivist belief in technological efficiency and bureaucratic organisation as a means of maximising school efficiency (Wexler, 1976). Much of what is written about rural education in South Africa tends to focus on describing or quantifying the disadvantaged position of rural schools, which reflects a bias towards 'old' sociology of education, as in Gordon (1996), Human Rights Watch (2004), and NMF (2005) (see Chapter 2).

The worldwide rapid expansion of educational systems between the 1950s and 1960s was soon followed by socio-economic problems such as lack of employment, poor educational standards, teacher shortages, student riots and public disorder (Shimbori, 1979). Research to inform national plans of education was urgently required, and this was often in form of large-scale national and international investigations into schooling (Hallinan, 2000). Sociologists played a central role in these investigations, which in addition to helping in the formulation of new educational strategies also helped to stimulate interest in the sociology of education field

(Banks, 1982). This explanation illustrates the third distinguishing characteristic of 'old' sociology of education, namely the close relationship between researchers and education policy makers. A close relationship between educational policy and research in South Africa was demonstrated when the country's first major post-apartheid curriculum framework, C2005, was overhauled following its review in 2000, which was commissioned by the then national Minister of Education, Professor Kader Asmal (see Section 6.6).

According to Banks (1982), 'old' sociology of education's major contribution has been the extensive documentation of educational inequalities that exist in society, as in South Africa's most recent report on rural education, *Emerging Voices* (2005). The field has been less successful in offering insight into the causes of these inequalities and appropriate solutions, and knowledge accumulation and theory building have been of secondary importance (Shain & Ozga, 2001). 'Old' sociology of education reached its peak during the early 1970s, and has been in general decline since then (Shain & Ozga, 2001), although for Banks (1982) the field has never been totally eclipsed by the 'new' sociology of education approaches.

7.4.3 'New' sociology of education

The 'new' sociology of education represents an amalgamation of different approaches to sociology of education research which emerged in the late 1960s (Whitty, 1985), although the term 'new' sociology of education' was coined only in 1973 (Young, 1998). According to Hammersley (1996), during its development, 'new' sociology of education incorporated inputs from various diverse fields such as Marxism, neo-marxism, interactionism, feminism and antiracism, and was never a homogenous field. This has contributed to the variety of terms used to refer to 'new' sociology of education, which include the 'new direction in sociology of education,' 'radical/phenomenological sociology of education' (Demaine, 1981), the 'interpretive approach' or the 'new paradigm/school of thought/perspective' in the sociology of education.

'New' sociology of education originated in the teacher educating colleges or institutions of Britain, notably the London Institute of Education and the Open University (Banks, 1982). Early pioneers of this approach to the sociology of education included Basil Bernstein, Michael Young and their colleagues. Young's 1971 book *Knowledge and Control* and the Open University's Course Number 282 called *School and Society* played a major role in the development of this approach (Banks, 1982). As the new sociology of education took root, it

rapidly spread throughout Britain and by the late 1960s and early 1970s was the dominant sociology of education approach in Britain and the rest of Europe. However, the approach was largely a British enterprise and enjoyed less success in the USA (Karabel & Halsey, 1977).

Adherents of the 'new' sociology of education were disillusioned by the failure of the 'old' sociology of education to explain educational under-achievement and to initiate successful educational reforms (Shain & Ozga, 2001). In addition, the validity of the assumption that related educational under-achievement to socio-cultural background was coming under more criticism. They rejected the concept of educatability and the prevailing macro-sociological approach to educational research (Banks, 1982). They sought to break away from the traditional social stratification approaches to the sociology of education, in search of new subject matter, new approaches and new methods (Young, 1998).

Some of the major principles underlying 'new' sociology of education are outlined in Young (1998). Followers of this approach believed educational inequalities arose from the selective features of the curriculum rather than the educability of the learners. Although the problem of educational under-achievement still underpinned their research, educational content and pedagogy as social processes were now regarded as being paramount. Thus new sociology of education prioritised curriculum as the central topic in the sociology of education (Sadovnik, 1991). By focusing on the analysis of school curricula, 'new' sociology of education represented the first major attempt to analyse the nature of school knowledge, and contributed to the development of the sociology of knowledge field. This approach sought answers to working class educational failures from what went on inside the schools or classrooms (Sadovnik, 1991). Thus in addition to the curriculum, problems of pedagogy, assessment and teacher-pupil interactions became dominant concerns of educational research from a sociological perspective (Karabel & Halsey, 1977). While 'old' sociology of education relied on politicians and bureaucrats to make use of research findings to remove educational inequalities, 'new' sociology of education was characterised by a distrust of officialdom, and instead emphasised the role of teachers and teacher educators as agents of progressive change (Young, 1998).

Research methodologies were another distinguishing feature of the 'new' sociology of education. Whitty (1985) notes that two camps can be distinguished, according to the

research approaches used. The first camp consisted of research which was theory-driven and influenced by neo-Marxism, and which focused on the study of relationships between dominant social groups, social values and social structure. The second camp of research rarely ventured outside classrooms or schools, and relied on qualitative research methods such as phenomenology and ethnography to study teacher and learner interactions (Whitty, 1985). Whitty points out that the division in subject matter and research approaches that existed in 'new' sociology of education was in fact a continuation of the old rift between macro and micro level sociological analyses that started with 'old' sociology of education.

In its early stages, 'new' sociology of education was heralded by its followers as a new basis for educational and social change. However, in his analysis of the contribution of this approach, Young (1998) wrote that these ideals were short lived. Young concludes that the new perspective failed to live up to its expectations, which led to its premature abandonment. Even in Britain, which is regarded as the home of 'new' sociology of education, Whitty (1985) summarises its political impact as minimal, and its role in reorienting the sociology of education towards curriculum issues as relatively short-lived. The overall verdict was that while 'new' sociology of education was vigorous in its criticisms of 'old' sociology of education, it offered little by way of empirical research or theory building (Karabel & Halsey, 1977).

Among the major weaknesses which characterised 'new' sociology of education were: the failure to build links with other educational researchers; over-emphasis of educational research as a driver of social change; misleading autonomy to teachers as the sole agents of curriculum change; and the failure to develop criteria for assessing and developing curriculum initiatives (Young, 1998). For Karabel and Halsey (1977), it was the very nature of the subject matter (new), the research methods used (soft) and the type of data collected (mainly qualitative) that contributed to the undoing of 'new' sociology of education. The effects that the declining socio-economic and political conditions in Europe during the early 1970s had on education systems also contributed to the fall of the new approach (Banks, 1982). According to Banks (1982), one of these effects was the growing influence of neo-marxist perspectives in the sociology of education field. The adoption of neo-marxist, structuralist, and functionalist perspectives into 'new' sociology of education caused renewed interest in the structural aspects of society. The curriculum was now seen as 'given' and epiphenomenal (Whitty, 1985). By the early 1980s, classroom-based research and interest in

the curriculum were in decline, in favour of macro-sociological analysis, which signalled a return to 'old' sociology of education.

Despite its numerous weaknesses, 'new' sociology of education was not a total failure. In fact as its influence in Britain went into decline, the approach was becoming increasingly popular in the USA, fuelled by the writings of Apple, Wexler and Giroux (Whitty, 1985). Although 'new' sociology of education failed to effectively deal with the issues of educational inequality, it made significant contributions on three fronts, although they were short-lived. Firstly, Banks (1982) writes that the new approach managed to focus attention on the content of the curriculum and its social organisation, which hereto had been taken for granted. This resulted in a shift of research interest from the structure of schooling to the study of its contents. Secondly, it contributed to the systematic study of schooling by generating interest in the micro processes of schooling, and linking them to the larger society of which they were part. Thirdly, by replacing the social surveys of 'old' sociology of education with participant observations, 'new' sociology of education contributed to the development of ethnography and phenomenology research techniques in the sociology of education field.

7.5 THE SOCIOLOGY OF CURRICULUM

Shaw (1973) stipulates that during the 1920s there was increasing interest in the sociology of knowledge as the socially constructed and transient nature of knowledge became apparent. Shaw (1973) attributes the rejuvenated interest in the content of school knowledge that occurred among researchers in the sociology of education to Thomas Luckmann and Peter Berger, both of whom were researchers in the sociology of knowledge field. Berger and Luckmann presented their interpretation of the sociology of knowledge in their book entitled *The Social Construction of Reality* (1966). Shaw (1973) reports that researchers in the sociology of education found Berger and Luckmann's interpretation of the sociology of knowledge appealing because: it involved the analysis of the origin, exchange, maintenance and modification of knowledge; took into account all types of knowledge, including everyday knowledge; and drew on theorists from diverse fields such as social psychology, Marxism and phenomenology. Many of the papers in Young's book called *Knowledge and Control* (1971), which is one of the major texts in the sociology of education, drew on Berger and Luckmann's views on knowledge (Shaw, 1973). Writing in this book, Young (1971) identified the key task of sociology of education as the analysis of the principles of school knowledge, its organisation and selection. He argued that curriculum, like any other social

institution, reflected competing interests, value systems as well as social and political ideologies.

Young (1971) sees the social organisation of school curriculum as being composed of three dimensions: knowledge stratification, knowledge specialization and knowledge area inter-relationships. For him it is the analysis of these issues which should constitute the basis of the sociology of the curriculum. He explains knowledge stratification as referring to the value accorded to knowledge, which is divided into two components: prestige and property. The prestige component relates to the different ways in which different kinds of knowledge are valued, while the property component is about the control of accessibility to knowledge, knowledge distribution to different social groups, and the associated reward structure. Another dimension which forms the basis of the sociology of the curriculum concerns the scope of school knowledge. By this Young means the level of knowledge specialisation provided to different social groups. Young's last dimension of the sociology of the curriculum consists of relationships between different knowledge areas and between the social groups which have access to those knowledge areas.

It is the last dimension of Young's typology of sociology of the curriculum that forms the basis of the study described here. By investigating the extent of NRM integration in the Grade 10 Life Sciences curriculum, the study sought to provide insight into the relationships between NRM knowledge and that of Grade 10 Life Sciences, and between the agents and agencies that are responsible for the interpretation of these knowledge types across Eastern Capes disadvantaged rural education sector (see Chapters 9, 10 and 11).

7.6 CRITICAL CURRICULUM STUDIES

Another field which contributed to 'new' sociology of education was that of critical curriculum studies. Although by the early 1970s research in 'new' sociology of education had shifted to curricular content, theories to explain how curriculum knowledge was selected, organised and assessed were still lacking (Whitty, 1985). 'New' sociology of education researchers had to turn to the field of critical curriculum studies for these theories. Critical curriculum studies is described as a sociological approach to schooling which is intellectually rooted in the Frankfurt School of critical theory (Pinar & Bowers, 1992), is opposed to existing social order, functionalism and Marxism (Shimbori, 1979), and involves empowerment for social change (Fien, 1993). Apple's 1979 book *Ideology and the*

Curriculum played a leading role in the spread of critical curriculum studies thinking from America to Europe and Australia (Whitty, 1985).

To help explain the link between the curriculum and the world external to schools, early theories in critical curriculum studies placed the emphasis on capitalism as the determining factor (Sadovnik, 1991). One such theory was the correspondence theory which was advanced by Herbert Gintis in 1972 (Giroux, 1980). This theory gained prominence in American and British sociology of education circles after the 1976 publication of Gintis' book *Schooling in Capitalist America*. The correspondence theory, and its many other variants explains schools as sorting mechanisms for the production of stratified labour demanded by capitalism (Whitty, 1985). Banks (1982, p. 23) states that the underlying theme of this theory was that education systems correspond with the class structure in which they are embedded.

The correspondence theory soon came in for severe criticism from researchers, due to a number of shortcomings, among which were its deterministic and simplistic nature, its reliance on a fixed class structure, its failure to explain the processes by which reproduction takes place, and its non-recognition of human agency (Bates 1980, p. 72). Researchers eventually abandoned the correspondence theory in favour of others like structuralist Marxism, post-Marxism, and resistance theory (Whitty, 1987).

The impact that the correspondence theory had on the sociology of education field in Britain is seen as being both positive and negative (Whitty, 1987). On the positive side, the theory (and its variants) introduced neo-Marxism to the sociology of education field, the consequences of which was a return to macro-sociological research, a focus on historical change, and the sidelining of the relativism of 'new' sociology of education (Banks, 1982, p. 24). On the negative side, the theory caused a shift away from Young's work on curriculum content to studies of the underlying structural causes of social inequities (Whitty, 1987, p. 28). The theory is also blamed for rendering teachers and sociologists of education helpless by its suggestion that no educational reform could be successfully implemented until the capitalist system was first destroyed (Whitty, 1987).

As researchers in the sociology of education rejected the overly economist view of schooling depicted by the correspondence theory, there was parallel growth in interest in the various

interpretations of structural Marxism (Apple, 1979). While researchers such as Althusser, Bourdieu, Passeron and Bernstein did not reject the role that schools play in reproducing social inequalities, they argued that the correspondence theory gave only one side of the picture. They believed instead, that capitalism was a product of a complex interplay between economic, political and ideological practices (Whitty, 1987, p. 31). They maintained that only through the analysis of the cultural, political and ideological forces shaping curriculum could insight be gained about the link between schooling and social inequalities. What was missing was the social theory to explain this link.

7.7 BERNSTEIN'S SOCIOLOGY OF CURRICULUM

7.7.1 Introduction

Sadovnik (1995) identifies two major approaches to the sociology of the curriculum. Researchers such as Young and Nell Kiddie adopt a phenomenological approach to the field, which focuses on the relationship between social interactions and the construction of knowledge. Bernstein and Bourdieu, on the other hand, were interested in how the social divisions of labour, and economic and social systems affect curriculum and pedagogy, which represents a structuralist approach to the sociology of the curriculum. Bernstein's work is informed by ideas from various theorists such as Durkeim, Marx, Mead, Halliday, Mary Douglas (Atkinson, 1985), and Weber, Vygotsky, Parson, Bourdieu, and Foucault (Diaz, 2001). The orientation of Bernstein's work is difficult to place due to these numerous influences, and has been variously described, for example, as structuralist, post-structuralist and functionalist (Diaz, 2001), or neo-Marxist, interactionist or functionalistic (Sadovnik, 1991, p. 57).

According to Sadovnik (1995), one area in which class reproductionists such as Bowles and Gintis failed was in explaining what goes on in schools, i.e. their analysis did not reach the micro level of schooling. Bernstein, on the other hand, was interested not only in understanding the micro processes of schooling, but also in analysing how they link to the larger institutional societal and historical factors of which they are part. Tsatsaroni, Ravanis and Falaga (2003, p. 391) write that Bernstein's theories provide tools for analysing and describing educational processes at all levels. This includes the structure, organization, and functioning of pedagogic discourse, the construction of specialist knowledge and its transformation into school knowledge, and the nature of classroom interactions. Bernstein's approach to the study of schooling has been described as unique in its ability to link what

happens at the macro level of the education system to the micro processes inside the classroom. In this way Bernstein's ideas are viewed as being very relevant to the South African education context, in light of the top-driven curriculum reforms which have taken place in the country since the end of apartheid in the quest to remove the legacy of apartheid from the country's education system (see Section 6.6). For example, Bernstein's theories have proved useful in analysing and explaining the unintended consequences of a constructivist and integrationist approach to learning for South Africa's disadvantaged rural learners, as in Taylor and Vinjevoold (1999) and in Taylor, Muller and Vinjevoold (2003).

One weakness often levied against Bernstein's work, is its highly abstract nature and the lack of empirical data (Atkinson, 1985, p.131). Atkinson points to the need for empirical testing of Bernstein's concepts, theories and models, not only for their verification, but also as a means of improving our knowledge and understanding of them. This study aims to do this for three key elements of Bernstein's work, namely, his theory of pedagogic device, and that of knowledge recontextualisation, and his concept of *classification*.

7.7.2 Bernstein's theory of the pedagogic device

Bernstein (2000, p. 25) poses this question:

Are there any general principles underlying the transformation of knowledge into pedagogic communication, whether the knowledge is intellectual, practical, or official knowledge or local knowledge?

In asking this question, Bernstein was expressing his concern over the focus on the content of the message that is relayed during pedagogic transmission that is in the reproduction theories, while ignoring the structure of the relay system which makes this transmission possible. Bernstein maintains that it is the structure of this relay system which should instead be the main focus of investigations, and puts forward the theory of the *pedagogic device* as the means by which the construction of pedagogic discourse is made possible. According to Bernstein (1990, 1996) it is the internal structure of the pedagogic device which regulates pedagogic communication. He contends that the internal structure of the pedagogic device consists of three hierarchically related rules, and that by varying these rules, different realisations of the pedagogic discourses are made possible (Bernstein, 1996, pp. 41-42). Bernstein maintains that these internal rules are not neutral, and are instead ideologically laden in favour of dominant social groups. Through its internal structuring, the pedagogic

device safeguards the ideologies of dominant power relations, by regulating the production, distribution and evaluation of pedagogised knowledge (Haaveslrud, 2001, p. 329). Bernstein (1996, p. 117) explains:

In this way there is always a struggle between social groups for ownership of the device. Those who own the device own the means of perpetuating their power ... and establishing, or attempting to establish their own ideological representations.

Bernstein (1990, 1996) calls the rules of the pedagogic device: distributive rules, recontextualising rules and evaluative rules. He explains that distributive rules act as a relay of power relations by regulating access to different forms of knowledge. In other words, they determine who gets access to which knowledge. As a result, different social groups develop different orientations to meaning or pedagogic identities (Singh, 2002, p. 573). For example, it could be argued that by taking Mathematical Literacy instead Mathematics, the majority of learners in South Africa's poor schools are being denied access to careers such as Accounting and Engineering where high competency in Mathematics is a prerequisite. The second group of rules, the recontextualising rules, is derived from distributive rules, and regulates the formation of specific pedagogic discourses (Bernstein, 1996, p. 46). Recontextualising rules selectively appropriate discourses from their fields of production, refocus and relocate them to new pedagogic sites. In other words, recontextualising rules regulate the process by which unmediated discourses are converted into pedagogised knowledge, by specifying the 'what' of its content and the 'how' of its transmission (Bernstein, 1996, p. 117). For example, in the context of this research project, the NRM knowledge that is created through research by universities and other research institutions is different from what is eventually transmitted to learners, as a result of the recontextualisation process that it undergoes before it reaches the classrooms. The third category of rules, the evaluative rules, are derived from recontextualising rules, and operate at classroom level by providing the evaluative criteria to be transmitted and acquired (Bernstein, 1996, p. 117). Evaluative rules constitutes specific pedagogic practices (Bernstein, 1990, p. 180). Singh (2002, p. 573) describes evaluative rules as being concerned with recognising what counts as valid acquisition of instructional and regulative texts. For example, a teacher might make the evaluation criteria distinct and clear at the onset of the learning process, in which case control of evaluation lies in the hands of the teacher. Alternatively, the evaluation criteria may be diffuse or implicit, thus giving the learner more leeway in the evaluation process. Post-apartheid curriculum reforms have

promoted the use of alternative approaches to learner assessment other than the end-of-year formal subject examinations.

The principles underlying the construction and structure of the pedagogic device may be supported, contested or challenged by agents and agencies working at various levels of the education system (Bernstein, 1996). These levels of the education system constitute the fields of the pedagogic device (Singh, 2002), which Bernstein (1996, pp. 117-118) refers to as the fields of production, recontextualisation and reproduction fields (see Figure 7.1). The three fields are hierarchically related to one another 'in that recontextualisation of knowledge cannot take place without its production, and reproduction cannot take place without recontextualisation' (Singh, 2002, p. 574).

The production field of the pedagogic device forms the intellectual field of the education system, where new ideas and specialist discourses are created (Bernstein, 1990, p. 191). This new knowledge is created and positioned in this field by a process Bernstein calls primary contextualization. Major agents or agencies operating in this field are usually individual researchers, or research bodies at higher education institutions or research centres, funded by public or private funds (Bernstein, 1990). Within the context of this study, it would be useful to analyse the ideology behind the funding of research into communal natural resources in the Eastern Cape, and of the nature, quantity and quality of knowledge that has so far been created regarding these natural resources. According to Bernstein's model of pedagogic discourse, it is this knowledge which forms the basis of the pedagogised NRM knowledge that is subsequently transmitted and acquired at rural Eastern Cape schools. It would also be useful to know the identity of the major agents and agencies involved in the creation of this specialist NRM knowledge, the power and control relations between them, and the ideologies which underline their activities and practices. However, these issues were not investigated during the study since the study's focus was on the extent of NRM integration within the recontextualisation and reproduction fields (see Section 1.6) and did not include the production of specialist NRM knowledge.

The recontextualisation field is concerned with the construction of pedagogic discourse from the specialist knowledge and discourses created in the production field (Bernstein, 1990, 1996, 2000). This field consists of two major subfields, which may be split into more subcategories. The first subfield is always present and is called the Official Recontextualising

Field (ORF). This subfield is created by the state, and is dominated by government departments and/or government sub-agencies (Bernstein, 1990, p. 192). In South Africa this would include the national and provincial government departments (Ensor, 2004). The texts produced in this subfield form part of the official pedagogic discourse, and include curricula, subject syllabi, teaching and assessment guidelines. The second recontextualisation subfield is called the Pedagogic Recontextualising Field (PRF) and is usually present, but not always so (Bernstein, 1990, 1996). Examples of agents or agencies that operate within this subfield include teacher trainers, writers of textbooks and curriculum guides, educational journals, educational non-governmental organisations (NGOs), and higher education departments. The recontextualising field may also extend to fields outside the education system whose activities exert influence on agents and practices within education (Bernstein, 1990, p. 192). In the case of environmental education in South Africa, this would include state departments for example, the departments of Water Affairs and Forestry, and Environmental Affairs and Tourism; and governmental parastatals such as the South African Institute of Aquatic Biodiversity and the South African National Biodiversity Institute.

Figure 7.1: The fields of pedagogic discourse according to Bernstein (1990, 1996)

FIELD	AGENTS /AGENCIES	ACTIVITIES
1. Production	Researchers e.g. universities or private research institutions	Creation of new knowledge or specialised discourses by research
2. Recontextualisation <ul style="list-style-type: none"> • Official recontextualising Field (ORF) • Pedagogic recontextualising field (PRF) 	State departments e.g. national/provincial departments of education Teacher educators, textbook writers, NGOs etc	Create pedagogic texts, carry out pedagogic practices e.g. teacher professional development programmes etc Create pedagogic texts, carry out pedagogic practices e.g. in-service training, teacher professional development programmes etc
3. Reproduction field	Institutions e.g. schools and colleges	Conduct teaching and learning activities, produce pedagogic texts etc

The third field under which the pedagogic device operates is the reproduction field, which is formed by pre-schools, primary and secondary schools, and tertiary education institutions (Bernstein, 1990, 1996). Wilmot (2006, p. 223) describes the reproduction field as being

concerned with reproducing and acquiring pedagogic texts and practices. Practitioners operating within the reproduction field make use of texts and in-service teacher training activities generated in the ORF and the PRF to construct their own pedagogic texts and practices. The construction of the pedagogic texts and practices in the reproduction field is influenced by the pedagogic ideologies of the practitioners, the context of the institutions, and the nature of the relationships between the institution and the surrounding community (Bernstein, 1990, 1996).

Neves and Morais (2001a) state that Bernstein's model of the fields of the pedagogic device seeks to show the complex relations involved in the production and reproduction of pedagogic discourse. They point out that the model suggests that the production of pedagogic discourse involves extremely dynamic processes. Bernstein's model of the structure of the pedagogic discourse offers a theoretical framework for understanding the production and reproduction of knowledge, associated pedagogic practices and related power issues (McAlpine & Greateorex, 2000) within a formal education system governed by a national curriculum. Lerman and Tsatsaroni (1998) advise that we need to look at the activities within the pedagogic fields, and the relations between them to help us understand the practices of production, transmission, acquisition and evaluation of school knowledge. Bernstein characterises the three fields as sites of intense struggle over control of the pedagogic device. Later in his writing Bernstein preferred to use the term 'arena' when referring to these fields to reflect the intensity of this struggle (Bernstein & Solomon, 1999). The struggle is over control of the rules of the pedagogic device, for whoever gains control of these rules becomes the ultimate ruler of consciousness by virtue of being able to determine the content of pedagogic discourse, and the means of its transmission and evaluation (Bernstein, 1990, 1996).

Bernstein underlined the profound effect that an autonomous PRF can have on what is reproduced at classroom level, mainly through its influence on initial teacher training, and through textbooks. He writes:

Where the PRF exists, is effective, enjoys relative autonomy, then it is possible [for] the activities within this field to recontextualise texts which *in their own right* may be considered illegitimate, oppositional ... [in relation to the official pedagogic discourse] (Bernstein, 1990, pp. 201-202).

The state can try to limit influence of the PRF by, for example, centralising the curriculum and system of assessment, or by selective funding of research topics. Bernstein maintains that the nature of the relationship between the ORF and PRF is especially important during periods of curriculum reform

The four case study schools of this project represent the reproduction field of pedagogic discourse of which they are part. In order to understand and explain what is taking place in the classrooms of these schools with regard to the extent of NRM integration, it is necessary to study the activities and practices of the major agents and agencies that operate in the ORF and the PRF of which these schools are part, and to analyse the nature of the relations between them, and between them and the four schools. Muller (2000) reports that unlike during the apartheid era, when the ORF was dominant, South Africa's post-apartheid educational reforms have involved rapid growth in the PRF in terms of its influence. In the context of this research project it would therefore be useful to investigate if, and how the rapid post-apartheid growth in the PRF has impacted on the curriculum recontextualisation process and pedagogic practices in Eastern Cape's rural and under-resourced schools.

According to Bernstein's thinking, each of the four schools which took part in this study is part of a larger system that is responsible for the production of NRM knowledge and its transmission into the classrooms of these schools. I used Bernstein's model of pedagogic discourse as a heuristic in the description of the organisation and of activities of the different sections which make up this system. Bernstein's model of the fields of the pedagogic device allowed me to locate the position of the four schools in the larger picture involving the creation and transmission of NRM discourse, and to relate what was happening at these four case study schools (see Chapter 11) to what was happening elsewhere in the pedagogic device of which the schools were part (see Chapter 9 and 10).

7.7.3 Bernstein's theory of recontextualisation

Recontextualisation is defined as a process that extracts texts, signs or meaning from its original context, in order to introduce it into another context (Wikipedia, 2008). Bernstein (2000) uses this concept to refer to changes which occur in discourses as they are transferred from one education site to another. He describes the recontextualisation of discourses as:

... selective appropriation of a discourse or part of a discourse from the field of production, and a principle of re-location of that discourse as a discourse within the recontextualising field (Bernstein, 2000, p. 113).

Bernstein (2000, pp. 32-33) maintains that the process of moving a discourse from its original site to another site, creates opportunities for ideological changes in the discourse. He points out that the recontextualising process is influenced by the theories, practices and social relations that exist in the recontextualising field, which in turn affect the nature of the pedagogic discourse created, together with its transmission (Bernstein, 2000). He states that:

No discourse ever moves without ideology at play. As this discourse moves, it is ideologically transformed: it is not the same discourse any longer (Bernstein, 2000, pp. 32-33).

Bernstein suggests that a principle of decontextualisation is responsible for regulating the new ideological position of the discourse. He writes:

When a text is appropriated ... the text usually undergoes a transformation prior to its relocation. The form of this transformation is regulated by a principle of decontextualising This process refers to the change in the text as it is first delocated and then relocated. This process ensures that the text is no longer the same text ... (Bernstein, 1990, p. 60).

He identifies three types of changes which may occur in a discourse during recontextualisation. They relate to:

- The position of the discourse in relation to other discourses, or their positions,
- The nature of the discourse itself as a result of selection, simplification, condensation or elaboration, and
- The discourse's repositioning and refocusing (Bernstein, 1990, p. 61).

Bernstein believes it is important to analyse the role of the ORF in the relations and movement of discourses within and between the different pedagogic fields. In the context of this study, I used the theory of recontextualisation as a theoretical lens to help me understand and explain the changes to the extent of the integration of NRM knowledge as it is relayed across the fields of pedagogic discourse of which the four case study schools are part.

7.7.4 Bernstein's construct of *Classification*

Having shown that the pedagogic device acts as a relay of power relations, Bernstein was interested in analysing how power relations are transformed into pedagogic discourse and practice. Bernstein maintains that in pedagogical context, power relations take the form of boundary maintenance between categories. For Bernstein, power relations are expressed in the nature of the boundaries around individual categories, rather than the contents within the categories. He states that:

Power relations ... create boundaries, legitimise boundaries, reproduce boundaries, between different categories of groups, gender, class ... Thus, power always operates to produce dislocations, to produce punctuations in social space (Bernstein, 2000, p. 5).

Bernstein believes that it is the insulation around a particular category which gives it its distinctiveness, its own internal rules and its specific voice. He argues:

... A can only be A if it can effectively insulate itself from B ... if that insulation is broken, then the category is in danger of losing its identity, because what it is, is the space between it and another category. Whatever maintains the strengths of the insulation, maintains the relations between the categories and their distinct voices (Bernstein, 1996, p. 6).

Bernstein (1990, 1996) uses the concept of *classification* to help clarify and describe the relationship between categories, insulation and power. He refers to *classification* as the degree of boundary maintenance between categories (Bernstein, 1996, p. 20). If there is strong insulation between categories, then there is a strong principle of *classification*, which creates specialised categories, each with its own internal rules and a unique 'voice' (Bernstein, 1996, p. 21). Weak *classification* on the other hand, results from weak insulation, and creates less specialised categories, with less specialised identities and 'voices.'

The concept of *classification* lies at the heart of Bernstein's theory of curriculum and forms its basic structure (Sadovnik, 1991). Bernstein believes the organisation of curriculum can be studied by analysing the nature of the boundaries between its different contents. He differentiates two types of curricula depending on the nature of the boundaries between the curriculum contents. Subjects may be well insulated from each other (collection curriculum) or in an open relationship with one another (integrated curriculum) (see Section 1.4).

Sadovnik (1995) explains that a curriculum with strong *classification* is highly differentiated into traditional subjects, while one with weak *classification* is integrated, with fragile boundaries between subjects. Bernstein contends that there is nothing intrinsic about the relative status of different subjects in a curriculum: it is all a matter of external social factors (see Section 5.9).

Bernstein (1990, 1996) differentiates between two types of *classification*: internal; and external. Internal *classification* refers to relations within the same category (Neves & Morais, 2001a, p. 189), for example between learners, teachers, learners and teachers or between subjects in a given curriculum. External *classification* is about relations between different categories, for example between school and family, teachers and parents, or academic and nonacademic discourses. This study investigates both types of *classification*, as, for example, in the relationship between Life Sciences knowledge and that of NRM within the Grade 10 curriculum documents (*internal classification*) (see Chapters 9 and 10), and that between NRM and school activities (*external classification*) (see Chapter 11).

Bernstein also proposes a four-point scale to express different degrees of *classification* or insulation between categories:

- C+ + for very strong *classification*/very strong insulation or very weak integration,
- C + for strong *classification*/strong insulation or weak integration,
- C- for weak *classification*/weak insulation or strong integration, and
- C - - for very weak classification/very weak insulation or very strong integration (Bernstein, 1990, p. 51).

In this research, I used the concept of *classification* as a theoretical ‘lens’ through which I examined the Grade 10 Life Sciences curriculum documents, and other school documents, activities and practices in order to analyse the extent to which they integrate NRM. *Classification* provided me with the theoretical language with which I was able to provide refined descriptions of the different extents of NRM integration which emerged from the analysis. The analytical tools which I used to analyse the extent of NRM integration in the different pedagogic texts and practices and activities were also based on this concept, and on Bernstein’s scale of *classification*. These tools consisted of indicator frameworks, with each

indicator linked to a particular scaling grid (see Section 8.8). The scaling grid showed which levels of indicator performance with regard to the extent of NRM integration corresponded with which levels of *classification* on the Bernstein's scale of *classification* shown above. The performance of the indicator with regard to the extent of NRM integration was determined either qualitatively or quantitatively, depending on the item which was being analysed, and on the nature of the indicator in question (see Chapters 8, 9, 10 and 11).

7.8 BERNSTEIN'S CONSTRUCT OF *FRAMING*

Researchers working with Bernstein's concept of *classification* very often combine it with his other concept of *framing* (though not always so). Although I did not make use of the concept of *framing* in this study (due to a different research focus) it is worthwhile to devote some time to differentiate between the two concepts, as the two are closely aligned to each other.

Bernstein (1990, 1996) maintains that in any interactional relation, such as that between teachers and learners, there is always control over the communication process. The form that this control takes may show temporal and spatial variations, and is a reflection of power relations that exist in a particular society. Bernstein (1996, p. 101) explains that in a school context, the communication process involves the relations of transmission and acquisition between the teacher and the learner. He is interested in forms of control and their location, together with the effect they have on the communication process. He uses the concept of *framing* to analyse and explain how power relations are transformed into forms of control over the communication process in a pedagogic context. He defines *framing* as 'means whereby principles of control are transformed into specialised regulations of ... pedagogic relations which attempt to relay a given distribution of power' (Bernstein, 1996, p. 3).

Like the *classification* principle, the *framing* principle is based on boundary maintenance between what can and cannot be transmitted in a pedagogic relationship, and between school knowledge and everyday common knowledge (Bernstein, 1990, 1996). However, while *classification* is about the 'what' of pedagogic discourse, *framing* refers to the 'how', the 'where' and 'when' of the discourse (Bernstein, 1996). The *framing* principles do this by controlling the communication process. Changes in the forms of control over the communication result in changes in the communication process itself, which in turn affects the social relations of pedagogic practice (Bernstein, 1990, p. 36). Bernstein (1990, p. 51) proposes a four-point scale similar to that of *classification*, which can be used to express

decreasing levels of framing, namely: F+ +; F+; F-; and F - -. Since the study did not extend to the investigation of modes of pedagogic transmission, it did not make use of the concept of *framing* (see Section 13.8).

7.9 WORKING WITH BERNSTEIN'S THEORIES

There is a focus on the testing of Bernstein's theories among researchers working with his ideas (Sadovnik, 1991). This has involved Bernstein's former students PhD students at the Institute of Education, University of London, and other researchers spread across the globe, especially in Portugal, Greece, Australia and South Africa (Sadovnik, 1991; Bernstein, 1996). This research has contributed to a better understanding of the internal working of the schooling system both at macro and micro levels. Davies (2001, p. 1) regards Bernstein's work as offering the best developed grammar for understanding the shape and character of modern educational practices. This body of research has also led to refinement of Bernstein's theories (Sadovnik, 1991).

Bernstein's model of pedagogic discourse has formed the basis of numerous studies including Neves and Morais' (2001a) investigation into the implementation of curriculum reforms, Tyler's (2001) examination of computer-based learning, and Bertram's (2008) study tracking the trajectory of history as a subject across different levels of the education system. Bernstein's theory of *recontextualisation* formed the basis of the investigation into the interpretation of environment discourse by different agencies in Ramsarup (2006), and in schools by Jenkins (2007), and Tundzi (2009). Other researchers who used the theory of *recontextualisation* in their research include MacDonald, Hunter and Tinning (2007) during their analysis of the implementation of a new Physical Education curriculum, and Tsatsaroni, Ravanis and Falaga (2001) who investigated the teaching of Science in a pre-school. Researchers who have worked with the concept of *classification* include Bertram (2008) who used it to compare types of knowledge integration across two different history curriculum policy documents, Chien (2004) who used it to analyse the status of *Integrated Studies* in a school curriculum, and Hoadley (2005) and Ensor (2004) who used the concept (together with that of *framing*) to differentiate between modes of teaching practice.

One major limitation of Bernstein's constructs of *classification* and *framing* is that while they facilitate the analysis of the organisation of knowledge in curriculum, or in a lesson, they say nothing about the quality of that knowledge. Bertram (2008, p. 27) makes the point that

Bernstein was more concerned with the form of the *relay* system, but not with the quality of what was being *relayed*. Hugo, Bertram, Green and Naidoo (2006) explain that *classification* and *framing* only describe the structure of the relay system i.e. its constituent elements, the relationship between them, and resultant pedagogical modalities. What these concepts do not provide are the criteria by which the quality of the message that is being relayed can be analysed and described. This creates a situation, for example, where two lessons that are allocated the same values for *classification* and *framing*, but may vary as far as the quality of the pedagogical experiences they provided.

Hugo, Bertram, Green and Naidoo (2006) hold the view that *classification and/or framing* based analysis are ideal in educational contexts where the delivery of the curriculum is assured, and social inequality is a result of variations in the relay system, the pedagogy modalities. They contend that when it comes to South Africa's disadvantaged education contexts, the quality of curriculum delivered is such that rather than pedagogical modality, it is the content of the transferred knowledge which should take precedence, as shown in Jenkins (2007). They argue that in such education contexts *classification* and *framing* analysis alone are insufficient, for they do not go deep enough to describe the quality of the content that is being transferred. Hugo et al. are not calling for the dismissal of *classification* and *framing* analysis in South African educational research. What they are advocating is that in cases where pedagogy is absent or is of a questionable nature, *classification* and *framing* need to be supplemented by another set of analytical tools to provide information on the quality of the message being relayed.

Hoadley (2005) and Dowling (1998) also grappled with the issue of the quality of the relayed message. Hoadley's solution was to add an extra 'F⁰' category to Bernstein's scale of *framing* (F+ +; F+; F-; F- -) to accommodate those cases where the researcher believed the quality of the pedagogical experience on offer was doubtful. However, Hugo et al. (2006) point out that although this improves the quality of the analysis, it does not completely solve the problem. Dowling's (1998) approach to this problem was to evaluate the strength of *classification* along two separate axes, one of knowledge, and a second one representing the mode of expression. This creates what Dowling calls the esoteric, descriptive, expressive and public domains of (mathematical) practices. Parker (2006) and Christiansen (2007) applied Dowling's model to analyse Mathematics curriculum documents. However, this model of analysis is not applicable to all subjects, especially those which are weakly *classified*, and

whose content is not as esoteric as that of Mathematics (Bertram, 2008). The interdisciplinary nature of NRM knowledge makes it fall in this category.

Hugo et al. (2006) recommend a combination of *classification* and *framing* (to describe the form of the message system), and Bloom's Revised Taxonomy (to provide information on the complexity of the message being relayed). They successfully applied this approach to illustrate the difference in quality between two assessment tasks with similar *classification* and *framing* values, but offering differing pedagogic experiences.

Although quality is important in relation to the 'what' of pedagogy, it was not a focus of this study. The study's focus was the *extent* to which NRM discourse is integrated into school documents, activities and practices at different levels of pedagogic discourse involving four isolated rural under-resourced schools. Therefore the issue which Hugo et al. (2006) raise over the inability of Bernstein's construct of *classification* to provide qualitative information on the content of pedagogic discourse was not investigated. For the same reasons, the study did not make use of Blooms Revised Taxonomy, or Dowling's model of *classification*. Secondly, since the study's focus was on the extent of the content of the NRM discourse, it was the 'what' of pedagogy which was the study's main focus, rather than how it was transmitted in the classroom, the 'how' of pedagogy. For this reason, as indicated earlier, the study did not make use of Bernstein's construct of *framing*.

7.10 DEVELOPING AN EXTERNAL LANGUAGE OF DESCRIPTION

Since I was working with a highly abstract construct (*classification*), I had to develop what is called an external language of description. In Bernstein (1996, pp. 135-136), the external language of description is defined as 'the syntax whereby the internal language can describe something other than itself'. By internal language Bernstein meant the theoretical constructs or framework that underpins a research project. Moore and Muller (2002, p. 634) explain that the internal language is too general, too data distant to be able to speak to the empirical world. They state:

... a data-near device (the external language) must be constructed to categorise, in a logical grid, what for this particular field of data, is to count as stable identifiable instance of C and F ... every investigation requires the construction of an external language of description that consists of empirical categories that can unambiguously

be translated into the conceptual categories of the internal language (Moore & Muller, 2002, p. 634).

In the case of this research, the internal language was the *classification* concept, which I had to refine so as to be able to generate data on the extent of NRM integration in the curriculum documents and the schools activities and practices that I was analysing. In other words I had to operationalise *classification*, so that this concept and the empirical world could speak to each other. Operationalising *classification* and *framing* is a challenge that any researcher working with these concepts in the field has to face (Moore & Muller, 2002).

Constructing an external language of description involves designing research instruments through deductive and inductive means ‘moving interactively between the internal language and engagement with the empirical data’ (Ensor & Hoadley, 2004, p. 93). As stated earlier, researchers such as Neves and Morais (2001a) and Hoadley (2005), have done ground-breaking work on how to operationalise *classification* and *framing* to analyse pedagogic texts, and describe classroom interactions, respectively. Their work is based on the identification of indicators of *classification* and *framing* at the empirical level. However, external languages of description are rarely universal since they depend on the focus and context of each research project. I draw on the work of the above authors in the design of the research instruments that were used during the study. For details of how I developed external languages of description during the analysis of the various pedagogic texts, school activities and practices, see Chapters 8, 9, 10 and 11.

7.11 CONCLUSIONS

The main aim of this chapter was to discuss the theoretical constructs which framed the study. The chapter first outlined the historical development of the sociology of education field, focusing mainly on the major approaches that shaped this field. Having established an historical trajectory in which to locate Bernstein’s sociology of the curriculum, the chapter then introduced and described the key elements of his corpus that informed the study. These were the construct of *classification*, his theory of the fields of pedagogic device, and that of knowledge *recontextualisation*. Bernstein’s concept of *classification* provided the theoretical lenses through which I analysed the different school documents and activities and practices for the extent to which they integrated NRM. The concept of *classification* also provided a theoretical language (a language of description), and a grading system that I could use to

express the different extents of NRM integration that I encountered. I used Bernstein's model of the fields of the pedagogic device as a heuristic to analyse and describe the structure, organisation and the activities of the different parts of the education system that are involved with the transmission of NRM discourse within the Grade 10 Life Sciences curriculum. I used Bernstein's theory of *recontextualisation* to explain the changes to the extent of NRM integration as the Grade 10 Life Sciences curriculum was transferred across the different fields of pedagogic discourse. The chapter also discussed the one major limitation of Bernstein's constructs of *classification* and *framing*: the inability to provide information on the quality of the message that is being delivered, and how various researchers in South Africa have tried to overcome this limitation. The chapter ended with a discussion on developing 'external language of description' and why this is necessary when working with Bernstein's concept of *classification*.

In the next chapter I describe the research design, methodology and methods of the study.

CHAPTER 8

RESEARCH DESIGN, METHODOLOGY AND METHODS

8.1 INTRODUCTION

This study aimed at providing answers to one basic question, which was: what is the extent of NRM integration in different fields of pedagogic discourse in a rural under-resourced education context? (see Section 1.6) The study sought to provide empirical data on knowledge integration practices, which is a marginalised area of the integrationist discourse (see Section 5.10), and aims to contribute to the small but growing research interest in this study area in South Africa (see Bertram, 2005, 2008; Parker, 2006). In Chapter 7 the location of the study within the sociology of curriculum field was described, followed by the major theoretical constructs which framed the study. This chapter discusses the study's research design, methodology and methods. The aim of the chapter is to provide background information about the philosophical assumptions which framed the decisions that were made during the research process regarding research strategies and data generating methods. The chapter also explains the analytical tools and the procedures that were used to generate data on the extent of NRM integration in the various school documents, activities and practices that were analysed. The chapter ends with a discussion of how research quality and ethical issues were addressed during the study.

8.2 LOCATING THE RESEACH PROJECT

Like any other research into the social world, this research project was underpinned by ontological, epistemological and methodological assumptions. These assumptions formed the underlying theoretical approach to the study, from the initial stages of research question formulation, and the selection of research strategies and methods, up to the final stage of making interpretations of the research findings. According to Denzin and Linclon (2005a), in addition to ontological, epistemological and methodological assumptions, any research process is also informed by the researcher's personal history in terms of race, gender and experience. Furthermore, during the research process, researchers also have to contend with other key issues, such as the study's ethics and values, power relations, the role of the researcher, empowerment of the respondents and quality criteria (Denzin & Lincoln, 2005a, p. 184). All these factors together with the already existing knowledge available in a field of

inquiry play a major role in determining the researcher's 'world view' from where he or she approaches the research project, which shapes the project's research paradigm.

Guba (1990, p. 17) defines research paradigm as a '... basic set of beliefs that guides action'. He further explains that paradigms guide researchers in how the world can be understood and studied. A similar view of paradigm is held by Krauss (2005, p. 759) who describes research paradigms as '... the underlying basis that is used to construct a scientific investigation.' In Bassey (1999, p. 42) a research paradigm is described as '...a network of coherent ideas about the nature of the world and of the functions of researchers, which are adhered to by a group of researchers, conditions the patterns of their thinking and underpins their research actions'.

This research project, much like any other inquiries into the social world, was not conducted in a vacuum. Part of developing the research design for this study involved clarification of different research paradigms and approaches in relation to the research question and context, and my prior experiences of education as explained in Chapter 1. In this venture, I was supported by Creswell (2003, p. 4) who quoting from Slife and Williams (1995) notes that although philosophical ideas remain largely hidden in research, they still influence the practice of research and need to be identified. This required an in-depth understanding of the paradigm debate influencing educational research.

8.3 THE PARADIGM DEBATE

Different research paradigms demand that a researcher approaches the research process from a particular angle, starting from the types of questions that can be asked, to the different methodologies and methods that can be employed to answer them. Armed with the knowledge of what Bassey (1999, p. 42) terms a 'coherent network of ideas' to guide this research, I also took into consideration Denzin and Lincoln's (2005c, p. xii) comment about their book, in which they note that '... other editors, working from different perspectives, would...construct this book in different ways...focus on other concerns, emphasize different methods, or otherwise organize the contents differently', which indicated the significance of how research design shapes the research programme and findings.

Seeking out a 'coherent set of ideas' as recommended by Bassey (1999) was not a straightforward task however, since the social and educational research landscape are

characterized by fluidity in the number of recognized paradigms by different writers, and debate over their intellectual legitimacy and hegemony. Krauss (2005) warns new researchers in the social sciences of the intensity of this debate, and of how the numbers, types and names of different paradigms vary from author to author. For example if I chose to work with Taylor and Bogdan (1998) the search for a research paradigm would be a simple choice between positivism and interpretivism. Denzin and Lincoln's (2000) typology of major research paradigms offers a choice between positivism, post-positivism, constructivism, critical theory and feminism. This typology was further expanded to include participatory action research (Guba & Lincoln, 2005). In addition researchers also need to take cognizance of research perspectives such as critical race theory, queer theory and cultural studies which provide additional guidance to the research process in terms of criteria, assumptions and methodologies (Denzin & Lincoln, 2005a, p. 184).

Guba and Lincoln (2005) point out four issues that proved to be major turning points in the design of this research. The first one was that the days of looking for one unifying research paradigm under which all research in the social sciences was to be conducted are well over, multi-realities and multi-voices now being widely acknowledged. The second point made by these authors was with regard to the emergence of new research paradigms in the social sciences to challenge the more established ones. However, Guba and Lincoln (2005) note that the borders between the various variants are blurred as a result of the shared commonalities between them. They propose that it is these shared similarities and the differences between the various paradigms which should form the core of the paradigm debates rather than intellectual hegemony. Another point made by these authors that was very helpful to this study concerned the question of commensurability: whether it was valid for a single study to be underpinned by a mixture of philosophical assumptions picked from different research paradigms. Connole (1998) notes the increased tendency among researchers of "poaching" philosophical elements from different research paradigms to inform their research projects. However, according to Guba and Lincoln (2005), this is only possible between closely allied paradigms such as positivism and post-positivism, and interpretivism and critical theory. These authors maintain that such cross-borrowing of paradigmatic elements is not possible between opposing paradigms such as positivism and interpretivism since their axioms are 'contradictory and mutually exclusive' (Guba & Lincoln, 2005, p. 201).

8.4 ONTOLOGICAL AND EPISTEMOLOGICAL CONSIDERATIONS

Ontological views influence epistemology which in turn influences the methodological approach and methods of a research project (Guba & Lincoln, 2005). With this came the realisation that, armed with a set of research questions, I could not simply select any research methodology or research methods to answer them. Thus an important part of the research process involved ensuring that the choice of methodology and methods was consistent with the ontological and epistemological underpinning of the research.

The research paradigms that are named above offer opposing perceptions of the nature of the social world, which Cohen, Manion and Morrison (2007) describe as the realism versus nominalism debate. Under traditional forms of realism, to which positivists adhere, social reality is comparable to the physical objects of the natural sciences. It is tangible and is seen as being 'out there' (Denzin & Lincoln, 2000), external to the knower and the researcher. Positivists believe in the existence of general laws which govern individual and social behaviour (Cohen, Manion & Morrison, 2007), and their research aims at identifying these laws so that the nature of the social world can be controlled, or predicted. The debates on realism at the start of the 21st century are more complex with the advent of critical realism, which acknowledges a realist and depth ontology, a constructivist, relativist epistemology, and the fallibility of knowledge.

Constructivists view social reality through completely different lenses. They adhere to relativism, under which social reality is believed to be intangible, and existing in the form of mental constructs and discourses. Denzin and Lincoln (2000) explain that within constructivism, social reality is believed to take the form of the various names, labels and concepts that are used to construct that reality. Social reality is thus internal to the knower (Cohen, Manion & Morrison, 2007). These mental constructs which constitute social reality are individually and socially created according to experiences and socio-cultural contexts. Hence social reality under constructivism is local and specific (Denzin & Lincoln, 2000). Within constructivism there is no one fixed social reality, instead multiple realities occur, none of which is privileged above the rest (Plack, 2005, p. 228). Positivists regard matters which relate to aesthetics and morals as falling outside the realm of scientific research (Guba & Lincoln, 1994). According to Plack (2005), while external observable behaviour is important, the individual experiences, intentions, values, attitudes and beliefs that lie behind that behaviour are also equally important. It is these factors which constructivists focus on

during their research, other than looking for generalisable laws to explain human or social behaviour (Cohen, Manion & Morrison, 2007).

Epistemological assumptions provide philosophical answers as to the nature of what can be known (knowledge), the relationship between knowledge and the knower (Guba & Lincoln, 1994), and by default that between the knower and the researcher. Constructivists are opposed to the positivist view of knowledge as being hard objective facts which exist independent of the observer. Instead they believe in a subjective epistemology of knowledge in which the knower and the researcher are interdependent, and are both involved in its construction (Denzin & Lincoln, 2000). Guba and Lincoln (1994) also point out that not any relationship can be assumed to exist between the knower and the object of research, as the nature of this relationship depends on the ontological position held by the researcher. The constructivist view on the nature of knowledge is that it lies in the personal experiences of the individual, and that a researcher's values and biases influence the research process and its findings.

The above constructivist-based ontological and epistemological assumptions had a number of implications for the way this research project was approached and conducted. The first implication related to the 'location' of the objects of the study. The social phenomenon that constituted the study i.e. the extent of integration of NRM, was not a tangible product which existed 'out there' for a researcher to apprehend and study. Instead, NRM integration as a type of social reality, existed in the form of respondents' actions with regards to NRM integration, in the artefacts they created as part of these actions, and in the experiences and mental constructs they held regarding the extent of NRM integration. These entities were the objects of my research. The second implication of a constructivist ontological and epistemological position related to my position as researcher. As a constructivist, I could not disengage myself from the research process and become an independent observer. Thus I had to deeply immerse myself in the respondents' contexts so that I could understand and interpret their NRM integration views and other forms of meaning-making. Furthermore, this interpretation would involve the co-creation of knowledge about the extent of NRM integration rather than the discovery of this knowledge. This knowledge would be local and context-specific, and subject to revision, following consensus on re-interpretations, and remain bounded by the case study methodology (although developing contextual profiles and working with theory provided wider reference points for interpretation than mere empirical

experiences of the respondents). Thus the study was both inductive and abductive in its mode of inference. These implications shaped the methodology and methods for the research project, the details of which are described below.

8.5 METHODOLOGICAL CONSIDERATIONS

There are various ways of defining methodology. Some researchers interchangeably use methodology and methods, a practice Guba and Lincoln disagree with, arguing that ‘the methodological question cannot be reduced to a question of methods’ (1994, p. 108). For this study, I adopted Terre Blanche and Durrheim’s definition of methodology as the means of ‘specifying how researchers may go about practically studying whatever they believe can be known’(1999, p.6). These authors further explain that not just any methodology is appropriate for a particular research project. This view of methodology is supported by Krauss (2005) when he writes that distinct methodological strategies are linked to specific ontological and epistemological assumptions (p. 764).

This interpretation of methodology influenced the research process in numerous ways. First, it implied that not any method could be used to determine the extent of NRM integration in the various entities that were being investigated. The choice of methods was influenced by constructivist ontological and epistemological perspectives. Secondly, since the ontological assumptions on which the study was based stressed the importance of the respondents’ experiences and socio-cultural contexts in determining their actions with regard to NRM integration, the project was better researched using methods which leave the natural settings as intact as possible. The third implication was that since I was not looking for generalisable rules to describe the extent of integration of NRM, methods which allowed the examination of this phenomenon within a select number of individuals were appropriate, rather than those which involved large samples. The fourth implication for the choice of methods was that since I was looking for insight into the extent of NRM integration from the perspective of the respondents, the choice of methods should be those that allow them to openly express their experiences, views, beliefs and so forth about the integration of NRM within their contexts. The fifth implication was that the methods should allow me to create ‘thick and rich’ descriptions of the respondents’ actions and artefacts regarding the extent of NRM integration. It was also important that the methods used should facilitate a two-way dialogue between researcher and respondent, as both would be involved in the co-creation of knowledge about the extent of NRM integration.

8.6 CASE STUDY METHODOLOGY

8.6.1 Introduction

The term case study is used differently by different writers, as any inspection of social science and education research literature soon reveals. The main contention seems to be between researchers who view the concept as a methodology, research strategy or approach, and those who regard it to be a research method. The perspective taken of case study research in this study is that the concept represents a methodology, research strategy, or research style. This is the view held by Cohen, Manion and Morrison (2007) who describe case study as one of the eight major research methodologies or styles in education, the others being ethnography, historical research, surveys, correlation research, experiments and action research. The same view of case study is held by Creswell (2003) who lists case studies, together with ethnographies, grounded theory, phenomenology, and narrative research as the major strategies associated with qualitative research. Yin (2003) alternatively uses research strategy and research approach to refer to case studies, and describes it as one of the research approaches, the others being experiments, surveys, histories, and the analysis of archival documents. Other researchers who treat case study as a form of research methodology include Tellis (1997), and Flyvbjerg (2004).

There is no common agreement on the definition of a case study. Gerring (2004, p. 341) refers to case study as being in a state of 'definitional morass'. According to Merriam (2005) the various definitions that have been proposed can be placed into three categories depending on the focus of the author. The three categories are whether the case study is seen as a process, an end-product or a unit of study.

For this study, I worked with the definition that focuses on a case study as a single case or unit of study. This view is supported by Stake (2005, p. 443) who states that a case is defined by interest in individual cases, not by the method of inquiry. Merriam (2005, p. 27) maintains that a case study involves the analysis of a single unit, or bounded system, and that if what is being studied is not intrinsically bounded, then it is not a case. This view of case studies is also supported by Babbie and Mouton (2001, p. 281) who identify the emphasis on individual unit as the defining feature of a case study. For a guiding definition of a case study, I relied on two case study definitions. The first one was proposed in Gerring (2004, p. 37) and describes a case study as '... an intensive study of a single unit or a small number of units ... for the purpose of understanding a larger class of similar units ...'. The second definition is

from Merriam (2005, p. 6) where a case study is described as an ‘... intensive, holistic description and analysis of a single unit or bounded system’.

Selection of the case study as the most appropriate research methodology for this study was based on a number of reasons. Firstly, I was looking for a methodology which allowed me to focus on a single event within its natural setting. Using the case study methodology I was able to focus on the phenomenon of NRM integration within the natural setting of four rural high schools. Cohen, Manion and Morrison (2007) regard the intense attention given to the intricacies of a case as one of the advantages of the case study methodology. My research interest was in providing contextual details on the extent of NRM integration, rather than a broad overview of extent of NRM integration across all the high schools in the study area. Secondly, I wanted a methodology that would facilitate the creation of rich and thick descriptions of the phenomenon that I was investigating. Using the case methodology allowed me to use both qualitative and quantitative data to create detailed descriptions of the extent of NRM integration within selected documents and school activities and practices. This methodology also allowed me to make use of various methods of data collection which was consistent with the multiple perspectives of reality that underpin the constructivist orientation of this study. Furthermore Cohen, Manion and Morrison (2007, p. 256) observe that case studies facilitate the presentation of data in forms that are accessible to the general public, thus contributing to the democratisation of knowledge. This last point was important as I intended to present the research findings to the teachers, and other key stakeholders in the study area of this project, and I am hoping that they will make use of the findings long after the end of the research project.

In selecting case study as the research methodology for the project, I was also aware of its limitations and weaknesses. For example, Cohen, Manion and Morrison (2007) cite the lack of generalisability of results, and the susceptibility of the research process to researcher bias as some of the weakness of this methodology. Other limitations of this methodology are its lack of systematic procedures (Yin, 2003), the generation of a large amount of data often resulting in lengthy reports, and the long time that the researcher has to spend in the field (Spirer, 1980; Merriam, 2005).

Of the above mentioned weaknesses that are associated with the case study methodology, the lack of basis for generalisation from one case study to another has received most attention.

However, Stake (1994) doubts the validity of this debate, arguing that the very purpose of a case study is to represent a single unit, and not the general population. In this he is supported by Yin (2003) who points out that case study sites are not equivalent to the sampling units of positivist surveys. Yin (2003) also brings attention to the need to distinguish between the type of generalisability that is found in positivist studies (statistical generalisations), and that which is possible under case study methodology (analytical generalisation). According to him, in the latter form of generalisability, previously developed theoretical propositions form the basis of making inference about other case study sites, rather than empirical evidence. Bassey (1999) proposes the production of ‘fuzzy’ generalisations in case study research which are characterised by inbuilt uncertainty, and which do not necessarily apply in every case. Babbie and Mouton (2001) recommend increasing the number of representative case study sites as a means of overcoming the problem of generalisability of case study findings.

8.6.2 Case study design decisions

Yin (2003) states that once the case study methodology has been decided upon, there are other major decisions that have to be made before work in the field can begin. These decisions relate to the design of the case study and include the following:

- The nature of the case study,
- The number of sites to be studied,
- How the sites will be selected, and
- Which research methods to use (Yin, 2003, p. 33).

The research design decisions which relate to the nature of the case study methodology employed in this project were determined by the overall goal of the research project, and the types of research questions that the project set out to answer (see Section 1.6). The research project constituted what Yin (2003) would describe as a descriptive case study. Such a case study seeks to provide detailed information on a phenomenon within its natural context (Yin, 2003). The phenomenon described during this study was the extent of NRM integration within selected school documents, school activities and practices, at a selected group of rural under-resourced high schools. The major aim was not to generate future research questions from this study (exploratory case study) or to analyse causal-effect relationships that relate to the integration of NRM at these schools (explanatory case study). The study was carried out with the main aim of providing in-depth information on the extent of NRM integration within

the aforementioned entities. The project can also be described as being an instrumental case study. Stake (2005, p. 445) defines such a study as being driven by the need to know more about an overriding issue, the case study itself being of secondary importance. For this study, the overriding issue was the extent of NRM integration in rural under-resourced schools. I used a case study of NRM integration at a selected group of rural under-resourced schools to gain insight into this issue. I was interested in a detailed study of the case of NRM integration because it helped me to gain insight into another wider research issue (curriculum recontextualisation) (see Section 1.6).

I also had to decide between a holistic multiple-case study design and one described as an embedded multiple-case study. Yin (2003) describes a holistic case study as consisting of one major unit of analysis. In the case of this study, that would mean treating a whole school as one unit of analysis. In the embedded case study, each major case consists of sub-units which also represent units of analysis. In the case of this study, each school formed a major unit of analysis, which was linked to specific research questions and research instruments. Within each school the Grade 10 Life Sciences lessons and their associated pedagogic documents represented sub-units of analysis for which I also had to formulate separate research questions as well as construct separate research instruments. Hence the research project was what Yin (2003) would describe as embedded multiple-case design.

Another design decision that had to be made concerned the number of case study sites that would constitute the research project. According to Yin (2003) a case study may consist of one unit (single-case design) or it may involve many separate similar units (multiple-case design). Yin (2003, p. 46) maintains that increasing the number of case study units improves the robustness of the results, through replication, but warns of the increased costs and complexity of the research process as a result. In the end I had to balance the desire for increased robustness of the research findings with practical issues such as time and resource availability. After careful consideration, I opted to carry out my field work at four rural high schools (see Section 6.5.4). The main rationale behind this sample size was that I was more interested in sample quality rather than sample quantity, as would have been the case had I been conducting a survey.

Having agreed on the number of case study sites, I then had to decide on their selection criteria. In this I was guided by Yin's (2003) caution on the need to distinguish between

sampling logic and replication logic. According to Yin (2003), in multiple-case studies, sites are selected for their similarity to the original study site (literal replication), or their dissimilarity to it (theoretical replication). This is unlike in large-scale surveys where samples are selected according to strict statistical procedures to act as representative of the entire population (sampling logic). In this research project, I was not interested in selecting samples of schools to represent the entire population of high schools in the study area. Rather, I decided on a set of conditions to be met, and I purposefully selected those schools which met these conditions. The conditions were that the school be rural, have at least a Grade 10 class, offer Life Sciences as a subject in the curriculum, be under-resourced, and have a consistent record of poor performance in the Grade 12 national examinations. These criteria were selected to ensure consistency with the research goal of describing curriculum implementation in rural under-resourced education contexts. Logistics also played a role in the decision as I wanted to work with schools which were relatively close to each other, and which were easy to reach by public transport. In the end all the four selected schools were rural, under-resourced and under-performing, and were located within 10 kilometres from each other (see Section 6.5.4).

The last case study design feature that had to be decided was the type of methods to be used to generate data on the extent of NRM integration. These methods are described in the section below.

8.7 RESEARCH METHODS

8.7.1 Introduction

This section describes the various methods that were used during this research. The definition of methods that guided the study was that proposed by Cohen, Manion and Morrison (2007, p. 47). According to these authors, methods refer to the ‘... the range of approaches used ... to gather data which are to be used as a basis for inference and interpretation, for explanation and prediction.’ These authors further explain that the term refers to techniques and procedures used in the process of data gathering. The same view of methods is held by O’Leary (2004, p. 162) for whom the term implies the ‘... data collection that involves researchers asking respondents basically open ended questions’.

According to Yin (2003) there are no methods which are specific to case studies, although interview, observations and document analysis are the most commonly used methods. In selecting which method to use for which unit or sub-unit of analysis I had to make sure that

not only were the selected methods capable of generating information about the extent of NRM integration, but also that they were in accordance with the ontological and epistemological framework of the study, as described in Section 8.4 above. Among the criteria which played a major role in the selection of which methods to use were that the method:

- Allowed prolonged engagement with the major unit of analysis, and its sub-units,
- Did not involve manipulation of the context of the unit or sub-unit of analysis i.e. was naturalistic,
- Facilitated free exchange of dialogue between the researcher and respondents,
- Allowed the respondents to express their ideas about the extent of NRM integration,
- Created opportunities for developing thick and rich descriptions of the extent of NRM integration, and
- Allowed the generation of both qualitative and quantitative data about the extent of NRM integration.

The methods which met the above listed criteria, in addition to satisfying the constructivist assumptions about the nature of NRM integration as a social phenomenon, and how knowledge about it can be generated (see Sections 8.4), were interviews, observations, and content analysis. There were two main layers of research to this project, each layer comprising of different units and sub-units of analysis, and hence necessitating the use of different techniques to generate data on the extent of NRM integration. The first layer of research involved the analysis of the extent of NRM integration in various school documents, while the second research layer involved the analysis of the extent of NRM integration in various school activities and practices (see Table 8.1).

Table 8.1 provides a summary of the research activities that were conducted during the study and the methods that were used. For detailed information on the procedures that were followed to generate data on the extent of NRM integration, see Chapters 9, 10 and 11.

Table 8.1: A summary of the study’s research activities and methods

Research Layer	Focus	Unit of analysis	Method
First Research Layer	School documents	<p>1. Official recontextualising field texts</p> <ul style="list-style-type: none"> • 3 National Grade 10 Life Sciences documents • 2 National Grade 10 Life Sciences examination papers • 3 Provincial Grade 10 Life Sciences documents <p>2. Pedagogic recontextualising field texts</p> <ul style="list-style-type: none"> • 2 Grade 10 Life Sciences textbooks <p>3. Reproduction field texts</p> <ul style="list-style-type: none"> • Teachers’ class notes • Learners’ class work • Schools’ Grade 10 Life Sciences examination papers • Miscellaneous school documents • Diaries of Grade 10 learners 	Content analysis
Second Research Layer	Activities and practices	<p>District level</p> <ul style="list-style-type: none"> • 2 teachers’ workshops <p>School level</p> <ul style="list-style-type: none"> • 8 out of class school activities and practices • 15 Grade 10 Life Sciences lessons 	Interviews & observations

8.7.2 Interviews

As shown in Table 8.1, I used interviews as a method of data generation in the second research layer of the study, namely during the analysis of the school's activities and practices to determine the extent to which they integrate NRM. Each of the four schools formed a major unit of analysis, while the selected school activities and practices formed the sub-units of analysis. Section 11.3 and 11.4 provide details on the school activities and practices which were analysed. In each school, the school's principal and the Grade 10 Life Sciences teacher formed the respondents for the interviews. I interviewed the principals in order to gain insight into the extent of NRM integration within the selected school activities and practices from their perspectives. I interviewed the Grade 10 Life Sciences teachers because I wanted to obtain detailed information about their training and teaching experiences especially with regard to NRM.

The interviews created an opportunity for the school principals and the teachers to describe their feelings and experiences regarding the integration of NRM using their own words. The interviews also allowed me to cross-check data about the integration of NRM that I obtained from other sources. The interviews that I conducted were of the semi-structured type. According to O'Leary (2004, p.164) this type of interview is partially flexible in that only few of the questions are pre-determined, and the respondents are allowed to digress from them. I conducted each series of interviews with the aid of an interview schedule which contained inter alia a few questions on the respondents' background, and a list of NRM integration related issues that I wanted to talk about with the respondents (see Appendix 1). Using this type of interview, I was able to change the order in which I asked the questions according to the emerging context of the interview. I was also able to probe the responses from the interviewees, which helped to give the interviews more breadth and depth. To keep an accurate record of the proceedings, the interviews were audio-taped (with permission from the respondents), and were later transcribed.

8.7.3 Observation

Observation was the second method of data generation that was used in the study. As indicated in Table 8.1, I used this method in the second research layer of the study mainly to generate data on the extent of NRM integration during teachers' workshops, and in a sample of Grade 10 Life Sciences lessons. The observation method was also used during the analysis

of the school activities and practices, but mainly to cross-check the data that had been obtained from the interviews with various respondents.

Creswell (2003, p. 185) describes observation as method in which the researcher takes field notes on the behaviour and activities of individuals at the research site. Cohen, Manion and Morrison (2007, p. 396) refer to the data obtained through observation as 'live'. Similar views about the observation method are expressed in Jones and Somekh (2006, p.138) who state that the method entails being present in a situation and making a record of one's impressions of what takes place. There were two major advantages of using the observation method in the study. The first was that I was able to conduct the study in a natural school or classroom setting, without any deliberate manipulation of the natural environment. The second advantage was that I was able to record the activities and behaviour of the respondents as they related to the extent of NRM integration, instead of relying on secondary sources such as interviews. According to Cohen, Manion and Morrison (2007, p. 396), the latter is the method's unique strength. In opting to use this method I was well aware of the various critiques that have been levelled against it, such as: selective observations and data entry, the effect of the researcher's presence on the respondent's behaviour; the researcher's lack of control of the research situation; the relatively small sample sizes; and the difficulty of gaining access to the research sites (Cohen, Manion & Morrison, 2007). See Section 8.8 below for details of how these issues were dealt with in this study.

There are several approaches to the use of observation as a research method, for example, unstructured, semi-structured and structured. Usher and Scott (1999) point out that the different approaches to observation reflect different theoretical assumptions about social reality and the generation of knowledge about it. According to Usher and Scott (1999), unstructured observation involves detailed recording of all that is taking place, with no a priori decisions being made of what is to be recorded. I used this approach to observation for the first two Grade10 Life Sciences lessons that I attended. This involved taking copious field notes of everything I saw and heard during these lessons. The aim was to use these first observations as a means of exploring the lessons with the intention of identifying possible areas I could focus on so as to make future amounts of data and its analysis more manageable. In the following classroom observations I relied on the semi-structured approach rather than the structured approach. The structured approach to observation has positivist underpinnings through its reliance on the systematic recording of predetermined categories of

actions and the generation of quantitative data (Jones & Somekh, 2006). On the other hand, the semi-structured approach is far less predetermined, in that categories of actions are replaced by an agenda of issues, and data generation proceeds in a less systematic manner (Hitchcock & Hughes, 1995). For example, in this case I was not interested in recording the sequence at which the various actions took place. The agenda of issues under which I conducted the observations was identified from the exploratory data of the first two classroom observations, and consisted of the following: topic of the lesson; oral questions asked; the teaching and learning materials used; notes written on the blackboard; and assessment tasks set during the lesson (see Appendix 2). These issues helped to focus the observations, and to capture the lessons' dynamics without resorting to the use of a standard atomised observation schedule.

Another typology of observation approaches includes: complete participation; participant-as-observer; observer as participant; and complete detachment (Cohen, Manion & Morrison, 2007), depending on the level at which the researcher identifies with the phenomenon that is being investigated and its context. During the observations that were conducted in the study, I assumed the role of observer as participant. In this approach to observation, the researcher participates in the activities of those they are observing to some extent (Jones & Somekh, 2006). While I did not actively teach the Grade 10 Life Sciences lessons, the extended period of engagement with the schools' principals and the Grade 10 Life Sciences teachers (two school terms) created an opportunity for me to engage and interact with them at a deeper level. Thus I was able to gain deep insight into their activities and practices regarding the extent of NRM integration (see Sections 11.3 and 11.4).

For each Grade 10 Life Sciences lesson that I observed, guided by the five agenda issues listed above, I made detailed notes of what I saw and heard. I also made audio-tape recordings of the lessons. The tape recordings were transcribed for future data analysis. See Chapter 11 for details of how the data were analysed, and the results that were obtained.

8.7.4 Content analysis

The third method that was used in this research project was content analysis, which is sometimes referred to as document analysis (O'Leary, 2004), systematic content analysis or statement analysis (Bos & Tarnai, 1999). Silverman (2004) notes that content analysis is one of the major methods in qualitative research, although according to Bos and Tarnai (1999) its

use is relatively marginalised compared to observations and interviews. In O'Leary (2004, p. 177), the method involves the 'collection, review, interrogation and analysis of various forms of text as a primary source of research data'. O'Leary (2004) stresses the point that the documents that are analysed pre-exist the data that are generated by a given research project. For this project I adopted O'Leary's approach to content analysis, and used this method for the analysis of texts in the first research layer of the project, as shown in Table 8.1 (although there are researchers who believe this should be extended to include the transcripts from interviews, and field notes from observations). The texts which I analysed using this method were the various pedagogic texts produced by the national and provincial departments which relate to the teaching, learning and assessment of Grade 10 Life Sciences (see Sections 9.2 and 9.3) and two Grade 10 Life Sciences textbook which were in use at the case study schools (see Section 10.2). I also used this method to analyse various texts produced by teachers and learners during Grade 10 Life Science lessons (see Sections 11.3 and 11.4). However, it is useful to keep in mind that the use of content analysis is not restricted to written texts: it may also be used to analyse such items as photographs, films, video recordings (Merriam, 2005), websites and works of art (Babbie, 2007).

The use of pre-existing documents as a primary source of data comes with a number of advantages and disadvantages. The advantages include the fact that it is cost-effective as compared to other methods, since it does not necessarily require special equipment or additional staff; is unobtrusive and does not cause reactivity from the respondents; it enables researchers to reach inaccessible persons or subjects; and works with data that are permanent and stable, which makes reanalysis and replication possible (Merriam, 2005; Cohen, Manion & Morrison, 2007). I was also aware of the limitations of this method, as pointed out by these same two authors. These include the fact that since the documents are not produced for research purposes, they may be biased, incomplete, contain information which is not necessarily relevant to the study and may not be freely available. A limitation of this method which was of immediate relevance to this project was the fact that the various documents that I analysed were structured differently, which meant that I could not rely on the use of a standard research instrument for their analysis (see Chapters 9, 10 and 11 for examples of the different research instruments that were used in the study).

According to Ahuvia (2001, p. 143), content analysis proceeds in three main stages, which are: selection of focal texts; coding of the focal texts; and interpreting the results of the

coding. In deciding to use this method, there were three major issues to contend with. The first issue was concerned with whether to use a quantitative or qualitative approach to the content analysis. Mayring (2004) and Merriam (2005) note that some researchers take a positivist approach to content analysis during which they record the frequencies of certain items (for example, words, concepts, or themes) throughout the document. Berg (2004, p. 269) sees such an approach as reductionist, and critiques it for focusing on only the surface meaning of the texts (manifest content), while ignoring its deeper meanings (latent content). Another researcher for whom the distinction between manifest and latent content is crucial to the research process is Ahuvia (2001). Ahuvia maintains that manifest content analysis only looks at 'the most obvious and straightforward meaning of a text' (2001, p. 41), and the coding of the texts follows strict rules in order to enhance inter-coder reliability. Ahuvia contends that manifest content analysis is appropriate for cases where there is general agreement on the meanings of the terms being coded, and on how to code them. This represents the traditional quantitative approach to content analysis.

There is growing interest in a qualitative approach to content analysis, partly in response to the interpretive turn in social science research (Wester, Pleijter & Renckstorf, 2004). For Ahuvia (2001) latent content analysis represents such an approach in that rather than quantifying the terms in the text, the approach focuses on their interpretations. Qualitative/interpretive content analysis also differs in the way coding is carried out. There are no strict rules to guide the coding process, and each case is treated individually 'to make the most compelling and contextually sensitive interpretation' (Ahuvia, 2001, p. 162). In addition, rather than focusing only on specific terms in the text, the researcher takes a holistic approach to the analysis and considers how the rest of the text influences the part that is being coded.

Knobel and Lankshear (2004) maintain that whichever approach one uses to analyse the text, it must concur with conceptual and theoretical underpinnings relevant to the study. These authors imply that researchers who are working within the interpretivist/constructivist paradigms undertake content analysis of texts so as to identify the meanings that are embedded in them. For such researchers, text represents a form of social reality, whose meaning is accessible only through the analysis of the latent content. Babbie (2007) notes that although such an approach results in a deeper and richer analysis of the text, it is subject to bias from the researcher. Ahuvia (2001) points out that the interpretivist researcher acknowledges that the interpretations are not objective and that they are made from a

particular perspective. Thus maintaining interater reliability is less important in interpretive content analysis than in manifest content analysis. Ahuvia (2001, p. 149) states that rather than demonstrating that the coding could not be done in any other way, what is important in interpretive content analysis is for researchers ‘... to show that the codings are at least as plausible and compelling as rival interpretations’. This view is supported by Berg (2004) who recommends that where the interpretive approach is used, detailed excerpts of texts be made available to document the trajectory of the researcher’s interpretations.

For this research project I opted to use both approaches to content analysis of the various documents that I investigated. In taking this decision, I was heeding Berg’s (2004) recommendation that both approaches be combined since whichever is appropriate depends on the unit of analysis under consideration. For example, during the analysis of the Grade 10 Life Sciences textbooks, my focus was on comparing the frequency of NRM concepts with that of concepts which are specific to Life Sciences in the books’ indices, which implied a quantitative approach to content analysis (see Section 10.2). In contrast, during the analysis of the extent of NRM integration within the *National Curriculum Statement for Grades 10-12 (General) Life Sciences* document, I looked for how explicit references to NRM were in the stated definition and purpose of Life Sciences, which represented an interpretive approach to content analysis (see Section 9.5). My long experience and knowledge of the research issues which were being investigated, and of the context in which the research was conducted, coupled with an extensive literature review enabled me to make use of abduction in developing with plausible categories of what was read, said or observed during the study regarding the extent of NRM integration.

To enhance the quality of the data that are generated through content analysis, it is important that the process be conducted in a transparent and systematic manner. According to Cohen, Manion & Morrison (2007) care has to be taken when selecting units of analysis during content analysis since the process can be conducted at the level of, for example, individual words, phrases, sentences, themes, paragraph or chapters. Babbie (2007, p. 320) observes that determining appropriate units of analysis can be a complicated task. In this research project there was no standard unit for the content analysis of the documents. The type of unit of analysis that was used depended on the nature of document that was being investigated. For example, during the analysis of the extent of NRM integration within the textbooks, I used illustrations, and words in the index as units of analysis (see Section 10.2). Other examples of

the units of analysis that I used during the analysis of the ORF pedagogic texts included sentences, concepts, and paragraph (see Section 9.5 and 9.6). As explained earlier, it was necessary to use different units of analysis because the various documents that I analysed were structured differently and also had different contents (see Chapters 9, 10 and 11).

Two major options are available to researchers with regard to the formation of categories under which data can be analysed: the deductive and the inductive approach (Berg, 2004). The deductive approach is based on the use of pre-determined categories to analyse the texts, and stands the risk of overlooking some of the data. The inductive approach allows the categories to emerge from the data, which is the approach that I used. Berg (2004, p. 273) states that this approach allows the researcher to ground the categories to the data from which they derive. This approach demanded prolonged engagement with the various documents as I sought to make sure that the most significant sections or meanings of the documents were all accounted for in the categories that I came developed. I also had to make sure that the categories of analysis were distinctive enough (where a quantitative approach to content analysis was adopted) to allow replication studies to be conducted on the same texts. In order to achieve this I had to pilot test the categories on the relevant texts a number of times, and also sought input from critical friends.

8.8 THE ANALYSIS PROCEDURE

8.8.1 Introduction

The procedure that was used to analyse the extent of NRM integration in the various school documents, activities and practices consisted of a series of distinct steps which were:

- Identification of criteria in the school document, activity or practice under which the analysis was to be conducted,
- Selection and description of suitable indicators to describe the criteria with regard to the extent of NRM integration,
- Construction of scaling grids for the indicators based on Bernstein's scale of *classification*,
- Generation of data for the selected indicators, and grading their performance with regard to NRM integration with the help of the scaling grids, and
- Illustration of the results in form of radar/spider diagrams.

8.8.2 Identification of criteria

The identification of criteria in each item under which the analysis was to be conducted formed the first step of the analysis procedure. The criteria were key features of a particular item which represented possible or suitable areas of NRM integration. The final criteria identified for a particular item that was analysed depended on its structure, content and purpose. For example, during the analysis of the textbooks, the book cover, illustrations, and index were some of the criteria that were identified (see Section 10.2). During the analysis of the Grade 10 Life Science lessons some of the criteria that were identified were: topic of the lesson; questions asked by the teachers; and notes written on the board (see Section 11.4). Identification of criteria was necessary because it was assumed that not all parts of the item being analysed had the potential to integrate NRM. It also facilitated the analysis process by breaking up the items into more manageable parts. The identification of criteria further helped to focus the analysis process to those key areas of the item which are relevant to the integration of NRM in a particular item. Not only was it important that the selected criteria be capable of integrating NRM, but also that they were representative of the item under analysis and were easy to identify in the item. For example, during the analysis of the National Curriculum Statement Grades 10-12 (General) Life Sciences (South Africa.DoE, 2003) the criteria 'Illustrations' could not be used because illustrations did not feature in this document at all (see Section 9.2.1). Similarly, the criteria 'glossary' was used during the analysis of the National Curriculum Statement Grades 10-12 (General) for Life Sciences document, but was not relevant or appropriate in the analysis of the Grade 10 Life Sciences lessons (see Section 11.4). The identification of criteria also helped with the selection of suitable indicators of extent of NRM integration in the different items which were analysed.

8.8.3 Selection and description of indicators of extent of NRM integration

Once the criteria for the analysis had been identified, those parts of the item which correspond or contain the criteria were carefully examined (for example, by reading or observing) to determine their content, underlying message(s) or principle(s) regarding the integration of NRM. I conducted this examination with the aid of indicators.

Indicators are traditionally used as a tool to monitor and assess the health of systems, and their interpretation and use vary with the nature of the field and the context. In the context of this study, the term indicator refers to a 'piece of information' or 'variable' which can be

used to show the current situation, progress made and trends regarding the integration of NRM in the identified criteria. Each identified criterion in a particular item was linked to one such indicator, with the aim of helping to describe the current status of that criterion with regard to the extent of integration of NRM. In other words I used the indicators as markers to show how much progress towards integrating NRM had been made in a given criterion, in the different items that I analysed.

Indicators can be grouped in many different ways. This study used the typology of indicators presented in Tilbury, Janousek and Bacha (2007), which recognises three types of indicators. The first group is what are called ‘status indicators’ which in the case of this study provide information on the position or status of NRM integration in each criterion. The second group of indicators are the ‘facilitative indicators’ which in this study assess the variables that support or assists engagement with NRM integration, for example, supply of relevant teaching and learning materials, and the professional development of teachers. The third group, the ‘effect indicators’ is concerned with outcomes and effects of NRM integration. This study only considered indicators from the first two groups, in line with the study’s focus on the extent of NRM integration and the recontextualisation of NRM discourse, but not on their effects or resultant outcomes (see Section 1.6).

The indicators described (quantitatively or qualitatively) the performance or status of the criterion with regard to the integration of NRM. Thus the analysis involved the use of both quantitative and qualitative indicators. Quantitative indicators were in the form of ‘percentages’ and reflected a quantitative approach to the analysis, which focused on manifest content, as explained in Section 8.7. For example, during the analysis of the textbooks (see Section 10.2), one of the criteria under which the analysis was conducted was the ‘index’ of the textbooks. The indicator which was linked to this criterion was ‘percentage of NRM concepts in the index’ (see Section 10.2.2). This value was calculated by comparing the total number of concepts listed in the index to that of the NRM concepts. The meanings of the concepts in the index were taken at their face value and no deep interpretations were involved. Such an approach was not possible for all the criteria in the different items that were analysed. For example, during the analysis of the *National Curriculum Statement Grades 10-12 (General) for Life Sciences* document, one of the identified criteria was ‘definition of Life Sciences’ (see Section 9.5). The indicator linked to this criterion was ‘reference to NRM in the definition of Life Sciences.’ The approach taken to assess the status

of this criterion with regard to the extent of NRM integration was qualitative in that there were no frequency counts involved. Instead the text of the document where the definition was located was carefully read to gain an in-depth meaning of Life Sciences as provided in this document. This involved a focus on latent content of the text resulting in a textual description of the definition (rather than a number), which reflected an interpretive approach to the analysis (see Section 8.7.4).

Since there is always a large pool of potential indicators, a selection process is necessary (Tilbury, Janousek & Bacha, 2007). I used the concept of SMART to facilitate the selection of suitable and relevant indicators (of the extent of NRM integration), as recommended by Tilbury, Janousek and Bacha (2007). SMART is an acronym which stands for:

- Specificity i.e. indicators should closely measure what they are intended for,
- Measurable i.e. what indicators measure should be clear and concise,
- Attainable i.e. the required data should be obtainable at a reasonable cost,
- Realistic i.e. targets set for indicator performance should be realistic and practically achievable, and,
- Timely i.e. what the indicators measure can be assessed frequently enough to inform progress (Tilbury, Janousek & Bacha, 2007).

The table below provides an example of the criteria and their associated indicators which were used to analyse the extent of NRM integration in the case of the Grade 10 Life Sciences textbooks (see Chapter 10). As explained before, each of the items that were analysed had its own set of criteria and indicators which aided the analysis.

Table 8.2: The criteria and indicators used to analyse the extent to which Textbook A and B integrate NRM

Criteria	Indicator	Type of indicator
1. Book cover	a. Nature of reference to NRM on the book cover	Qualitative, status
2. Illustrations	b. Percentage of illustrations based on NRM	Quantitative, status
3. Activities	c. Percentage of activities based on NRM	Quantitative, status
4. Revision questions	d. Percentage of revision questions based on NRM	Quantitative, status
5. Case studies	e. Percentage of case studies based on NRM	Quantitative, status
6. Investigations, projects and experiments	f. Percentage of investigations, projects and experiments based on NRM	Quantitative, status
7. Glossary	g. Percentage of NRM concepts in the glossary	Quantitative, status
8. Index	h. Percentage of NRM concepts in the index	Quantitative, status

8.8.4 Construction and use of the scaling grids

After obtaining information about the extent of NRM integration in each criterion with the aid of the selected indicators (by conducting observations, interviews and content analysis) (see Section 8.7), I then converted these results into *classification* levels, based on Bernstein’s 4-point scale (see Section 7.7.4). I did this with the help of scaling grids. Each indicator had its own scaling grid, which showed which indicator performance (in relation to the extent of NRM integration) corresponded with which level of *classification*. For example, the definition of Life Sciences in the *National Curriculum Statement (General) for Grade 10-12 Life Sciences* document contains only implicit references to NRM. According to the scaling grid attached to the indicator ‘Nature of reference to NRM in the definition of Life Sciences’ an implicit definition of NRM corresponds with a *classification* level of C+ (see below for the explanation). Analysis of the criterion ‘Glossary’ in the same document revealed that only 7% of the terms listed were based on NRM, which corresponded to a *classification* level of C- according to the scaling grid for the indicator ‘Percentage of NRM concepts in the Glossary’ (see Section 9.5).

All the indicators of a particular item that was analysed had their *classification* levels determined in a similar manner, so that at the end of the analysis each indicator had a particular *classification* level linked to it, depending on what was found in the criteria

concerning the extent of NRM integration. As an example, the table below illustrates the scaling grids which were used to grade the performance (with regard to the extent of NRM integration) of some of the indicators that were used during the analysis of the Grade 10 Life Sciences textbooks (see Section 10.2).

Table 8.3: Examples of scaling grids used to grade the performance of indicators of extent of NRM integration during the analysis of the Grade 10 Life Sciences textbooks

Indicator	C ++ (very weak NRM integration)	C + (weak NRM integration)	C – (strong NRM integration)	C - - (very very strong NRM integration)
1. Nature of reference to NRM on the book cover	Refers only to Life Sciences / No reference at all to NRM	Reference general to both Life Sciences and NRM	Contains implicit reference to NRM	Contains explicit reference to NRM
2. Percentage of illustrations based on NRM	No NRM-based illustrations (0%)	<10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM
3. Percentage of activities based on NRM	No NRM-based activities (0%)	< 10% are based on NRM	Between 10 - 20% are based on NRM	> 20% are based on NRM

Three points about the scaling grids need to be highlighted. The first one concerns how Bernstein’s four-point scale was interpreted during the construction of the scaling grids. As explained in Section 7.7.4, the four points on Bernstein’s scale, namely C+ +, C+, C- and C- - correspond to: very strong *classification* (very high insulation); strong *classification* (high insulation); weak *classification* (weak insulation); and very weak *classification* (very weak insulation), respectively. During the construction of the scaling grids and their use in grading the performance of the indicators, insulation was treated as the opposite of integration. Therefore Bernstein’s scale was reinterpreted to read as follows: C+ + (very low extent of NRM integration); C+ (low extent of NRM integration); C- (high extent of NRM integration); and C- - (very high extent of NRM integration). The table that follows gives a summary of these interpretations.

Table 8.4: Interpretation of Bernstein’s scale of *classification*

<i>Classification level</i>	Extent of insulation	Extent of integration
C+ +	Very high	Very low
C+	High	Low
C-	Low	High
C- -	Very low	Very high

Secondly, the scoring system that was used in the construction of each scaling grid was based on field reflexivity, hence the attention to literature review and contextual profiling detail in this respect in Chapters 2 to 6, as well as professional knowledge of the context, and of the requirements of Life Sciences as a Learning Area (see sections 1.2 & 6.7). There are no set rules which state that when the definition of Life Sciences in a document is implicit, it must correspond with a *classification* level of C+, or that when the percentage of NRM based questions in the Life Sciences examination paper is above 20% it corresponds with a very strong NRM integration. These decisions were part of the research process of the study. The decisions concerning which *classification* level corresponded with which indicator performance involved establishing acceptable standards of performance with regard to the extent of NRM integration for each indicator. It is recommended that the process of setting up what are called ‘reference points of indicator performance’ be conducted in a participatory manner and involve key stakeholders (Tilbury, Janousek & Bacha, 2007). It was not possible to involve the respondents of this study in the grading of the performance of the different indicators, or in construction of the scaling grids for the indicators. However, effort was made to ensure that the target performance set for each indicator (which represented the set goal of NRM integration for a particular criterion) was both realistic and achievable. This explains why for example, in the case of the indicator ‘Percentage of illustrations based on NRM,’ which was used during the analysis of the Grade 10 Life Sciences examination exemplar papers, values above 20% were judged to represent a *classification* level of C- - (very strong NRM integration) (see Section 9.5). Very high percentage values, for example 65% or 90% were judged as being neither realistic, desirable nor achievable for this particular indicator, given the other demands of the Life Sciences Learning Area.

Thirdly, the scoring system reflected on the scaling grids was not uniform across all the indicators. This is because different indicators analysed different criteria, and the target indicator performance varied between the different criteria and indicators. For example,

during the analysis of the Grade 10 Life Sciences examination exemplar papers, a value of 10-20 % indicated a *classification* level of C- (i.e. strong NRM integration) on the scaling grid for the indicator ‘Percentage of illustrations based on NRM.’ However, in the case of the indicator ‘Percentage of investigations based on NRM,’ any value below 15% was allocated a *classification* level of C+ (weak NRM integration) (see Section 9.5.4). Similarly, during the analysis of the *Subject Framework for Grades 10-12 Life Sciences*, the indicator ‘Percentage of NRM concepts in the elaborated content of the knowledge areas,’ was allocated a *classification* score of C- - (very strong NRM integration) for any values above 10%, whereas in the case of the indicator ‘Percentage of teaching time allocated to NRM,’ it is only values above 20% which were interpreted as corresponding to very strong NRM integration (see Section 9.6). The variations in the scoring system should not be seen as a sign of inconsistencies in the scoring system. Rather it is a reflection of the intrinsic differences between the various criteria that were used during the analysis that set limits to desirable and attainable extents of NRM integration in the items that were analysed. This resulted in different targets of indicator performance being set for different indicators, and hence variations in which level of indicator performance corresponded with which *classification* level.

8.8.5 Interpreting data on natural resource management

The definition of natural resource management (NRM) that was adopted for the study is that in Hugo, Viljoen and Meeuwis (1997, p. 178) which states that:

(Natural) resource management examines strategies and technologies for resource development in order to sustain economic growth without causing unnecessary environmental degradation and destruction.

The conceptual framework of NRM that was adopted for the study is illustrated in Figure 8.1 below. According to Omara-Ojungu (1992), NRM involves a compromise between ecological, economic, social, and institutional processes. Hence natural resource management can be conceptualised as four interlocking circles, each circle representing one of the four dimensions of NRM. Hugo, Viljoen, and Meeuwis (1997) contend that appropriate (natural) resource management requires detailed information about each dimension of NRM.

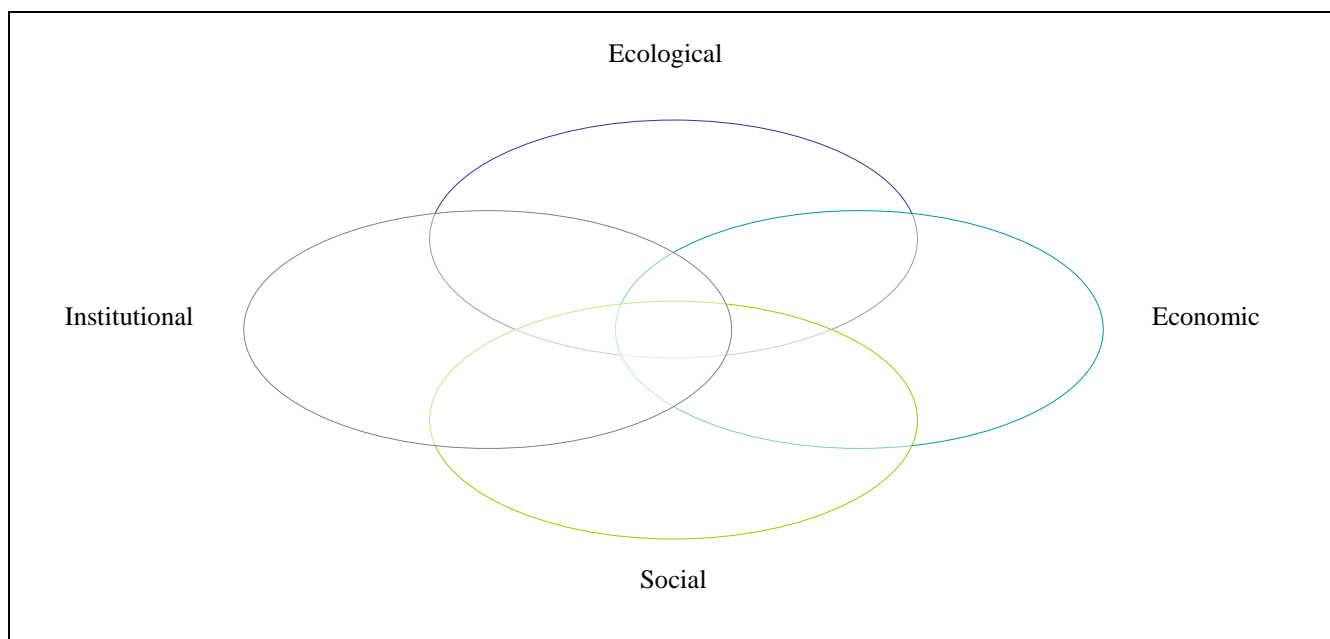


Figure 8.1 The four dimensions of natural resource management (after Omara-Ojungu, 1992)

Given South Africa's sectorial approach to natural resource management (see Section 4.9), there is more literature on the management of individual natural resources than on natural resource management as a field of study. Two South African texts which contain information on NRM as a field of study are Hugo, Viljoen and Meeuwis (1997) and Hugo (2004). These two texts were used as a guide to compile a list of issues regarded as being relevant to the management of communal natural resources, which is illustrated in Table 8.5 below.

Table 8.5: List of issues identified as being relevant to the management of communal natural resources

Ecological	Economic	Sociological	Institutional
1. Basic ecological principles	1. Uses of natural resources	1. Local NRM knowledge and skills	1. Access rights to local natural resources
2. Natural resource types	2. Rate of use of natural resources	2. Local attitudes and beliefs towards NRM	2. Regulations controlling use of natural resources
3. The biology and ecology of the natural resources	3. Economic importance	3. Gender issues in NRM	3. Community based natural resource management
4. The spatial and temporal distribution of the natural resources	4. Monitoring use of local natural resources		4. Penalties
5. Effect of human activities	5. Sustainable use of local natural resources		5. Conservation initiatives

As explained earlier, the analysis of the extent of NRM integration was based on indicators of the extent of NRM integration (see Section 8.8). Where the analysis involved a quantitative approach the decision over which indicator performance corresponded with which *classification* level depended on frequency counts of items, and was a relatively straightforward matter, for example during the analysis of the textbooks (see Section 10.2.2). However, where a qualitative approach was adopted, for example where analysis was based on the *nature of reference* to NRM, as during the analysis of the ORF texts (see Section 9.5), more details are needed to explain how the final decision on the extent of NRM integration was made.

For such cases the nature of reference to NRM was conceptualised into four categories, namely:

- Explicit reference to NRM,
- Implicit reference to NRM,
- Reference which is general/common to both NRM and Life Sciences, and
- No reference to NRM at all or reference is specific to Life Sciences.

Thus reference to NRM in the items which were analysed during the study could come from any of the four dimensions of NRM illustrated in Figure 8.1, and fall under any of the four categories listed in Table 8.5. If in the item that was being analysed there was reference to any of the issues listed in Table 8.5 above, the nature of reference to NRM was judged to be explicit, and interpreted as reflecting very strong extent of NRM integration. For example, the topics which are listed under the Knowledge Area of ‘Diversity, Change and Community’ in the *National Curriculum Statement Grade 10-12 Life Sciences (General)* (South Africa. DoE, 2003) include ‘biodiversity uses and importance’, and ‘conservation,’ which was interpreted as explicit reference to NRM in this document (see Section 9.7).

If the criterion being analysed did not specifically mention any of the issues listed in Table 8.5 but made reference to other related issues, the nature of reference to NRM was placed in the category of ‘implicit reference to NRM.’ For example, during the analysis of the *National Curriculum Statement for Grades 10-12 Life Sciences (General)*, one of the Learning Outcomes made mention of ‘indigenous knowledge, and the interrelationships between

environment and society,' which were interpreted as implicit reference to NRM (see Section 9.7).

Reference to NRM was judged to be common to both NRM and Life Sciences if the item being analysed mentioned or included issues which related to basic ecological principles, or mentioned the scientific method of investigation, or the development of analytical, problem solving, or reflexive skills among learners. For example, some of the observed lessons at School A, C and D were based on the structure and functioning of ecosystems, which was interpreted as being common to both Life Sciences and NRM (see Section 11.7).

References which were judged to be specific to Life Sciences only contained biological concepts, and did not fall into any of the four dimensions of NRM listed in Figure 8.1, or relate to any of the issues listed in Table 8.5. For example, at School B all the observed Life Sciences lessons were based on topics which were specific to Life Sciences, and which lacked any reference at all to NRM. The extent of NRM integration in those lessons was subsequently judged to be very weak (see Section 11.7).

Where the item being analysed contained various references to NRM which fell under different categories, the reference which reflected the strongest extent of NRM integration took preference over other references. For example during the analysis of the *National Curriculum Statement for Grades 10-12 Life Sciences (General)*, although only one out of the nine Assessment Standards made explicit reference to NRM, the overall nature of reference to NRM in the Assessment Standards was judged to be explicit (see Section 9.7.1). Likewise, the overall nature of reference to NRM in the definition of Life Sciences in the same document was judged to be implicit, although the definition also contained concepts which were common to both NRM and Life Sciences (see Section 9.7.1).

8.8.6 Illustration of the results

Once I had determined the *classification* level and the extent of NRM integration for each indicator for a given item of analysis, the next step was to display the results of the analysis in graphic form. The type of graph that I used to display the results from each document is what is called a radar or spider diagram. I chose this type of graph for four major reasons. The first reason was the need for a graph which was adaptable to both quantitative and qualitative data. I wanted a type of graph which was easy enough to construct and read even

by inexperienced researchers such as teachers in rural under-resourced schools. I was also interested in a type of graph with very strong visual effect to allow easy communication of differences in the extent of NRM integration not only between different indicators within a given item, but also across different items which were analysed, both in time and space. Lastly, using radar diagrams made it easy to identify which criteria in the analysed items were firmly established and those that needed immediate attention with regard to the integration of NRM.

Each radar diagram consisted of different arms, each arm representing a given indicator. For example, the radar diagram used to illustrate the overall extent of NRM integration in Textbook A, and B, consisted of eight arms, which represent the eight indicators that were used in their analysis (see Section 10.4). The different *classification* levels were indicated along each arm, with the weakest extent of NRM integration (C+ +) towards the centre of the radar diagram, while the rim of the radar diagram represented the strongest extent of NRM integration (C- -).

8.9 ENSURING QUALITY

Ensuring the quality or rigour of a research project is of major concern to investigators, for as Cohen, Manion & Morrison (2007) point out, without it, a research project is worthless. This is true for all research irrespective of its theoretical underpinnings. Lincoln and Guba (1985, p. 290) proposed four questions as a guide to ensuring the rigour of a study, which relate to the findings' truth value, applicability to other similar situations, consistency and neutrality. Golafshani (2003) notes that how individual researchers approach these questions is greatly influenced by their philosophical assumptions. Traditionally, the rigour of a study has been described in terms of its validity and reliability (Golafshani, 2003). Validity is used to refer to the correctness or credibility of a description, conclusion, explanation, or interpretation (Maxwell 2005, p. 106), while reliability is about whether the results are replicable (Golafshani, 2003). Both these terms have been critiqued as being rooted in positivism, in that they are based on the existence of one fixed objective truth, against which other accounts are compared (Maxwell, 2005). Although there is still a need to establish ways of ensuring quality in naturalistic studies, it is now widely supported that other alternatives to validity and reliability be used.

Decisions concerning which terminology and which approach to quality should be used in the study were influenced by the constructivist assumptions outlined in Section 8.4. Decisions on the approach to quality were also influenced by Lietz, Langer and Furman's (2006) advice not to depend on a set of rigid procedures by which to ensure the quality of a study. Similar views are also expressed by Maxwell (2005, p. 107) when he points to the non-use of a priori strategies such as randomised sampling, and statistical tests in naturalistic research. I also heeded Maxwell's suggestion that rather than aiming for the removal of all threats to the trustworthiness of the research, I should instead focus on understanding these threats and explaining how to deal with them, so as to reduce their negative impacts on the quality of the research. I thus needed not only a different set of lenses through which to analyse what is meant by quality in the study, but also different terminology for the concept, as well as strategies to enhance it. In this I was guided by Maxwell's (2005) view that methods and procedures alone do not guarantee rigour. Strategies of ensuring rigour needed to be broad enough to cover data analysis and interpretation, as well as the reporting of the findings (Fossey, Harvey, McDermott & Davidson, 2002).

Of the several alternative concepts to validity and reliability that have been suggested for naturalistic studies, Lincoln and Guba's (1985) construct of trustworthiness has received wide recognition. The trustworthiness of a research project refers to whether the findings reflect as closely as possible the meanings of the project's participants (Lietz, Langer & Furman, 2006, p. 445). According to Fossey et al. (2002) trustworthiness also involves ensuring coherence between the findings and the social context in which they are derived. In the end, efforts at enhancing the trustworthiness of the study were driven by two major goals. The first goal was to ensure that the descriptions of respondents' actions, views and experiences regarding the extent of NRM integration were recorded as accurately and rigorously as possible (hence the attention to detail in the analysis as described above). The second goal was to give prominence to the voice of the respondents, or that of the documents that I analysed in the interpretations relating to the integration of NRM.

Various authors have proposed measures or strategies that researchers in naturalistic studies can put in place to enhance the quality of their research. However, Fossey et al. (2002) caution that not all strategies are equally important, or applicable in every research project. Maxwell (2005) proposes that researchers deal adequately with a select group of threats to the quality of research in the context of a study, rather than resorting to abstract discussions of all

possible threats. The strategies that were used to enhance the trustworthiness in this research were: prolonged engagement, triangulation, member checking, peer debriefing an audit trail and reflexivity.

I used prolonged engagement in two ways. The first was with the various documents that I analysed to make sure that I developed a deeper understanding of any underlying messages about NRM that they were conveying. This involved reading these documents over and over again, and cross-checking my interpretations. The second prolonged engagement involved contact with the four case study schools, their contexts and the schools' principals and Grade 10 Life Sciences teachers. Field work with the schools covered two school terms, and involved two series of school visits (see Chapter 11). This was to help establish an atmosphere of trust and rapport between myself and the respondents, and to become familiar with their context so to understand their subjective meanings better.

I used triangulation in two ways. I used various sources of data (data triangulation), and different methods (methods triangulation) to help build a more complete picture of the extent of NRM integration, and to confirm the research findings (see Section 8.7). I cross-checked the field notes and transcripts with the respondents for accuracy (member checking). I held discussions with critical friends and colleagues, to share research experiences with them, and to gain their input into the project (peer debriefing). I kept a record of all the major steps of the research process and explanations of all the major decisions that I took (audit trail). I constantly reflected on how my personal biography might be influencing my understanding and interpretation of what I saw, heard or read with regard to the integration of NRM (reflexivity). I also developed detailed contextual profiles of rural education (see Chapter 2), Curriculum (see Chapter 3), natural resource education (see Chapter 4), curriculum integration (see Chapter 5) and the Eastern Cape (see Chapter 6) to ensure field-based reflexivity.

8.10 DEALING WITH ETHICAL ISSUES

I used two major documents as a guide on how to deal with the ethical issues of the study. These were Rhodes University Ethical Guidelines (Rhodes University homepage, 2005) and Creswell (2003). The first ethical issue that I dealt with was getting permission to conduct research at a public school. Permission to do so was obtained from the Peddie Circuit education office, and from the four school principals (Appendix 14). The second ethical issue

concerned obtaining informed consent from the respondents. For this, I had to hold a meeting with the school principals and the Grade 10 Life Sciences teachers during which I informed them about the purpose of the study, the methods I was going to use, what was expected of them. I informed the respondents of their right to withdraw from the study at any stage. In all cases, oral permission to conduct the research was granted. The third ethical issue was about respecting the respondents as human beings. I did this by being sensitive to their cultural norms, respecting their space, and making sure that that the study did not cause them physical or psychological harm. I also shared the results of the research with them on an ongoing basis. The fourth ethical issue was about ensuring respondents' confidentiality. I achieved this by not mentioning their names or those of their schools in the final research report.

8.11 CONCLUSIONS

In this chapter I described the research design decisions made to identify and establish appropriate methods for generating data about the extent of NRM integration in the various school documents, activities and practices that were analysed. A major key to the choice of methods was clarifying philosophical assumptions about the nature of reality and how knowledge is created. This chapter introduced constructivism as the main philosophical base of the research project, described its key features and how they influenced the entire research process. The chapter further explained why the case study methodology was used and the selection of semi-structured interviews, observations and content analysis as the main methods of data generation. The chapter provided details on the procedure which was followed during the analysis of the different items, and described the construction and role of the different research instruments used during the analysis. The chapter also included a discussion on approach to quality in research, and outlined various strategies that were employed to ensure rigour in the research. The chapter ended with a description of how various ethical issues were dealt with in the study.

The next three chapters detail the analysis of the extent of NRM integration in the different fields of pedagogic discourse, starting with the official pedagogic field (Chapter 9), which is followed by the pedagogic recontextualising field (Chapter 10), and lastly the reproduction field (Chapter 11).

CHAPTER 9

THE ANALYSIS OF THE EXTENT OF NRM INTEGRATION IN THE OFFICIAL RECONTEXTUALISING FIELD (ORF) TEXTS

9.1 INTRODUCTION

As explained in Chapter 1, the overriding goal of this study was to obtain better understanding of the extent of NRM integration in different fields of pedagogic discourse in a rural under-resourced education context. The three fields of pedagogic discourse which formed the basis of the investigation were first introduced in Section 1.5, and discussed in more detail in Section 7.7.2. According to Bernstein's (1990, 1996) model of pedagogic discourse, the three fields are: the ORF, the PRF and the reproduction field. This chapter introduces the official Grade 10 Life Sciences pedagogic texts (curricular documents) that formed the object of the analysis in the ORF field. Two types of ORF documents were analysed: those that were issued by the National Department of Education, Pretoria (see Section 6.5.2) and those which came from Eastern Cape's Provincial Department of Education (see Section 6.5.3). Both types of documents are described as official pedagogic texts because they are produced by organs of the state, and represent the Official Pedagogical Discourse (OPD) regarding the teaching, learning and assessment of Grade 10 Life Sciences in South Africa. In this chapter, I describe these texts in terms of their origin, structure, content and intended purposes. This is followed by a discussion of the tools that were used to analyse these texts, and an outline of the procedures that were followed during the analysis. The chapter ends with a presentation of the overall extent of NRM integration in each document that was analysed.

9.2 THE NATIONAL ORF PEDAGOGIC TEXTS

There are four major national policy documents which relate to the teaching, learning and assessment of Grade 10 Life Sciences throughout South Africa. Grade 10 Life Sciences teachers are expected to engage with these four documents as they plan and implement Grade 10 Life Sciences learning programmes, lesson plans, and assessment tasks. These documents are the:

- *National Curriculum Statement Grades 10-12 (General) Life Sciences* (South Africa. DoE, 2003),

- *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programme Guidelines* (South Africa. DoE, 2007a),
- *National Curriculum Statement Grades 10-12 (General) Life Sciences Subject Assessment Guidelines* (South Africa. DoE, 2007b), and
- *National Senior Certificate: A Qualification on Level 4 of the National Qualifications Framework (NQF)* (South Africa. DoE, 2005).

Only the first three documents were analysed for the extent to which they integrate NRM. This was because the Grade 10 Life Sciences teachers at the four case study schools admitted to working with only these three national documents, and were not familiar with the last one. In addition, two Grade 10 Life Sciences examination exemplar papers (Paper 1 and Paper 2) that were set by the National Department of Education (South Africa. DoE, 2006) were analysed as part of the official Grade 10 Life Sciences pedagogic texts. As was shown in Section 8.7, a total of five national documents were analysed.

9.2.1 The National Curriculum Statement Grades 10-12 (General) Life Sciences document

The *National Curriculum Statement Grades 10-12 (General) Life Sciences* (South Africa. DoE, 2003) spells out the curriculum policy regarding the teaching, learning and assessment of Life Sciences in the FET band. This document is 66 pages long, and is divided into four chapters. Chapter 1 serves as an introduction to the National Curriculum Statement, and contains general information regarding this curriculum framework, such as its principles and main design features. This chapter is seven pages. Chapter 2 which is four pages, defines the Learning Area of Life Sciences, and outlines its scope, purposes and its three Learning Outcomes. In Chapter 3 the Assessment Standards that are linked to the Life Sciences Learning Outcomes of each grade are presented, together with core knowledge areas that constitute the Learning Area of Life Sciences in the FET band. With 28 pages, Chapter 3 forms the longest chapter in this document. Chapter 4 is devoted to discussing the principles of National Curriculum Statement assessment in the Life Sciences, assessment types, and the various methods and procedures involved. Chapter 4 is 21 pages and ends with a Glossary. Prior to the 2006 introduction of the National Curriculum Statement into Grade 10 classrooms, this pedagogic text (and similar other types for different subjects), was distributed to schools throughout South Africa. This document is also available online from

various Internet sites such as the National Department of Education, and the website of Eastern Cape's education department.

9.2.2 The National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programme Guidelines

This policy document was issued in 2007 by the National Department of Education. It is 42 pages, and is intended to provide guidance to teachers and schools on how to plan and design Learning Programmes for Life Sciences. A Learning Programme is a planning tool which ensures that teaching, learning and assessment are conducted in a sequenced and progressive manner across the different grades that make up the FET band. Carefully planned and crafted Learning Programmes help the teacher to ensure that the Learning Outcomes and Assessment Standards for Life Sciences are realised in a coherent manner not only across the different grades, but also across the different knowledge areas. Section 1 of this document introduces the reader to the document and its aims, describes what is meant by a learning programme, as well as provides background information on the National Curriculum Statement. This part of the document is five pages. Section 2 contains information on Life Sciences as a Learning Area. It details the relationship between Life Sciences and the nine principles that underpin the National Curriculum Statement, and that which exists between the three Learning Outcomes for Life Sciences and the Critical and Developmental Outcomes (see Section 6.7). Section 3 forms the last section of this document and is 28 pages. This part of the document details the process of designing Learning Programmes for Life Sciences, and provides information on the stages and procedures involved and the key issues that need to be taken into account. Section 3 ends with the Annexure which outlines the skills areas for Life Sciences, and provides examples of Life Sciences Work Schedules for Grades 10-12.

9.2.3 The National Curriculum Statement Grades 10-12 (General) Life Sciences Subject Assessment Guidelines

This is a 36-page long document which was issued in 2007, and whose aim is to provide clear guidance to teachers on assessment of Grade 10-12 Life Sciences learners. The document is divided into three sections. Section 1 explains the purpose of the document, which is to provide guidelines for assessment in the National Curriculum Statement Grades for Grades 10-12 (General). Section 2 is six pages, and contains information on continuous and daily assessment in the National Curriculum Statement for this level, and the number and forms of assessment tasks that are required. Section 3 consists of seven pages, and details assessment

requirements for Grade 10-12 Life Sciences, such as mark allocation to the different types of assessment tasks, and Learning Outcomes. The last pages of this document provide examples of Grades 10-12 Life Sciences assessment tasks, such as practical work and research project.

9.2.4 The National Curriculum Statement Grade 10 Life Sciences Examination Exemplar Papers (Paper 1 and 2)

Both papers were issued in 2006 by the National Department of Education to offer guidance to Grade 10 Life Sciences teachers on the structure, format and content of a Grade 10 Life Sciences examination paper under the National Curriculum Statement framework. Each paper is worth 150 marks, and is 2 hours long. The two papers have the same structure, although Paper 1 is 18 pages, while Paper 2 has only 12 pages. Both papers contain four questions which are all compulsory. Each paper is divided into three sections. Section A which is worth 50 marks consists of only Question 1, and requires mostly one-word or single-sentence answers. Section B consists of Question 2 and 3 which are mostly data-response questions and each is worth each 30 marks. Question 4 makes up the entire part of Section C. The last sub-section of Question 4 requires learners to write an essay in which they express their views and provide suitable suggestions on a given topic. This essay alone accounts for 15 marks, out of a total of 40 marks that are allocated to Section C. Since the two papers are similar in format, to avoid unnecessary repetition, they were combined and analysed as one document.

9.3 THE PROVINCIAL ORF PEDAGOGIC TEXTS

9.3.1 Introduction

The Grade 10 Life Sciences teachers at the four case study schools admitted to working with three main provincial Grade 10 Life Sciences pedagogic texts. These were the:

- *Assessment Syllabus for Life Sciences Grades 10-12* (Eastern Cape Department of Education, 2006a) (see Appendix 3),
- *Subject Framework for Grade 10 Life Sciences* (Eastern Cape Department of Education, 2006b), and
- *National Curriculum Statement Grades 10-12 Life Sciences Resource Pack* (Eastern Cape Department of Education, 2006c).

As indicated in Section 8.7, these three documents also formed part of the ORF pedagogic texts that were analysed during the study.

9.3.2 The Assessment Syllabus for Life Sciences Grades 10-12

This is a nine-page document that was issued by Eastern Cape's Department of Education (2006a). Its main purpose was to provide further elaboration of the Learning Outcomes and Assessment Standards for Grades 10-12 Life Sciences. The Learning Outcomes are presented exactly as they appear in the National Curriculum Statement Grades 10-12 (General) Life Sciences document, so it was decided not to analyse them again. The document provides detailed information on the Life Sciences Assessment Standards for each Learning Outcome by grade.

9.3.3 The Subject Framework for Grade 10-12 Life Sciences

This is a five-page document that was issued by Eastern Cape's Department of Education (2006b). Its main purpose was to provide further elaboration of what is expected to be taught to Grade 10-12 learners in the Life Sciences. The Learning Outcomes and Assessment Standards are presented exactly as they appear in the *National Curriculum Statement for Grades 10-12 (General) Life Sciences* document, so it was decided not to analyse them again. The document provides further elaboration of the contents of the four main Knowledge Areas of Life Sciences by grade. The document also provides a time frame for each Knowledge Area by grade. It is the integration of NRM into the elaborated contents of the knowledge areas of Grade 10 Life Sciences, and the time allocated to each Knowledge Area of this curriculum, that formed the object of analysis of this document.

9.3.4 The National Curriculum Statement Grades 10-12 Life Sciences Resource Pack

This document was issued by the Department of Education in the Eastern Cape (2006c). It is 69 pages, and consists of three Grade 10 Life Sciences examination exemplar papers together with their marking memoranda. There was one exemplar of Paper 1 and two of Paper 2. Paper 1 had a total of 65 separate questions, and no NRM based questions. The first exemplar of Paper 2 had a total of 79 questions, of which only one was NRM-based, while the second exemplar had 25 NRM-based questions out of a total of 66 questions that the paper contained. For convenience, and to avoid unnecessary repetitions, it was decided to combine the three exemplar papers together and analyse them as a single pedagogic text.

9.4 THE ANALYSIS PROCEDURE

In this section I describe the tools that were used, and the procedure that was followed to analyse the extent of NRM integration in the national and provincial documents. As explained in Section 8.8, the analysis procedure involved the following steps:

- Careful scrutiny of the documents to identify the criteria under which the analysis was to be conducted,
- Selection of suitable indicators to describe the status of the criteria with regard to the extent of NRM integration in each criterion,
- Construction of a scaling grid for each indicator (based on Bernstein's scale of *classification*) to be used in grading the performance of each indicator with regard to the extent of NRM integration,
- Careful reading of the text in the document containing the identified criteria to generate data on the performance of each indicator with regard to the extent of NRM integration,
- Use of scaling grids to allocate *classification* levels to different levels of indicator performance, and
- Construction of radar diagrams to illustrate the overall extent of NRM integration in a given document.

As was explained in Section 8.8, the analysis procedure began with the identification of the criteria which structured the analysis of each document. This took place after careful examination of each document to identify its key features. The criteria selected for each document depended on its structure and contents. For example, the *National Curriculum Statement Grades 10-12 (General) Life Sciences* document contained a section on the definition of Life Sciences, purposes of studying Life Sciences and a glossary. Therefore these sections formed some of the criteria that were used to analyse this document. Criteria such as 'illustration' and 'book cover' could not be used in the analysis of this document because these items were not main features of this document.

As was discussed in Section 8.8.3, the next step in the analysis procedure was the selection of suitable indicators of the extent of NRM integration, which were used to describe the status of NRM within each selected criterion. As was explained earlier, the selected indicator could be qualitative or quantitative depending on the nature of the criterion which was being

analysed. For example, all the indicators used during the analysis of the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines* were qualitative, while those used in the analysis of the *National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences* document were a mixture of quantitative and qualitative indicators (see Section 9.5). Establishing a scoring system which formed the basis of the scaling grids that were used to grade the performance of each indicator in relation to the extent of NRM integration proved to be a major challenge (see Section 8.8.4). There are no guidelines which dictate the structure of the documents that were analysed, nor what their NRM content should be. The scoring systems that were used during the construction of the scaling grids were both based on a field reflexivity which was informed by literature review, and my professional knowledge and experience. Although it was not possible to obtain input from the Grade 10 Life Sciences teachers during the construction of the scaling grids, input was sought from critical friends and colleagues.

As explained earlier, the scoring systems on which the scaling grids were based varied between different criteria and indicators depending on what was deemed achievable and desirable for a given criterion. A scaling grid showed which performance for a particular indicator corresponded with which *classification* level, or extent of NRM integration (see Section 8.8.4). For example, it was judged neither achievable nor desirable for NRM-based questions to form 70% of the questions in the Life Sciences examination exemplar papers. This was because of other requirements of the Grade 10 Life Sciences curriculum which needed to be fulfilled as well. Therefore I decided on a more realistic figure of ‘above 10%’ as the target extent of NRM integration (C- -) for the criterion of ‘Allocation of marks’ (see Section 9.5.4). This figure represented the best performance for the indicator ‘Percentage of marks allocated to questions based on NRM,’ for that criterion. Having established the target extent of NRM integration for all the different indicators used in the analysis, I then worked backwards to allocate different indicator performances for the remaining *classification* levels (i.e. C-, C+, and C + +). For example, during the analysis of the *National Curriculum Statement Grades 10-12 (General) Life Sciences* document, for the indicator ‘Percentage of NRM concepts in the Glossary’ the values of 0%, less than 5%, and between 5-10% corresponded with the *classification* levels of C+ +, C+, and C-, respectively (see Section 9.5). The last step of the analysis procedure involved the construction of radar diagrams (see Section 8.8.6) to illustrate the overall extent of NRM integration in each document that was analysed.

9.5 ANALYSIS OF THE NATIONAL ORF PEDAGOGIC TEXTS

9.5.1 The National Curriculum Statement Grades 10-12 (General) Life Sciences

After careful scrutiny of this document, six criteria were identified to structure its analysis. The criteria and the indicators used to analyse the extent of NRM integration in this document are provided in the table below.

Table 9.1: The criteria and indicators used to analyse the extent of NRM integration in the *National Curriculum Statement Grades 10-12 (General) Life Sciences* document

Criteria	Indicator	Type of Indicator
1. Definition of Life Sciences	a. Nature of reference to NRM in the definition of Life Sciences	Qualitative, status
2. Purpose of Life Sciences	b. Nature of reference to NRM in the stated purpose of Life Sciences	Qualitative, status
3. Grade 10 Life Sciences Learning Outcomes	c. Nature of reference to NRM in the Learning Outcomes of Grade 10 Life Sciences	Qualitative, status
4. Grade 10 Life Sciences Assessment Standards	d. Nature of reference to NRM in the Assessment Standards of Grade 10 Life Sciences	Qualitative, status
5. Grade 10 Life Sciences Knowledge Areas	e. Nature of reference to NRM in the Knowledge Areas of Grade 10 Life Sciences	Qualitative, status
6. Glossary	f. Percentage of NRM concepts in the Glossary.	Quantitative, status

Table 9.2 shows the scaling grids used to grade the performance of the above indicators with regard to the extent of NRM integration in each criterion.

Table 9.2: The scaling grids used to grade the performance of the indicators during the analysis of the *National Curriculum Statement Grade 10-12 (General) Life Sciences*.

Indicator	C++ (very weak NRM integration)	C+ (weak NRM integration)	C- (strong NRM integration)	C- - (very strong NRM integration)
1. Nature of reference to NRM in Life Sciences definition	No reference at all to NRM or NRM related concepts made/reference specific to Life Sciences	References are general to both NRM and Life Sciences	Implicit reference to NRM concepts	Explicit reference to NRM concepts
2. Nature of reference to NRM in stated purpose of Life Sciences	No reference at all to NRM or NRM related concepts made/all specific to Life Sciences	References are general to both NRM and Life Sciences	Implicit reference to NRM concepts	Explicit reference to NRM concepts
3. Nature of reference to NRM in the Learning Outcomes.	No reference at all to NRM or NRM related concepts made/all specific to Life Sciences	References are general to both NRM and Life Sciences	Implicit reference to NRM concepts	Explicit reference to NRM concepts
4. Nature of reference to NRM in the Assessment Standards	No reference at all to NRM/all specific to Life Sciences	References are general to both NRM and Life Sciences	Implicit reference to NRM concepts	Explicit reference to NRM concepts
5. Nature of reference to NRM in the Knowledge Areas of Life Sciences	No reference at all to NRM/all topics specific to Life Sciences	References are general to both NRM and Life Sciences	Implicit reference to NRM concepts	Explicit reference to NRM concepts
6. Percentage of NRM concepts in the Glossary	All concepts are specific to Life Sciences/no NRM terms at all in the Glossary.	% of NRM concepts is < 10%	% of NRM concepts is 10-20%	% of NRM concepts is > 20%

9.5.2 The National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines

The five criteria and their corresponding indicators that were used to analyse the extent of NRM integration in this document are shown in Table 9.3.

Table 9.3: The criteria and indicators used to analyse the extent of NRM integration in the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines*

Criteria	Indicator	Type of Indicator
1. Definition of Life Sciences	a. Nature of reference to NRM in the definition of Life Sciences	Qualitative, status
2. Purpose of Life Sciences	b. Nature of reference to NRM in the stated purpose of Life Sciences	Qualitative, status
3. NRM concepts listed in the expanded Grade 10 Life Sciences syllabus	c. % of NRM concepts listed in the expanded syllabus for Grade 10 Life Sciences	Quantitative, status
4. Relationship between Life Sciences and the National Curriculum Statement principles	d. Nature of reference to NRM in the description of the relationship between Life Sciences and the National Curriculum Statement principles	Qualitative, status
5. The Life Sciences planning and pedagogical framework	e. Relevance of the Life Sciences planning and pedagogical framework to the integration of NRM in Life Sciences	Qualitative, facilitative

Table 9.4 on the next page illustrates the scaling grids that were used to grade the performance of the indicators with regard to the extent of integration of NRM.

Table 9.4 :The scaling grids used grade the performance of the indicators during the analysis of the extent of NRM integration in the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines*

Indicator	C++(very low NRM integration)	C+ (low NRM integration)	C- (high NRM integration)	C- - (very high NRM integration)
a. Nature of reference to NRM in the definition of Life Sciences	No reference at all to NRM/ specific to Life Sciences	Reference general to NRM and Life Sciences	Implicit reference to NRM	Explicit reference to NRM
b. Nature of reference to NRM in stated purpose of Life Sciences	No reference at all to NRM/all purposes specific to Life Sciences	Reference general to NRM and Life Sciences	Implicit reference to NRM	Explicit reference to NRM
c. Percentage of NRM concepts listed in the expanded syllabus for Grade 10	No NRM related concepts listed/all specific to Life Sciences	NRM concepts form < 10% of listed concepts	NRM concepts from 10-20% of listed concepts	NRM concepts form >20% of listed concepts
d. Nature of reference to NRM in the description of the relationship between Life Sciences and the National Curriculum Statement principles	No reference at all made to NRM	Reference general to NRM and Life Sciences	Implicit reference to NRM made	Explicit reference to NRM made
e. Relevance of the Life Sciences planning and pedagogical framework to the integration of NRM in Life Sciences	None of the nine listed issues in framework are relevant to NRM integration	Few (<3) of the issues listed in framework are relevant to NRM integration	Some of (3-5) of issues listed in framework are relevant to NRM	Majority (>5) of listed issues listed in framework are relevant to NRM integration

9.5.3 The National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences

The five criteria and their indicators that were used to analyse the extent of NRM integration in this document are shown in Table 9.5.

Table 9.5: The criteria and indicators used to analyse the extent of NRM integration in the *National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences* document

Criteria	Indicator	Type of Indicator
1. Stated purpose of assessment in the Life Sciences	a. Nature of reference to NRM in the stated purpose of assessment	Qualitative, status
2. Weighting of marks for Learning Outcomes	b. Percentage of marks allocated to Learning Outcome 3	Quantitative, status
3. Weighting of marks for knowledge areas	c. Percentage of marks allocated to Environmental Studies	Quantitative, status
4. Examples of assessment tasks	d. Nature of topics in the practical assessment task examples	Qualitative, status
5. Phrases	e. Percentage of phrases with explicit reference to NRM	Quantitative, status

Table 9.6 shows the scaling grids that were used to grade the performance of the indicators with regard to the integration of NRM.

Table 9.6: The scaling grids used grade the performance of the indicators used during the analysis of the extent of NRM integration in the *National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences*

Indicator	C++ (very weak NRM integration)	C+ (weak NRM integration)	C- (strong NRM integration)	C- - (very strong NRM integration)
a. Nature of reference in the stated purpose of	No reference at all to NRM/all references specific to Life Sciences	Contains references general to both NRM and Life Sciences	Contains implicit reference to NRM	Contains explicit reference to NRM
b. Percentage of marks allocated to Learning Outcome 3	Less than 10%	10-19%	20-30%	Above 30%
c. Percentage of marks allocated to Environmental Studies	Less than 10%	Between 10-5 %	Between 15-20%	Above 25%
d. Nature of topics in the practical assessment task examples	All are specific to Life Sciences/no NRM based topic	Very few based on NRM (< 3)	Only some based on NRM (3-4)	Majority (> 4) based on NRM
e. Percentage phrases with explicit reference to NRM	No phrases sentences at all which contain explicit reference to NRM	< 10% of the phrases contain explicit reference to NRM	10-20% of the phrases contain explicit reference to NRM	> 20% of the phrases contain explicit references to NRM

9.5.4 The National Curriculum Statement for Grade 10 Life Sciences examination exemplar papers (Paper 1 and 2)

To facilitate comparison of the examination exemplar papers with other ORF documents it was decided to combine the two papers together into a single document. I then conducted the analysis under five criteria which are listed below together with their associated indicators.

Table 9.7: The criteria and indicators used to analyse the extent of NRM integration in the *National Curriculum Statement for Grade 10 Life Sciences examination exemplar papers*

Criteria	Indicator	Nature of indicator
1. Question topics	a. Percentage of questions which are based on NRM	Quantitative, status
2. Allocation of marks	b. Percentage of marks allocated to questions based on NRM	Quantitative, status
3. Illustrations	c. Percentage illustrations based on NRM	Quantitative, status
4. Investigations	d. Percentage of investigations based on NRM	Quantitative, status
5. Essay question	e. Nature of reference to NRM in the essay question	Qualitative, status

The scaling grids used to allocate *classification* levels to the indicators that were used to analyse the examination exemplar papers are shown in Table 9.8.

Table 9.8: The scaling grids used to analyse the extent of NRM integration in the National Curriculum Statement for Grade 10 Life Sciences examination exemplar papers

Indicator	C++ (very weak NRM integration)	C+ (weak NRM integration)	C- (strong NRM integration)	C- - (very strong NRM integration)
a. Percentage of questions based on NRM	All questions specific to Life Sciences/no questions on NRM	Questions based on NRM < 5% of total	Questions based on NRM form 5-10% of total	Questions based on NRM form > 10% of total
b. Percentage of marks allocated to questions based on NRM	No marks allocated to NRM (0%)	Marks allocated to NRM form < 10% of total	Marks allocated to NRM form 10-20% of total	Marks allocated to NRM form > 20% of total
c. Percentage of illustrations based on NRM	No illustrations based on NRM/ all illustration specific to Life Sciences.	Illustrations based on NRM form < 10%	Illustrations based on NRM form 10-20%	Illustrations based on NRM form > 20%
d. Percentage of investigations based on NRM	No investigations based on NRM/ all the investigations were specific to Life Sciences	Investigations based on NRM form < 15%	Investigations based on NRM form 15-30%	Investigations based on NRM form > 30%
e. Nature of reference to NRM in the essay question	Essay topic is specific to Life Sciences	Essay topic is general to both NRM and Life Sciences	Essay topic refers implicitly to NRM	Essay question refers explicitly to NRM

9.6. ANALYSIS OF THE PROVINCIAL PEDAGOGIC TEXTS

A total of three provincial ORF texts were analysed during the study (see Section 9.3). The results of the analysis per document and per indicator are presented below.

9.6.1 The Assessment Syllabus for Life Sciences Grades 10-12

The contents of the eight elaborated Assessment Standards formed the single criterion under which the extent of integration of NRM in this document was analysed (see Section 9.3). Since this analysis was based on a single criterion, the analytical tools were simpler than the ones used for the other documents (see Tables 9.9 and 9.10).

Table 9.9: The criterion and indicator used to analyse the integration of NRM in the *Assessment Syllabus for Life Sciences Grades 10-12*.

Criterion	Indicator	Type of indicator
Contents of elaborated Assessment Standards	Nature of reference to NRM in the elaborated Assessment Standards	Qualitative, status

The extent of NRM integration in the *Assessment Syllabus for Life Sciences Grades 10-12* was analysed with the aid of the rubric below.

Table 9.10: Rubric used to analyse the extent of NRM integration in the *Assessment Syllabus for Life Sciences Grades 10-12* document

Nature of reference to NRM in the elaborated Assessment Standards	Classification level
1. Elaborated contents refer only to Life Sciences/no reference at all to NRM	C + + (very weak NRM integration)
2. Elaborated contents contain concepts which are general to both Life Sciences and NRM	C + (weak NRM integration)
3. Elaborated contents contain implicit references to NRM.	C- (strong NRM integration)
4. Elaborated contents contains explicit references to NRM	C - - (very strong NRM integration)
5. Content provided is insufficient for conducting the analysis	O

9.6.2 The Subject Framework for Grades 10-12 Life Sciences

The integration of NRM into the elaborated contents of the Knowledge Areas of Grade 10 Life Sciences, and the time allocated to each Knowledge Area of this curriculum formed the object of analysis of this document (see Section 9.3). The four criteria and their associated indicators that were used to analyse the integration of NRM in this document are shown in the Table 9.11.

Table 9.11: The criteria and indicators used to analyse the integration of NRM in the National Curriculum Statement Subject Framework for Grades 10-12 Life Sciences

Criteria	Indicator	Type of indicator
1. Learning Outcomes	a. Nature of reference to NRM in the Learning outcomes (as outlined in the document)	Qualitative, status
2. Assessment Standards	b. Nature of reference to NRM in the Assessment Standards (as outlined in the document)	Qualitative, status
3. Elaborated content of knowledge areas	c. Percentage of NRM concepts in the elaborated content of the knowledge areas	Qualitative, status
4. Time allocation	d. Percentage of teaching time allocated to NRM	Quantitative, status

The scaling grids that were used to grade the performance of the different indicators that were used to analyse the *Subject Framework for Grades 10-12 Life Sciences* document are shown in Table 9.12 below.

Table 9.12: The scaling grids used to analyse the extent of NRM integration in the Subject Framework for Grades 10-12 Life Sciences

Indicator	C+ + (very weak NRM integration)	C+ (weak NRM integration)	C- (strong NRM integration)	C- - (very strong NRM integration)
a. Nature of reference to NRM in the Learning Outcomes (as outlined in the document)	No references at all to NRM/all references specific to Life Sciences	References are general to both NRM and Life Sciences	Contains implicit reference to NRM	Contains explicit references to NRM
b. Nature of reference to NRM in the Assessment Standards (as outlined in the document)	No references at all to NRM/all references specific to Life Sciences	References are general to both NRM and Life Sciences	Contains implicit reference NRM	Contains explicit references to NRM
c. Percentage of NRM concepts in the elaborated content of the knowledge areas	All terms are specific to Life Sciences/no NRM concepts listed	% of NRM concepts < 5%	Percentage of NRM concepts is between 5-10%	Percentage of NRM terms is >10%
d. Percentage of teaching time allocated to NRM	No specific time allocated to teaching of NRM/all teaching time allocated to Life Sciences	Teaching time allocated to NRM concepts is < 10 %	Teaching time allocated to NRM concepts is between 10-20%	Teaching time allocated to NRM concepts is >20%

9.6.3 The National Curriculum Statement for Grades 10-12 Life Sciences Resource Pack

As explained in Section 9.3, the three examination exemplar papers in this resource pack were combined together and analysed as a single item. Since the structure and contents of the provincial Grade 10 Life Sciences examination exemplar papers were similar to those of the national exemplars, I used the same criteria and indicators for their analysis as the ones used for the analysis of the national exemplar papers (See Section 9.5.4).

9.7 RESULTS OF THE ANALYSIS OF THE NATIONAL PEDAGOGIC TEXTS

This section contains the results of the analysis of the extent of NRM integration in the ORF texts that were issued by the National Department of Education, and were in use at the four case study schools. The results are presented per indicator for each document that was analysed.

9.7.1 The National Curriculum Statement Grades 10-12 (General) Life Sciences

Indicator a: Nature of reference to NRM in the definition of Life Sciences

This indicator analysed the extent of NRM integration in this document by determining how explicitly NRM is referred to in the definition of Life Sciences that is provided in this document. According to this document, Life Sciences is:

... the systematic study of life in the changing natural and human-made environment. This systematic study involves critical inquiry, reflection, and the understanding of concepts and processes and their application in society (South Africa. DoE, 2003, p. 9).

In this definition, Life Sciences is seen as extending beyond the systematic study of life. Although the definition does not mention NRM specifically, it contains references to NRM related concepts such as ‘human-made environment’ (i.e. human activities) and application of life’s concepts and processes (i.e. human exploitation of nature). Hence there is a link to NRM related issues in this definition, although it is implicit rather than explicit. Using the scaling grid for this indicator (see Table 9.2), the integration of NRM in this definition was judged to be strong, which corresponds to a *classification* level of C-, indicating weak insulation between Life Sciences and NRM in the definition of Life Sciences.

Indicator b: Nature of reference to NRM in the stated purpose of Life Sciences

This indicator analysed the extent of NRM integration in this document by reviewing how explicitly NRM is referred to in the stated purposes of Grade 10 Life Sciences. According to this document there are numerous purposes to studying Life Sciences. Some of the stated purposes are based on a narrow view of Life Sciences, such as the need for learners to understand basic life processes (South Africa. DoE, 2003, p. 9). However, other listed purposes are broader. For example, one named purpose of Life Sciences is to enable learners to explore indigenous knowledge systems that are related to sciences. Other named purposes refer to Life Sciences as enabling learners to ‘apply scientific knowledge in their lives ... in ways that will contribute to ... sustainable management of resources’ and to help learners understand ... ‘conservation (and) sustainable living ...’ (South Africa. DoE, 2003, p. 9). The last two named purposes of Life Sciences contain explicit reference to the NRM (see Section 8.8.5). Based on the scaling grid for this indicator (see Table 9.2), the overall extent of integration of NRM in the stated purposes of Life Sciences was judged to be very strong and was allocated a score of C- -, indicating very weak insulation between NRM and Life Sciences in the purposes of Life Sciences, as stated in this document.

Indicator c: Nature of reference to NRM in the Learning Outcomes of Grade 10 Life Sciences

This indicator analysed the extent of NRM integration in the Grade 10 Life Sciences Learning Outcomes based on how explicitly they refer to NRM. The National Curriculum Statement for Grade 10 Life Sciences has three Learning Outcomes (see Section 6.7). Learning Outcome 1 (Scientific inquiry and problem skills) expects learning and teaching to focus on ‘... exploring and investigating environmental, biological ... systems in everyday life using inquiry, problem solving and critical thinking skills.’ For Learning Outcome 2 (Construction and application of Life Sciences knowledge), learners are expected to collect and share information and experiences from the world around them. For Learning Outcome 3 (Life Sciences, technology, environment and society), learners are expected to demonstrate an understanding of ‘... interrelationships of science, technology, indigenous knowledge, the environment and society’. None of the Learning Outcomes makes a direct and specific reference to NRM. However, there is implicit mention of NRM related concepts such as ‘indigenous knowledge’, ‘the environment and society interrelationships’, and the need for ‘investigating environmental systems in everyday life’, which form an implicit link to NRM. Based on the scaling grid for this indicator (see Table 9.2), the overall extent of integration of

NRM in the three Learning Outcomes was judged to be strong and was given a *classification* value of C-, indicating overall weak insulation between NRM and Life Sciences in the Learning Outcomes for Grade 10 Life Sciences.

Indicator d: Nature of reference to NRM in the Assessment Standards of Grade 10 Life Sciences

This indicator analysed the extent of NRM integration based on how explicitly the Assessment Standards of Grade 10 Life Sciences refer to NRM. Although the National Curriculum Statement for Grade 10 Life Sciences has nine Assessment Standards (see Section 6.7), for convenience they were all treated as one unit during the analysis. Assessment Standard 8 states that ‘The learner compares and evaluates the uses and development of resources and products and their impact on the environment and society’ (South Africa. DoE, 2003). Hence this Assessment Standard contains explicit reference to NRM concepts (see Section 8.8.5). Based on the scaling grid for this indicator (see Table 9.2), the overall extent of NRM integration in the Assessment Standards was judged to be very strong, and was allocated a *classification* value of C- -, indicating very weak overall insulation between NRM and the Assessment Standards.

Indicator e: Nature of reference to NRM in the Knowledge Areas of Life Sciences

This indicator analysed the extent of NRM integration in this document based on how explicitly NRM is referred to in the four Knowledge Areas of Grade 10 Life Sciences. The Knowledge Areas are: Tissues, Cells and Molecular Studies; Structures and Control of Processes in Basic Life Systems; Environmental Studies; and Diversity, Change and Continuity (see Section 6.7). The topics taught in Grade 10 under Environmental Studies include human influences on the environment, and the management and maintenance of natural resources. Learners are also expected to investigate a local environmental issue (South Africa. DoE, 2003). In Grade 10 Life Sciences, the Knowledge Area of Diversity, Change and Continuity, includes topics on biodiversity, its importance, threats and conservation (South Africa. DoE, 2003). All these topics are identified as being central to NRM (see Section 8.8.5) and are specifically and explicitly mentioned under the two Knowledge Areas. According to the scaling grid for this indicator (see Table 9.2), the overall extent of integration of NRM in the Grade 10 Life Sciences Knowledge Areas was judged to be very strong and was given a *classification* value of C- -, which indicates very weak overall insulation between NRM and the Knowledge Areas of Grade 10 Life Sciences.

Indicator f: Percentage of NRM concepts in the Glossary

This indicator analysed the extent of NRM integration in this document based on the percentage of NRM concepts contained in its Glossary. The Glossary of this document was found to contain a total of 30 concepts, out of which only two (7%) could be linked to NRM (biodiversity and indigenous knowledge). The rest of the concepts in the Glossary were specific to scientific research methods, for example ‘experimenting,’ ‘predicting’ and ‘reflecting.’ According to the scaling grid of this indicator (see Table 9.2), the extent of integration of NRM in the Glossary was weak, which corresponded with a *classification* level of C+, indicating strong insulation between NRM and Life Sciences in the Glossary.

Overall Results

The overall extent to which NRM is integrated into the *National Curriculum Statement for Grades 10 -12 (General) Life Sciences* is illustrated in the radar diagram below.

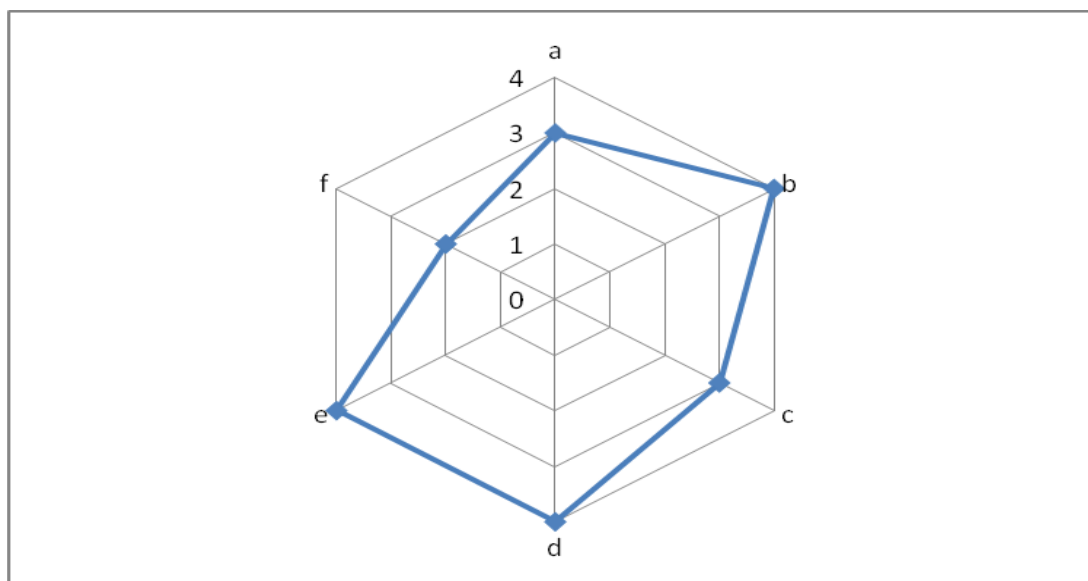


Figure 9.1: The overall extent of NRM integration in the *National Curriculum Statement Grades 10-12 (General) Life Sciences*

Key to classification levels: **0:** insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators: **a:** Nature of reference to NRM in the definition of Life Sciences; **b:** Nature of reference to NRM in the stated purpose of Life Sciences; **c:** Nature of reference to NRM in the Learning Outcomes of Grade 10 Life Sciences; **d:** Nature of reference to NRM in the Assessment Standards of Grade 10 Life Sciences; **e:** Nature of reference to NRM in the Knowledge Areas of Life Sciences; **f:** Percentage of NRM concepts in the Glossary

9.7.2 The National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines

Indicator a: Nature of reference to NRM in the definition of Life Sciences

In this document, Life Sciences is defined as:

... the systematic study of life in the natural and human-made environment. The study focuses on the understanding of basic life processes and the interrelationship and interdependence of components of the living and the physical world. Scientific inquiry, problem solving, critical thinking and the application of knowledge are essential skills ...Through the understanding of the relationship between Life Sciences, technology, environment and society, learners develop values that contribute to their development as responsible citizens. The subject Life Sciences draws from disciplines such as Botany, Zoology, Genetics and Physiology (South Africa. DoE, 2007a, p. 7)

On the surface, the definition of Life Sciences given in this document is not very different from that in the *National Curriculum Statement for Grade 10 Life Sciences* document. For example, NRM is not explicitly mentioned anywhere in this definition. The listed subjects from which Life Sciences draws (Botany, Zoology, Genetics, and Physiology) indicates a natural science focus for the subject. An implicit connection between NRM and Life Science is forged by mentioning NRM related issues such as ‘human-made environment’ and ‘environment and society’ and the ‘development of responsible citizens’ (South Africa. DoE, 2007a). According to the scaling grid of this indicator (see Table 9.4), the integration of NRM in this definition of Life Sciences was judged to be strong, which corresponds with a *classification value* of C-, indicating weak insulation between NRM and Life Sciences in this definition.

Indicator b: Nature of reference to NRM in the stated purpose of Life Sciences

This document states the purpose of Life Sciences as enabling learners to:

... develop an understanding of the nature of sciences, the influence of ethics and biases, and the interrelationships of science, technology, indigenous knowledge, environment and society. Learners explore those concepts, which are essential to basic life processes, and the interrelationship and inter-dependence of components of the living and the physical world. This understanding is directed to the improved quality of life and life support systems in the biosphere. It also allows learners to apply knowledge and skills in a way that will lead to sustainable management of resources and life support system (South Africa. DoE, 2007a, p. 7).

According to this document, there is more to studying Life Sciences than acquiring knowledge about the structure and functioning of the living and non-living world, and the relationship between them. The document first makes implicit reference to NRM by referring to concepts such as ‘environment and society’ and ‘indigenous knowledge.’ However, the document goes further and makes an explicit link between studying Life Sciences and the acquisition of knowledge and skills that are necessary for sustainable management of resources and improved quality of life (see Section 8.8.5). Based on the scaling grid for this indicator (see Table 9.4), the stated purpose of Life Sciences in this document was judged to reflect very strong NRM integration, which tallies with a *classification* level of C- -, indicating very weak overall insulation between NRM and Life Sciences in the purpose of Life Sciences, as stated in this document.

Indicator c: Percentage of NRM concepts listed in the expanded syllabus for Grade 10

The *National Curriculum Statement for Life Sciences Grades 10-12 (General)* document (South Africa. DoE, 2003), names the four Knowledge Areas that constitute the Grade 10-12 Life Sciences syllabus, and provides brief descriptions of their contents by grade. In the *National Curriculum Statement Grades 10-12 (General) Learning Programmes Guidelines Life Sciences* document (South Africa. DoE, 2007), this content is expanded further to provide teachers with more details on the types of concepts and issues that are expected to be taught under each Knowledge Area in each grade. This indicator analyses the extent of integration of NRM in this document based on the percentage of NRM concepts that are named in this document.

According to the *National Curriculum Statement Grades 10-12 (General) Learning Programmes Guidelines for Life Sciences* (South Africa. DoE, 2007a), a total of 104 different concepts are expected to be taught to the Grade 10 Life Sciences learners. Most of the listed Life Science concepts fall under the Knowledge Area of ‘Tissues, Cells, and Molecular Studies’ (30), while the least number of concepts occurred under the Knowledge Area of ‘Environmental Studies’ (19). The highest number of NRM concepts occurred in the Knowledge Areas of ‘Environmental Studies’ (18) and ‘Diversity, Change and Continuity’ (9). The total number of NRM concepts listed for the entire Grade 10 expanded syllabus was 34 (33%). Examples of NRM concepts named in the document include ‘exploitation,’ ‘sustainability,’ ‘threats to biodiversity’ and ‘land issues.’ Based on the scaling grid for this indicator (see Table 9.4), the extent of NRM integration in the expanded syllabus (as

presented in this document) was judged to be very high, and was given a classification level of C- -, indicating very weak insulation between NRM and Life Sciences in the Grade 10 Life Sciences Learning programme guidelines.

Indicator d: Nature of reference to NRM in the description of the relationship between Life Sciences and the National Curriculum Statement principles

There are nine principles which underpin the National Curriculum Statement for Grades 10-12 (General) Life Sciences (see Section 6.6). They are: social transformation; outcomes-based education; high knowledge and high skills; integration and applied competence; progression; articulation and portability; human rights, inclusivity, environmental and social justice; valuing indigenous knowledge systems; and credibility, quality and efficiency (South Africa. DoE, 2003). The *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines* document (South Africa. DoE, 2007a) describes how Grade 10-12 Life Sciences can be used to promote these curriculum principles. This indicator analyses the extent of NRM integration based on how explicit references to NRM are in the descriptions of the relationship between Life Sciences and the National Curriculum Statement principles that are provided in this document.

Two of the descriptions contained implicit reference to NRM. These were the descriptions involving the principles of ‘Human rights, inclusivity, and environmental and social justice’, and that of ‘Valuing indigenous knowledge systems’. Under the description of the principle of ‘Human rights, inclusivity, and environmental and social justice’ and the study of Life Sciences, mention was made of NRM linked issues such as ‘development of responsible and sensitive citizens’, ‘scientifically literate citizens’, and ‘informed decision-making’ (South Africa. DoE; 2007a, p. 9). Based on the scaling grid for this indicator (see Table 9.4), the overall extent of integration of NRM in the descriptions was judged to be strong, which corresponded with a *classification* level of C-, indicating weak insulation between NRM and the National Curriculum Statement principles in this document.

Indicator e: Relevance of the Life Sciences planning and pedagogical framework to the integration of NRM in Life Sciences

According to the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines* document, a learning programme is a planning tool which helps teachers to ensure that the teaching, learning and assessment of Grade 10-12 Life Sciences proceeds in a sequenced and progressive manner across the FET band (South

Africa. DoE, 2007a). One of the aims of this document is to provide guidance to teachers on how this planning process can be conducted. In addition to suggesting three major stages for this process (development of a subject framework; development of a work schedule for each grade; and the development of Life Science lesson plans by each teacher), this document also identifies and describes nine key issues that need to be addressed when designing Grade 10-12 Life Sciences learning programmes. They are: Policies and Principles; Content; Integration; Conceptual Progression; Time Allocation and Weighting; Learning and Teaching Materials; Assessment; Inclusivity and Diversity; and Learning and Teaching Methodology (South Africa. DoE, 2007a, pp. 13-19). This indicator assesses the extent of integration of NRM in this process by determining which of the listed issues above are relevant to the teaching, learning and assessment of NRM.

All the nine issues listed in the document as being important in the designing of Life Science programmes are also relevant to the teaching, learning and assessment of NRM. For example, a teacher wishing to teach NRM needs to consider which concepts of NRM (content) should be the focus of the Life Sciences lesson. The teacher also needs to take into account which concepts of NRM are appropriate for a particular grade (conceptual progression), and which NRM learning resources to use (learning and teaching materials), and so on. The Life Sciences planning and pedagogical framework was found to be supportive of NRM integration. Based on the scaling grid for this indicator (see Table 9.4), the integration between the framework and NRM was judged to be very strong, which implies a *classification* value of C- - , indicating very weak insulation between the Life Science's planning and pedagogical framework and NRM.

Overall Results

The radar diagram that follows illustrates the overall extent of integration of NRM in the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programmes Guidelines* document.

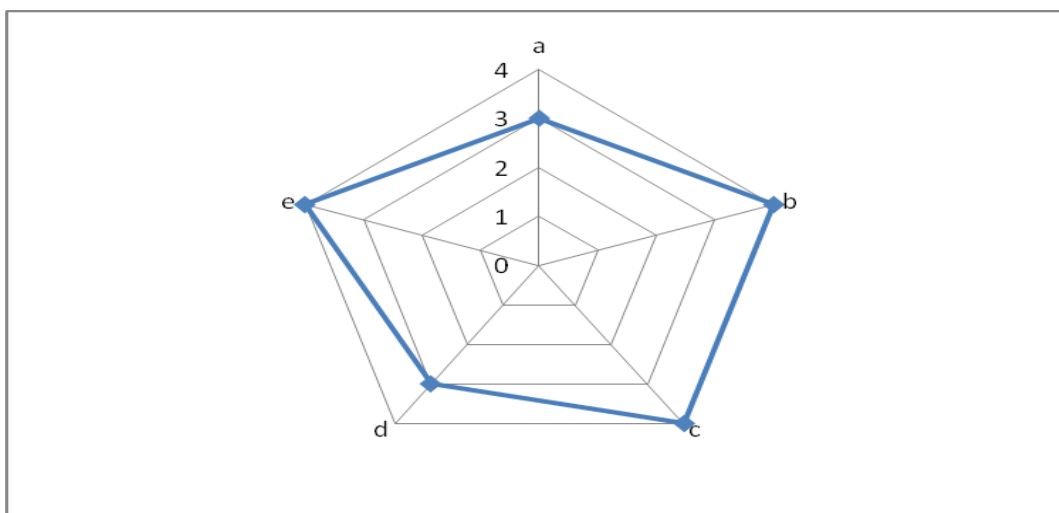


Figure 9.2 The overall extent of NRM integration in the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programme Guidelines*.

Key to classification levels: **0:** insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators

a: Nature of reference to NRM in the definition of Life Sciences **b:** Nature of reference to NRM in the stated purpose of Life Sciences; **c:** Percentage of NRM concepts listed in the expanded syllabus for Grade 10; **d:** Nature of reference to NRM in the description of the relationship between Life Sciences and the National curriculum Statement principles; **e:** Relevance of the Life Sciences planning and pedagogical framework to the integration of NRM in Life Sciences

9.7.3 The National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences

Indicator a: Nature of reference to NRM in the stated purpose of assessment

This indicator analyses the extent of NRM integration in this document based on how explicit references to NRM are in the purpose of assessment in Life Sciences, as stated in this document. This document describes the purpose of assessment in Grades 10-12 Life Sciences as:

... to determine the competences of learners in scientific inquiry, problem solving, critical thinking and application knowledge relevant to Life Sciences (South Africa. DoE, 2007b, p. 7)

The description contains references which are general to both Life Sciences and NRM, for example ‘scientific inquiry,’ ‘problem solving,’ and ‘critical thinking’ (see Section 8.8.5). There are no explicit or implicit references to NRM. Based on the scaling grid of this indicator (see Table 9.6), the integration of NRM in the stated purpose of assessment in Grades 10-12 Life Sciences was judged to be weak, and was allocated a *classification* level of

C+, indicating strong insulation between NRM and Life Sciences in the stated purpose of assessment for Grades 10-12 Life Sciences.

Indicator b: Percentage of marks allocated to Learning Outcome 3

According to this document, the three Life Sciences Learning Outcomes are weighted differently with regards to the allocation of marks. Of the three Learning Outcomes, Learning outcome 3 (Life Sciences, Technology, Environment and Society) bears the most relevance to the teaching and learning of NRM. This indicator analyses the integration of NRM by comparing the weighting allocated to Learning Outcome 3 to that of the other Learning Outcomes when allocating marks for tests and examinations. This document stipulates that Learning Outcome 3 should be allocated 20% of the marks in Grade 10 Life Sciences tests and examinations. According to the scaling grid of this indicator (see Table 9.6), allocation of 20% of the marks to Learning Outcome 3 corresponds with strong NRM integration, or a *classification* level of C-, indicating weak insulation between NRM and Life Sciences in the allocation of marks for Learning Outcome 3.

Indicator c: Percentage of marks allocated to Environmental Studies

The different knowledge areas of Grade 10 Life Sciences are also weighted differently with regard to the awarding of marks for Grade 10 Life Science tests and examinations. In Grade 10 Life Sciences, most of the NRM concepts are listed under the Knowledge Area of Environmental Studies. This indicator analyses the extent of NRM integration by comparing the weighting of marks that is accorded to the Knowledge Area of Environmental Studies to the rest of the other Knowledge Areas. According to this document, in Paper I, 60% and 40% of the marks go to the Knowledge Areas of ‘Structure, Control and Processes in Basic Life Systems’ and ‘Tissues, Cells and Molecular Studies’, respectively. In Paper 2 the ‘Environmental Studies’ Knowledge Area and that of ‘Diversity, Change and Continuity,’ each accounts for 50% of the total marks for this paper. Using the scaling grid of this indicator (see Table 9.6), the integration of NRM in the allocation of marks for Life Sciences examinations is judged to be very strong, which corresponds with a *classification* level of C- -, indicating very weak insulation between NRM and Life Sciences in the allocation of marks to the ‘Environmental Studies’ Knowledge Area.

Indicator d: Nature of topics in the practical assessment task examples

The *National Curriculum Statement 10-12 (General) Life Sciences Subject Assessment Guidelines* document contains a total of five assessment tasks which are presented as examples to guide teachers on what can be set for practical assessment for Grades 10-12 Life Sciences. This indicator analyses the integration of NRM in this document based on the number of suggested assessment tasks which are based on NRM. The topics of the assessment examples in the document are: the heart; fungal growth; osmosis; effects of smoking; and surveying smoking. None of the assessment tasks were based on NRM explicitly or implicitly. Nor did the assessment tasks include content which is general to both NRM and Life Sciences. Based on the scaling grid for this indicator (see Table 9.6), the integration of NRM in the practical assessment tasks suggested in this document was very weak, which tallies with a *classification* level of C+ +, indicating very strong insulation between NRM and Life Sciences in the practical assessment tasks that are suggested in this document.

Indicator e: Percentage of phrases with explicit reference to NRM

This indicator analyses the integration of NRM in this document based on the percentage of phrases containing explicit reference to NRM. A phrase was interpreted as a full sentence, or a group of words with an independent meaning, for example, ‘summary of scientific method’, ‘dissection of a sheep’s heart’ and ‘weighting grid for Paper 1’. A total of 534 phrases were counted in this document, none of which contained explicit reference to NRM. There were four phrases of ‘Environmental Studies’ in the document. These were treated as containing implicit reference to NRM. The majority of the phrases had contents which were general to both Life Sciences and NRM. Examples of these included ‘make accurate observations’, ‘designing lesson plans’ and ‘develop learners’ knowledge, skills and values’. Based on the scaling grid for this indicator (see Table 9.6), the integration of NRM in this document was judged to be very weak, which tallies with a *classification* level of C+ +, indicating strong insulation between NRM and the contents of this document.

Overall Results

The overall results of the analysis of the *National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences* document are shown in the radar diagram below.

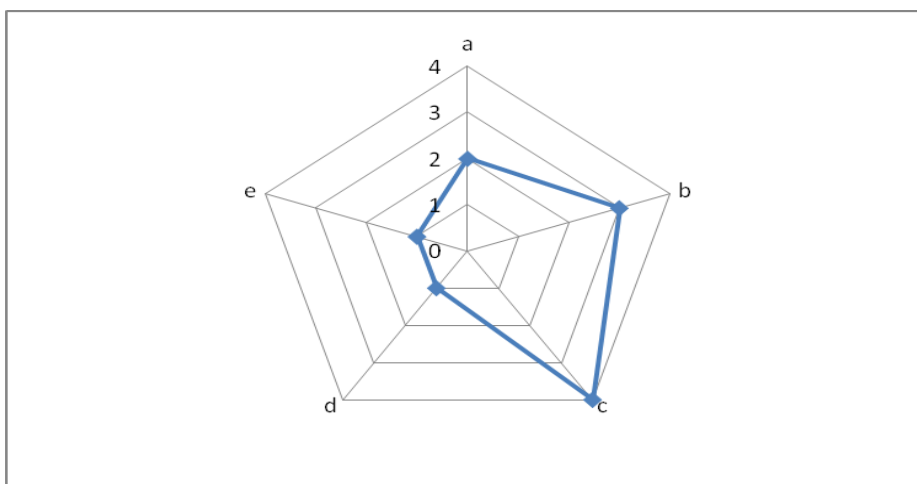


Figure 9.3: The overall extent of NRM integration in the *National Curriculum Statement Subject Assessment Guidelines for Grades 10-12 (General) Life Sciences*.

Key to classification levels: 0: insufficient data for analysis; 1: C ++ (very weak NRM integration); 2: C+ (weak NRM integration); 3: C- (strong NRM integration); 4: C- - (very strong NRM integration)

Key to indicators

a: Nature of reference to NRM in stated purpose of assessment; **b:** Percentage of marks allocated to Learning Outcome 3; **c:** Percentage of marks allocated to environmental studies; **d:** Nature of topics in the practical assessment task examples; **e:** Percentage of phrases with explicit reference to NRM

9.7.4 The National Curriculum Statement Grade 10 Life Sciences Exemplar Examination Papers (Paper 1 and 2)

Indicator a: Percentage of questions based on NRM

This indicator was used to analyse the extent of integration of NRM based on the percentage of questions in the examination exemplars which were based on NRM. The two examination exemplars had a total of 123 questions, of which 19 were based on NRM (15%). For example, Questions 3.1 and 3.2 of Paper 2 were based on ‘biodiversity’, and ‘conservation and environmental protection’, respectively, which are concepts identified as being central to NRM (see Section 8.8.5). Using the scaling grid of this indicator (see Table 9.8), the overall extent of NRM integration in the questions that are contained in the examination exemplars was judged to be very strong, which is a *classification* level of C- -, indicating very weak overall insulation between NRM and Life Sciences in the questions of the examination exemplar papers.

Indicator b: Percentage of marks allocated to questions based on NRM

This indicator was used to analyse the extent of NRM integration based on the percentage of marks allocated to questions in the examination exemplar papers which were based on NRM.

The total marks for the two examination papers were 300, of which 56 marks (19%) were allocated to questions that were based on NRM. Examples of such questions were:

- How can the Blue Crane be saved from extinction? (3 marks),
- List three ways in which the Blue Crane habitat is being lost or reduced (3 marks), and,
- How should people use plants ... wisely? (2 marks) (South Africa. DoE, 2006).

Based on the scaling grid for this indicator (see Table 9.8), the integration of NRM in the way the marks were allocated in the examination papers was judged to be strong, which corresponds with a *classification* value of C-, indicating weak insulation between NRM and Life Sciences in the allocation of marks in the exemplars.

Indicator c: Percentage of illustrations based on NRM

The items which were considered under illustrations included diagrams, maps, photographs, flow charts, tables and graphs. This indicator was used to analyse the extent of NRM integration based on the percentage of illustrations in the examination exemplars which were based on NRM concepts. Between them, the two exemplar papers had a total of thirteen illustrations, of which two (15%) were based on NRM. These two illustrations were based on ‘biodiversity conservation’ and ‘soil conservation.’ According to the scaling grid of this indicator (see Table 9.8), the integration of NRM in the illustrations used in the exemplar papers was judged to be strong and was allocated a *classification* value of C-, indicating weak insulation between NRM and Life Sciences in the illustrations used in the exemplars.

Indicator d: Percentage of investigations based on NRM

This indicator was used to analyse the extent of NRM integration based on the percentage of investigations in the two exemplar papers which are based on NRM. Between them the two exemplars contained a total of six investigations, one of which (13%) was based on NRM (soil pollution). Based on the scaling grid of this indicator (see Table 9.8), the integration of NRM in the investigations set in the exemplars was judged to be weak, and given a *classification* value of C+, indicating strong insulation between NRM and Life Sciences in the illustrations.

Indicator e: Nature of reference to NRM in the essay question

In both examination papers Section C contains a compulsory essay question (see Section 9.2.4). This indicator was used to analyse the extent of NRM integration in the exemplars based on nature of reference to NRM in the essay question. The essay topic in Paper 1 was on ‘Obesity’ which has no direct link to NRM. The easy question in Paper 2 was on ‘Negative environmental impacts’ which contains explicit reference to NRM (see Section 8.8.5). Based on the scaling grid for this indicator (see Table 9.8), the overall integration of NRM in the essay questions in the exemplars was judged to be very strong, and was allocated a *classification* value of C- -, indicating very weak overall insulation between NRM and Life Sciences in the essay questions.

Overall results

The results of the analysis of the exemplar papers are illustrated in the radar diagram below.

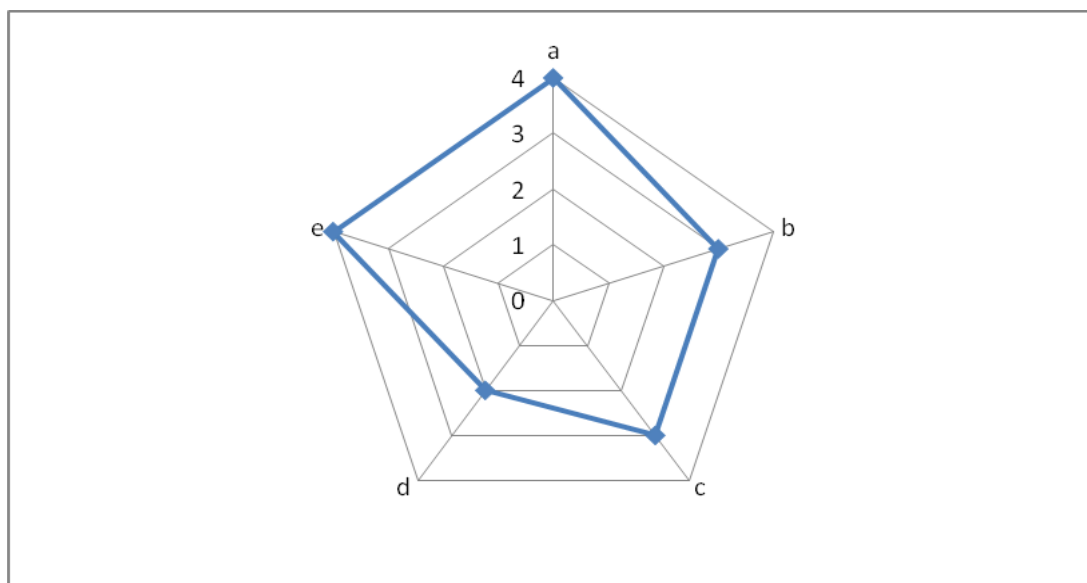


Figure 9.4: The overall extent of NRM integration in the *National Curriculum Statement Grade 10 Life Sciences Exemplar Examination Papers*

Key to classification levels: 0: insufficient data for analysis; 1: C ++ (very weak NRM integration); 2: C+ (weak NRM integration); 3: C- (strong NRM integration); 4: C- - (very strong NRM integration)

Key to indicators

a: Percentage of questions based on NRM; **b:** Percentage of marks allocated to questions based on NRM **c:** Percentage of illustrations based on NRM; **d:** Percentage of investigations based on NRM; **e:** Nature of reference to NRM in the essay question

9.8 RESULT OF THE ANALYSIS OF THE PROVINCIAL PEDAGOGIC TEXTS

This section contains the results of the analysis of the extent of NRM integration in the ORF texts that were issued by the Eastern Cape Department of Education, and were in use at the four case study schools. The results are presented per indicator for each of the three documents that were analysed.

9.8.1 The Assessment Syllabus for Life Sciences Grades 10-12

Indicator: Nature of reference to NRM in the elaborated Assessment Standards

This indicator analysed the extent of NRM integration in the elaborated Assessment Standards based on how explicitly they refer to NRM. Only Assessment Standard 8 (Comparing and evaluating the uses and development of resources and products and their impact on society) made explicit references to NRM. Examples of explicit references made to NRM in this Assessment Standard included:

- Comparing and evaluating the uses of resources,
- Comparing and evaluating the development of resources, and
- Evaluating the impact of resources and products on the environment (Eastern Cape Department of Education, 2006a) (see Section 8.8 5).

According to the rubric used to grade the performance of the elaborated Assessment Standards with regard to the integration of NRM (see Table 9.10), Assessment Standard 8 shows very strong NRM integration, or *classification* level C- -, indicating very weak isolation between NRM and Life Sciences in this particular Assessment Standard.

The elaborated contents of Assessment Standard 7 (Exploring and evaluating scientific ideas of past and present cultures) referred to ‘indigenous knowledge’ although no attempt was made to link it to NRM. This was judged to be an implicit reference to NRM (see Section 8.8.5). Based on the rubric used to assess the extent of NRM integration in the elaborated contents of the Assessment standards (see Table 9.10), the extent of NRM integration in the contents of Assessment Standard 7 was judged to show strong NRM integration, and was graded at C- *classification* level, indicating weak isolation between NRM and Life Sciences for Assessment Standard 7. The contents of the seven remaining Assessment Standards were general to both Life Sciences and NRM, and were judged to show weak NRM integration, or *classification* level C+, indicating strong isolation between NRM and Life Sciences in these

Assessment Standards. Examples of reference which were general to both NRM and Life Sciences in these Assessment Standards included:

- Formulate a hypothesis,
- Make measurement and observations, and
- Analyse data and information (Eastern Cape Department of Education, 2006a) (see Section 8.8.5).

Overall Results

The results of the analysis of the extent of NRM integration in the *Assessment Syllabus for Life Sciences Grades 10-12* document are illustrated in the radar diagram below.

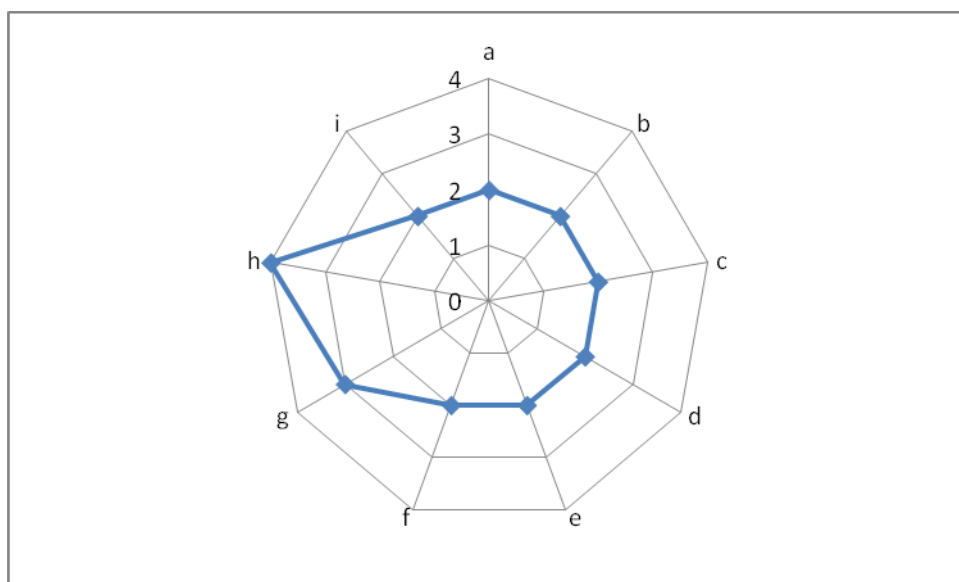


Figure 9.5: The overall extent of NRM integration in the *Assessment Syllabus for Life Sciences Grades 10-12* document

Key to classification levels: **0:** insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to assessment standards

a: Identifies and questions phenomena and plans investigations; **b:** Conducts investigations by collecting and manipulating data; **c:** Analyses, synthesises, evaluates data and communicates findings; **d:** Assessing knowledge; **e:** Interpreting and making meaning of knowledge in Life Sciences; **f:** Showing understanding of Life Science knowledge in everyday life; **g:** Exploring and evaluating scientific ideas of past and present cultures; **h:** Comparing the uses and development of resources and their impacts; **i:** Comparing the influence of different beliefs, attitudes and values on scientific knowledge

9.8.2 The National Curriculum Statement Subject Framework for Grades 10-12 Life Sciences

Indicator a: Nature of reference to NRM in the Learning Outcomes (as outlined in the document)

Only the headings of the three Grade 10 Life Sciences Learning Outcomes are presented in this document, and no further details are provided. For example, the contents under Learning Outcome 1 are limited to 'Scientific inquiry and problem-solving skills'. All that is written under Learning Outcome 2 is 'Constructs and applies Life Sciences knowledge'. There are no explicit or implicit references to NRM in the contents of these two Learning Outcomes as they are presented in this document (see Section 8.8.5). Based on the scaling grid of this indicator (see Table 9.12), the extent of NRM integration in the two Learning Outcomes is very weak, which corresponds to a *classification* level of C+ +. However, Learning Outcome 3 refers to 'Life Sciences, technology, environment and society'. References to 'environment' and 'society' can be treated as implicit reference to NRM (see Section 8.8.5). The integration of NRM in Learning Outcome 3 was judged to be strong (*classification* level C-) according to the scaling grid of this indicator (see Table 9.12). The overall integration of NRM for the contents of the three Learning Outcomes combined, as they are presented in this document, was judged to be strong, which corresponds with a *classification* level of C-, indicating weak overall insulation between NRM and the contents of the three Learning Outcomes (as they are presented in this document).

Indicator b: Nature of reference to NRM in the Assessment Standards (as outlined in the document)

This indicator assessed the integration of NRM in the Assessment Standards as they are interpreted in this document, based on how explicitly they refer to NRM. However, this document does not treat the nine Assessment Standards of Grade 10 Life Sciences individually. Nor does the document provide any details on any of the Assessment Standards, such as names and contents. The only reference made to the Assessment Standards is under each Learning Outcome, where 'All AS's covered. All grades' is written. Hence the form in which the Assessment Standards are presented in this document makes it impossible to analyse the extent to which they integrate NRM. As a result the extent of NRM integration in the Assessment Standards as interpreted by this document could not be analysed, and was allocated a *classification* value of O (see Sections 9.6.1 and 12.6).

Indicator c: Percentage of NRM concepts in the elaborated content of the knowledge areas

As was explained in Section 9.3.3, this document provides further elaboration on the contents of the four Knowledge Areas which constitute the National Curriculum Statement for Grade 10 Life Sciences. This indicator analyses the extent of NRM integration in this document based on the percentage of NRM concepts that are listed under the elaborated content of the four Knowledge Areas. Both types of concepts which were explicitly or implicitly linked to NRM were counted. A total of 69 concepts were listed under the four Knowledge Areas, the highest number occurring in the Knowledge Area of ‘Structure and Control of Processes in Basic Life Systems’ (21). The highest number of NRM concepts (both explicitly and implicitly linked to NRM) occurred in the Knowledge Areas ‘Environmental Studies’ (11), and ‘Diversity, Change and Continuity’ (09). Examples of listed concepts which were judged to be explicitly or implicitly linked to NRM included:

- Traditional medicines and traditional healers,
- Resource management,
- Exploitation,
- Sustainability, and
- Endangered species (see Section 8.8.5).

The number of NRM concepts listed in this document was 30, which formed 43% of the total number of concepts that were listed under the four Knowledge Areas in this document. Based on the scaling grid for this indicator (see Table 9.12), the extent of NRM integration in the elaborated content was judged to be very strong, and was allocated a *classification* level of C- -, which indicates very weak isolation between NRM and Life Sciences in the elaborated content of the four Knowledge Areas.

Indicator d: Percentage of teaching time allocated to NRM

The subject framework also draws up a time schedule for the teaching of the various Knowledge Areas of Grade 10 Life Sciences. This indicator analyses the extent of NRM integration based on the percentage of teaching time that was allocated to the Grade 10 Life Sciences Knowledge Areas which contain the highest number of NRM concepts. Of the 28 weeks devoted to the teaching of Grade 10 Life Sciences, the highest number of weeks was allocated to the Knowledge Areas of ‘Structure and Control of Processes in Basic Life

Systems’ (10 weeks) and ‘Tissues, Cells and Molecular Study’ (8 weeks). The two Knowledge Areas with the highest number of NRM concepts (Environmental Studies; and Diversity, Change and Continuity) were allocated a total of 10 weeks, which accounts for 36% of the total teaching time for Grade 10 Life Sciences. According to the scaling grid of this indicator (see Table 9.12), the allocation of teaching time was judged to show very strong NRM integration, and was allocated a *classification* level of C- -, indicating very weak insulation between NRM and Life Sciences in the allocation of teaching time to the different Knowledge Areas of the Grade 10 Life Sciences curriculum.

Overall Results

The results of the analysis of extent of NRM integration in the *Subject Framework for Grade 10 Life Sciences* document are illustrated in the radar diagram below.

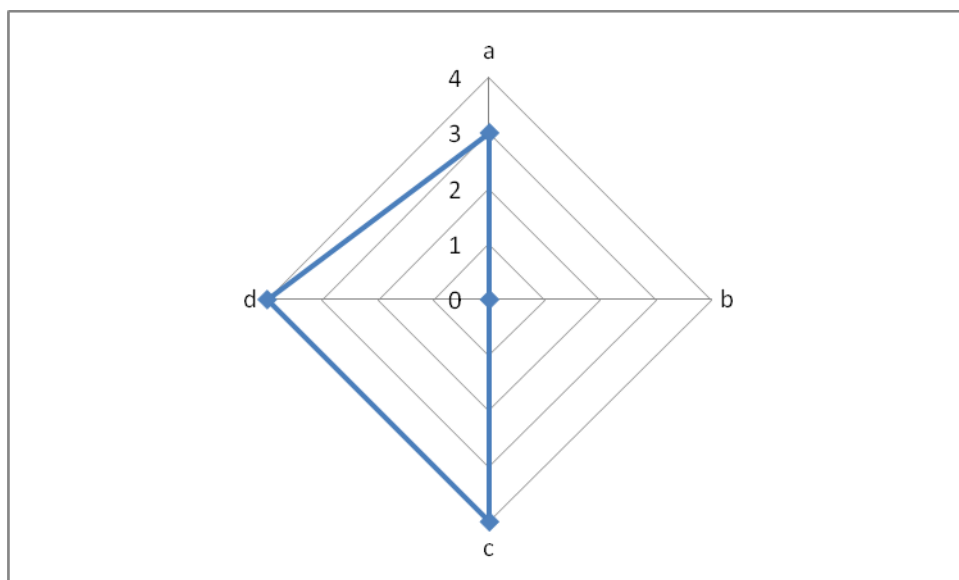


Figure 9.6: The overall extent of NRM integration in the *Subject Framework for Grade 10 Life Sciences* document

Key to classification levels: 0: insufficient data for analysis; 1: C ++ (very weak NRM integration); 2: C+ (weak NRM integration); 3: C- (strong NRM integration); 4: C- - (very strong NRM integration)

Key to indicators

a: Nature of reference to NRM in the Learning Outcomes (as outlined in the document); **b:** Nature of reference to NRM in the Assessment Standards (as outlined in the document); **c:** Percentage of NRM concepts in the elaborated content of the knowledge areas; **d:** Percentage of teaching time allocated to NRM

9.8.3 The National Curriculum Statement Grades 10-12 Life Sciences Resource Pack

Indicator a: Percentage of questions based on NRM

Part of the *National Curriculum Statement Grades 10-12 Life Sciences Resource Pack* contains three Grade 10 Life Sciences examination exemplar papers which were issued by the Eastern Cape Department of Education (see Section 9.3.4). This indicator analysed the extent of NRM integration in the Resource Pack based on the percentage of questions which refer explicitly or implicitly to NRM in the examination exemplars. The total number of questions in the exemplar papers was 210, of which 26 (12%) were based on NRM. Example of NRM concepts on which questions in the examination papers were based included:

- Genetically-modified crops (implicit reference to NRM),
- Effects of global warming, (implicit reference to NRM), and
- Over fishing (explicit reference to NRM (see Section 8.8.5).

Using the scaling grid for this indicator (see Table 9.8), the overall extent of NRM integration in the examination exemplars was judged to be very strong, which corresponded with a *classification* level of C- -, indicating weak insulation between NRM and Life Sciences in the examination questions contained in the Resource Pack.

Indicator b: Percentage of marks allocated to questions based on NRM

This indicator analyses the integration of NRM in the examination exemplar papers based on the percentage of marks which were allocated to NRM-based questions. The exemplar for Paper 1 contained no NRM-based questions. In the first exemplar of Paper 2, 17% of the total marks were allocated to NRM-based questions, while the corresponding figure for the second exemplar was 51%. Examples of NRM-based questions were:

- What percentage of plants in KwaZulu-Natal is endangered?
- How is the human race responsible for global warming?
- Explain what an endangered species is.
- What approach to development would be best for our country?

The overall percentage of marks allocated to NRM-based questions in the Resource Pack was 24% for the three exemplar papers. Using the scaling grid for this indicator (see Table 9.8),

the integration of NRM in the allocation of marks was judged to show very strong NRM integration, and was allocated a *classification* level of C- -, indicating very weak insulation between NRM and Life Sciences in the allocation of marks.

Indicator c: Percentage of illustrations based on NRM

This indicator analysed the extent of NRM integration in the examination exemplar papers based on the percentage of illustrations which were based on NRM. Between them, the three exemplars contained a total of 31 illustrations, of which only two (6 %) were based on NRM. The two illustrations were based on ‘Soil’ and ‘Environmental Hotspots.’ Using the scaling grid for this indicator (see Table 9.8), the overall extent of NRM integration in the illustrations contained in the exemplar papers was judged to be weak, and graded at *classification* level C+, indicating strong insulation between NRM and Life Sciences in the illustration used in the examination exemplars.

Indicator d: Percentage of investigations based on NRM

This indicator analysed the extent of NRM integration in the examination exemplars based on the percentage of NRM-based investigations. The total number of investigations contained in the three examination exemplars was eight, none of which was based on NRM concepts. Examples of concepts on which questions in the exemplars were based included ‘seed germination’, ‘bacterial growth’ and ‘respiration.’ Using the scaling grid for this indicator (see Table 9.8), the extent of NRM integration in the investigations that were set in the exemplar papers was judged to be very weak, and was allocated a *classification* level of C+ +, indicating very strong isolation between NRM and Life Sciences.

Indicator e: Nature of reference to NRM in the essay question

This indicator analysed the extent of NRM integration based on how explicitly the compulsory essay question in Section C of the examination exemplars referred to NRM. In the exemplar of Paper 1, the essay topics were ‘Smoking’ and ‘Bio-technology’, while those in the first exemplar of Paper 2 were ‘Abortion’ and ‘Genetically-modified food’. There was no essay question in the second exemplar of Paper 2. Both ‘Smoking’ and ‘Abortion’ bear only a very remote relationship with NRM. However, ‘Genetically-modified food’ and ‘Bio-technology’ are implicitly linked to NRM (see Section 8.8.5). Using the scaling grid for this indicator (see Table 9.8), the overall extent of NRM integration in the essay questions of the three exemplar papers was judged to be strong, and was allocated a *classification* level of C-,

indicating overall weak insulation between NRM and Life Sciences in the essay questions that were set in the examination exemplar papers.

Overall Results

The overall extent of NRM integration in the *National Curriculum Statement Grades 10-12 Life Sciences Resource Pack* document is illustrated in the radar diagram that follows.

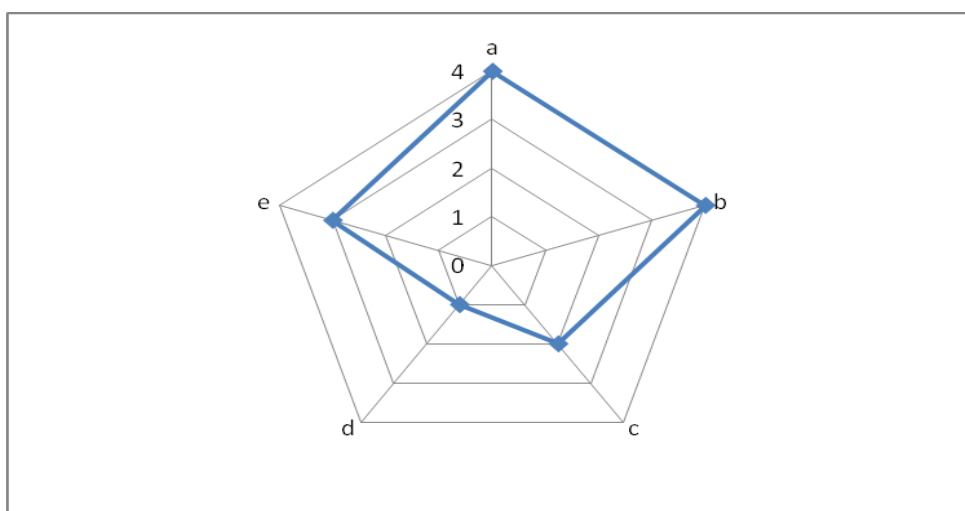


Figure 9.7: The overall extent of NRM integration in the *Grade 10 Life Sciences Resources Pack*

Key to classification levels: **0:** insufficient data for analysis; **1:** C++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators

a: Percentage of questions based on NRM; **b:** Percentage of marks allocated to questions based on NRM; **c:** Percentage of illustrations based on NRM; **d:** Percentage of investigations based on NRM; **e:** Nature of reference to NRM in the essay question

9.9 CONCLUSIONS

The aim of this chapter was to describe the analysis of the extent of NRM integration in the ORF. The chapter introduced and described the four national and the three provincial Grade 10 Life Sciences documents which were analysed as part of the official Grade 10 Life Sciences discourse. It also described the structure and the role of the two major research tools used during the analysis, namely the indicators and their associated scaling grids. The chapter gave a detailed account of the procedure which was followed during the analysis. This consisted of five basic steps of: criteria identification; indicator selection; collection data on indicator performance; grading of indicator performance according to *classification* levels;

and illustration of overall extent of NRM integration in each item. The chapter also provided the results of the analysis of each document per indicator, and illustrated the overall extent of NRM integration in each document in the form of a radar diagram. The results of the analysis will be discussed in Chapter 12.

The next chapter details the analysis of the extent of NRM integration in the PRF.

CHAPTER 10

THE ANALYSIS OF THE EXTENT OF NRM INTEGRATION IN THE PEDAGOGIC RECONTEXTUALISING FIELD (PRF).

10.1 INTRODUCTION

According to Bernstein (1990, 1996), the second field of pedagogic discourse, the recontextualisation field, consists of two major subfields: the ORF and the PRF (see Section 7.7.2). In Chapter 9, the extent of NRM integration in the ORF was described. The aim of this chapter is to describe the analysis of the extent of NRM integration in the PRF, in a rural under-resourced education context. Bernstein (1990, 1996) notes that agents and agencies located in the PRF may adapt the Official Pedagogic Discourse to suit their own interests, ideology and context, depending on how much autonomy exists between them and the ORF (see Section 7.7.2). Hence a comparison of the extent of NRM integration in the ORF and PRF stands to provide not only insight into the recontextualising process concerning NRM discourse within the Grade 10 Life Sciences curriculum in a rural under-resourced education context, but also serves to illuminate the nature of the relationship between the ORF and the PRF in this education context.

This chapter describes the items that were analysed as part of PRF discourse. It provides an outline of the procedure that was followed and the research tools which were used in the analysis process. The chapter also presents the results of the analysis.

10.2 THE ANALYSIS OF THE GRADE 10 LIFE SCIENCES TEXTBOOKS

10.2.1 Introduction

Between them, the four Life Sciences teachers involved in this study were using two types of Grade 10 Life Sciences textbooks, referred to here as Textbook A and B. It is these two textbooks that formed the object of analysis for this part of the research project. Both textbooks were issued in 2005 by two different textbook publishers, both major players in South Africa's textbook publishing industry. Each textbook is part of a series of Life Science textbooks which cater for learners in the entire FET band. Textbook A is 302 pages, and in addition Life Science knowledge content has an introduction, a glossary and an index. Textbook B consists of 211 pages, but lacks a glossary and an index.

10.2.2 The analysis procedure

The analysis of the textbooks followed the procedure outlined in Section 8.8, which was also used in the analysis of the ORF texts (see Section 9.4). As explained before, the procedure consisted of five basic steps (see Section 8.8.1). The first step of the procedure involved identification of the criteria for analysing the textbooks. This step was necessary to help focus the analysis on key aspects of the textbooks (see Section 8.8.2). Since the textbooks were structured differently from the ORF texts, the criteria for analysing the textbooks had to be different. Identification of the criteria was preceded by careful examination of the textbooks to ascertain their structure, format and contents. I found that although the two textbooks had a number of similarities. For example, they both had striking book covers, illustrations and revision questions. There were also major differences between the textbooks. For example, Textbook A had an index and glossary, which were absent in Textbook B. I developed a set of six common criteria for the analysis of both textbooks, in addition to two other criteria (index and glossary) which were unique to Textbook A (see Table 10.1). The next step involved selection of indicators to describe the extent of NRM integration in each criterion. As explained in Section 8.8.3, the selected indicators had to be easy to understand and also had to be based on data that were easily available in the textbooks. The eight criteria and their corresponding indicators that were used to analyse the extent of NRM integration in the textbooks are shown in Table 10.1 below.

Table 10.1: The criteria and indicators used to analyse the extent of NRM integration in Textbook A and B

Criteria	Indicator	Type of indicator
1. Book cover	a. Nature of reference to NRM on the book cover	Qualitative, status
2. Illustrations	b. Percentage of illustrations based on NRM	Quantitative, status
3. Activities	c. Percentage of activities based on NRM	Quantitative, status
4. Revision questions	d. Percentage of revision questions based on NRM	Quantitative, status
5. Case studies	e. Percentage of case studies based on NRM	Quantitative, status
6. Investigations, projects and experiments	f. Percentage of investigations, projects and experiments based on NRM	Quantitative, status
7. Glossary	g. Percentage of NRM concepts in the glossary	Quantitative, status
8. Index	h. Percentage of NRM concepts in the index	Quantitative, status

The extent of NRM integration in a given criterion was described quantitatively or qualitatively depending on the nature of the indicator. As explained before, the performance of each indicator in relation to the integration of NRM was graded with the aid of a scaling grid, which was based on Bernstein's *classification* scale of C+ +, C +, C-, and C- -, which indicate increasing levels of NRM integration (see Section 8.8.4). The scaling grids used to grade the performance of the indicators with regard to the integration of NRM during the analysis of Textbook A and B are shown in Table 10.2 below.

Table 10.2: The scaling grids used to grade the performance of the indicators with regard to the integration of NRM during the analysis of Textbook A and B

Indicator	C + + (very weak NRM integration)	C + (weak very NRM integration)	C – (strong NRM integration)	C - - (very very strong NRM integration)
1. Nature of reference to NRM on the book cover	Refers only to Life Sciences/ no reference at all to NRM	Reference general to both Life Sciences and NRM	Contains implicit reference to NRM	Contains explicit reference to NRM
2. Percentage of illustrations based on NRM	No NRM-based illustrations (0%)	<10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM
3. Percentage of activities based on NRM	No NRM-based activities (0%)	< 10% are based on NRM	Between 10 - 20% are based on NRM	> 20% are based on NRM
4. Percentage of revision questions based on NRM	No NRM-based revision questions (0%)	< 10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM
5. Percentage of case studies based on NRM	No NRM-based case studies (0%)	< 10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM
6. Percentage of practical assessment tasks based on NRM	No NRM-based investigations, projects or experiments (0%)	< 10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM
7. Percentage of NRM concepts in the glossary	No NRM concepts (0%)	< 10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM
8. Percentage of NRM concepts in the index	No NRM concepts (0%)	< 10% are based on NRM	Between 10-20% are based on NRM	> 20% are based on NRM

10.3 THE ANALYSIS OF THE EXTENT OF NRM INTEGRATION IN THE IN-SERVICE TEACHER TRAINING WORKSHOPS

10.3.1 Introduction

In this section I report on how I analysed the extent of NRM integration in the in-service training workshops that were conducted for the Grade 10 Life Sciences teachers by agents of the PRF. I describe the analytical tools used, the procedure followed, and the methods used to obtain data on the extent of NRM integration in the in-service workshops.

10.3.2 The analysis procedure

The analysis procedure consisted of two phases. The first phase involved the collection of data on the in-service training workshops that were conducted for the Grade 10 Life Sciences teachers in the Peddie Circuit, of the King William's District Education Office, under which the four case study schools fall (see Section 6.5.3). The second phase of the analysis followed the procedure described in Section 8.8. This approach to the analysis allowed the criteria which structured the analysis of the in-service training programmes to emerge from field data and reduced the risk of overlooking key aspects of the training programmes which were essential to the integration of NRM (see 8.7.4).

During the first phase of the analysis, I used three sources of data on the in-service teacher training programmes for the Grade 10 Life Sciences teachers. The first source of data was the semi-structured interview that I held with Mr C who is a Life Sciences Senior Education Specialist or Subject Advisor (see Section 6.5.3) for the King William's District Education Office, under which the four case study schools fall. This office represents a recontextualising site in the PRF (see Section 7.7.2), and was the only PRF recontextualising site that was investigated during the study (see Appendix 5 for the interview with Mr C). The aim of conducting this interview was to solicit information about the professional background of Mr C and his views and experiences regarding NRM in the Life Sciences curriculum, and on the activities he conducts which relate to the teaching and learning of Grade 10 Life Sciences.

The second source of data on the in-service teacher training programmes involved two workshops organised by Mr C for the Life Sciences teachers in the Peddie branch of the King William's District Education Office. The aim of attending these workshops was to obtain

insight into the activities which were taking place. I recorded my overall impression of the workshops in form of field notes recorded in my research journal (see Appendix 4). The third source of data was a questionnaire Mr. C filled in (see Appendix 7). The aim of administering this questionnaire was to cross-check the information about Mr C's profile that I had obtained from the semi-structured interviews, and to obtain more information from Mr C about his in-service teacher training activities of the previous year (2007).

The second phase of the analysis consisted of the five steps that were described in Section 8.8, and that were followed during the analysis of the ORF texts (see Section 9.4), and the school textbooks (see Section 10.2.2). From the information on the Grade 10 Life Sciences in-service training workshops obtained during the first phase, I was able to identify key aspects or criteria of these workshops (see Section 8.8.2) which then formed the basis of the analysis of the in-service workshops during the second phase. As explained in Section 8.8.3, the extent of NRM integration in a given criterion of the in-service training workshops was described with the aid of selected indicators of the extent of NRM integration. The criteria and their corresponding indicators which were used in the analysis of the in-service teacher training workshops are shown in Table 10.3 below.

Table 10.3: The criteria and indicators used to analyse the extent of NRM integration in the in-service teacher training workshops

Criteria	Indicator	Type of Indicator
1. Training agent's education and training background	a. Agent's training in environmental education or NRM	Qualitative, status
2. Training agent's experience	b. Agent's experience in implementing environmental education or NRM training workshops	Qualitative, status
3. Workshops	c. Aims of the workshops conducted for the Life Sciences teachers	Qualitative, status
4. Educational resources	d. Nature of Life Sciences equipment/ apparatus donated to schools by the district education office	Qualitative, status
5. Grade 10 Life Sciences pedagogical documents produced at district level	e. Nature of content of the Life Sciences pedagogic documents produced by the district education office	Qualitative, status

The scaling grids (see Section 8.8.4) that were used to grade the performance of the indicators with regard to the integration of NRM in the selected criteria of the in-service teacher training programmes are shown in Table 10.4.

Table 10.4: The scaling grids used to analyse the performance of the indicators with regard to the integration of NRM in the selected key criteria of the in-service teacher training workshops

Indicator	C ++ (very weak NRM integration)	C + (weak NRM integration)	C - (strong NRM integration)	C - - (very strong NRM integration)
1. Agent's training in environmental education or NRM	Lacks formal training in environmental education / NRM	Has attended a few workshops on environmental education /NRM	Has done some courses on environmental education / NRM	Holds specialist formal qualifications in environmental education /NRM
2. Agent's experience in implementing environmental education or NRM training workshops	Lacks experience in running NRM training workshops	Has some experience (less than 2 years)	Has considerable experience (over 2 years)	Has extensive experience (over 5 years)
3. Aims of the workshops conducted for the Life Sciences teachers	Are specific to Life Sciences only/not relevant to NRM	Are general to both Life Sciences and NRM	Implicitly refer to NRM teaching and learning	Explicitly refer to teaching and learning of NRM
4. Nature of Life Sciences equipment / apparatus donated to schools by the district education office	Is specific to the teaching and learning of Life Sciences only	Is general to the teaching and learning of Life Sciences and NRM	Can be adapted to teach NRM	Is very relevant and useful to teaching and learning of NRM
5. Nature of content of the Life Sciences pedagogic documents produced by the district education office	Content is specific to Life Sciences only	Content is general to both Life Sciences and NRM	Content makes implicit reference to NRM	Content makes explicit reference to NRM

10.4 RESULTS

10.4.1 The analysis of the textbooks

The results of the analysis of Textbook A and B are described below, and are presented per indicator per textbook.

Indicator a: Nature of reference to NRM on the book cover

Textbook covers are a very important part of any textbook. In addition to being a marketing tool, a textbook cover carries underlying messages concerning the contents, approaches and style of the textbook. This indicator analysed the extent of NRM integration in the textbooks based on how explicitly their book covers referred to NRM. Both textbooks had a picture and

title of the book on the cover. Textbook A had an electron photomicrograph of an animal cell, occupying about a third of the total space of the book cover. The picture was in white and grey and showed the different parts of an animal cell. An explicit link is made by the book cover between cell structure and the study of Life Sciences. The underlying message is that Life Sciences as the study of life involves understanding the basic unit of life, the cell. The book cover contains no explicit or implicit references to NRM (see Section 8.8.5).

For Textbook B, the book cover consisted of a multicoloured small bird nestling among bright yellow and orange petals of a flower. The bird represents animal life, and the flower plant life, and the nestling is an indication of the close relationship between animals and plants. The underlying message conveyed by this picture is that Life Sciences involves studying both animals and plants and the relationships or interactions between them. Again there were no explicit or implicit references to NRM on the book cover.

Based on the scaling grid of this indicator (see Table 10.4), the extent of NRM integration in the book covers of both Textbook A, and B was judged to be very weak, and given a *classification* score of C+ +, indicating very strong isolation between NRM and Life Sciences in the book covers of both textbooks.

Indicator b: Percentage of illustrations based on NRM

Illustrations (diagrams, pictures, drawings, tables, graphs etc.) are an integral part of Life Sciences teaching and learning. This indicator analysed the extent of NRM integration in the textbooks based on the percentage of NRM-based illustrations that they contain. The assumption underlying the use of this indicator was that the higher the number of NRM-based illustrations in the textbook, the stronger the extent of NRM integration. A priori examination of both textbooks revealed that there were numerous illustrations on almost every page. To reduce the quantity of data, it was decided to conduct the analysis on only every second page of each textbook. For Textbook A, this involved illustrations spread over 99 pages, while the corresponding figure for Textbook B was 151 pages. All items under one caption were treated as one illustration. Where captions were available, they were used as a guide to the intended message of the illustration. For illustrations which had no captions, and where the message in the illustration was not clear, the surrounding text was used as a guide.

The analysis of Textbook A involved a total of 241 illustrations, of which 73 (30%) were found to be based on NRM. Most of the NRM-based illustrations occurred in the Knowledge Area of ‘Diversity, Change and Continuity’ (65; 27%), and the least number in the ‘Tissues, Cells and Molecular Studies’ Knowledge Area (0%), which however, had the highest overall number of illustrations for all the Life Sciences Knowledge Areas (70; 29%). For Textbook B a total of 207 illustrations were analysed, of which 60 (29%) were found to be NRM-based. In this textbook it was the Knowledge Area of ‘Environmental Studies’ which contained the highest number of NRM-based illustrations (35; 17%), followed by that of ‘Diversity, Change and Continuity’ (20; 10%). As in Textbook A, the Knowledge area of ‘Tissues, Cells, and Molecular Studies’ had the highest number of illustrations overall (73; 35%), although none of them were NRM-based. NRM-based illustrations in the textbooks included photographs of terraced agricultural land (soil conservation), threatened species (loss of biodiversity) and a hiking trail (sustainable use of natural resources).

According to the scaling grid of this indicator (see Table 10.4), the illustrations in both Textbooks A and B were judged to show very strong NRM integration, which is equivalent to a *classification* level of C- -, indicating very weak isolation between NRM and Life Sciences in the illustrations contained in both textbooks.

Indicator c: Percentage of activities based on NRM

Throughout both textbooks are numerous activities which learners are expected to carry out. The nature of these activities was diverse: some were oral (for example, involving discussions and debates) while others involve written work, investigations and research. For example, in Textbook A one activity required learners to learn different parts of a microscope, while another activity in Textbook B tested learners’ knowledge about healthy eating. This indicator analyses the extent of NRM integration in the two textbooks based on the percentage of NRM-based activities that they contain, the assumption being that the higher the percentage of NRM-based activities in the textbook, the higher its level of NRM integration. All the activities in the textbooks were analysed.

In both textbooks, the Knowledge area of ‘Structures, and Control of Processes in Basic Life Systems’ contained the largest number of activities, while that of ‘Tissues, Cells and Molecular Studies’ contained no activities at all. Textbook A had a total of 77 activities of which 18 (23%) were based on NRM. For example, one activity in this textbook asked the

learners to discuss the role of biosphere reserves in environmental protection, while another one asked them to suggest ways in which degraded soil can be made fertile again. Textbook B contained more activities (102) of which 28 (27%) were based on NRM. The highest number of activities that are based on NRM occurred under the Knowledge Areas of ‘Environmental Studies’ (17; 17%) and ‘Diversity, Continuity and Change’ (10; 10%). Based on the scaling grid of this indicator (see Table 10.4), the extent of NRM integration in the activities contained in both textbooks was judged to be very strong, and was allocated a *classification* score of C- - , indicating very weak isolation between NRM and Life Sciences in the activities of both textbooks.

Indicator d: Percentage of revision questions based on NRM

In both textbooks, each Knowledge Area was divided into sub-sections, each sub-section generally consisting of one main topic. For example, in Textbook A, the Knowledge Area of ‘Biodiversity, Change and Continuity’ consisted of four sub-sections: biosphere; ecosystems structure; energy flows; and investigating ecosystems. In Textbook B, the Knowledge Area of ‘Tissues, Cells, and Molecular Studies’ was sub-divided into: microscopy; cell structure; tissues; and cell division. In both textbooks each sub-section was usually followed by revision questions which test the learners’ understanding and application of the main concepts of the sub-section. Unlike the questions under ‘Activity,’ revision questions always appeared at the end of a sub-section, were generally longer, and all involved written work. In Textbook A these questions appeared under ‘Summative Assessment.’ In one example of a NRM-based revision question in Textbook A, learners were asked to find out the local names of three species of threatened indigenous trees, while another such question required them to explain the importance of wetlands.

This indicator analysed the extent of NRM integration in the textbooks based on the percentage of NRM-based revision questions that they contain. All the revision questions in both textbooks were analysed. This involved careful reading of each revision question and determining whether it referred to NRM or not, depending on its contents (see Section 8.8.5). Sub-questions appearing under one main question, for example 1a, 1b and 1c were counted as separate revision questions. The total number of NRM-based and non-NRM based questions in each textbook were summed up and their percentage contribution calculated.

Textbook A contained a total of 83 revision questions, the majority of which fell under the Knowledge Area of ‘Structures and Control of Processes in Basic Life Systems’ (37; 45%). The total number of NRM-based revision questions in this textbook was only 10 (12%), and occurred mostly under the ‘Diversity, Change and Continuity’ Knowledge Area. Examples of NRM-based questions in Textbook A were:

- What can be done to control water consumption?
- Explain why wetlands are important, and
- Why do you think we are using natural resources at such an alarming rate?

Textbook B contained a total of 63 revision questions, mostly under the ‘Environmental Studies’ Knowledge Area (33; 53%), but contained only one revision question on NRM.

According to the scaling grid of this indicator (see Table 10.4), the integration of NRM in the revision questions of Textbook A was strong, while that of B was very weak, which corresponded to the *classification* levels of C- , and C++, respectively. This indicated weak isolation between NRM and Life Sciences in the revision questions in Textbook A, while for Textbook B, the isolation between NRM and Life Sciences in the revision questions was very strong.

Indicator e: Percentage of case studies based on NRM

Both Textbook A and B use case studies as a means of providing more detailed and contextual information on various Life Science concepts or issues. This indicator analyses the extent of NRM integration in the textbooks based on the assumption that the higher the number of NRM-based case studies within a textbook, the higher its level of NRM integration. The procedure followed involved careful reading of the case study to determine the major concepts it was based on. The total number of NRM-based case studies in each textbook was tallied, and their percentage contribution to the overall total number of case studies in the textbook calculated.

Textbook A was found to contain 16 case studies, of which 9 (60%) were based on NRM. Textbook B had a total of 11 case studies, of which 6 (60%) were NRM-based. Examples of NRM concepts which formed the basis of case studies in the textbooks included soil conservation, traditional knowledge, and the conservation of gorillas.

In both textbooks the highest number of NRM-based case studies occurred in the Knowledge Area of ‘Diversity, Change and Continuity,’ while that of ‘Tissues, Cells and Molecular Studies’ had no NRM-based case studies at all. According to the scaling grid of this indicator (see Table 10.4) the extent of NRM integration in the case studies of both textbooks was judged to be very strong, and was allocated a *classification* level of C- -, indicating very weak insulation between NRM and Life Sciences in the case studies of both textbooks.

Indicator f: Percentage of practical assessment tasks which are based on NRM

During the analysis of the textbooks, ‘practical assessment tasks’ was used as a general term for investigations, experiments and research projects. Due to their low numbers in both textbooks it was decided to combine the three items together and analyse them as a single unit. The use of this indicator was based on the assumption that the higher the number of NRM-based practical assessment tasks, the stronger the extent of NRM integration in the textbook. The procedure that was followed involved careful scrutiny of the practical assessment items in order to determine which ones were based on NRM, after which their percentage contribution was calculated.

In Textbook A the overall number of practical assessment tasks was 19, none of which were based on NRM. In Textbook B, the corresponding number was 23, of which only one (4%) were based on NRM. This sole NRM-based investigation required learners to investigate the use of traditional herbs in their communities, and occurred in the ‘Environmental Studies’ Knowledge Area.

According to the scaling grid of this indicator (see Table 10.4), the integration of NRM in the practical assessment tasks of Textbook A was judged to be very weak and was allocated a *classification* level of C+ +, indicating very strong insulation between NRM and Life Sciences in the practical assessment tasks of Textbook A. The corresponding results for Textbook B reflected weak NRM integration, and a *classification* level of C+, indicating strong insulation between NRM and Life Sciences in this textbook’s practical assessment tasks.

Indicator g: Percentage of NRM concepts in the glossary

The glossary forms an important part of any textbook. It holds clues as to the scope and depth of a textbook’s contents. This indicator was used to analyse Textbook A and not Textbook B

due to the absence of a glossary in the latter. The terms listed in the glossary were carefully studied to determine the number and percentage of those which refer to NRM (see Section 8.8.5). A total of 265 concepts were counted in the glossary of Textbook A, of which 26 (10%) were linked to NRM. Examples of such concepts included ‘endemic’, ‘eutrophication,’ and ‘indigenous.’

According to the scaling grid of this indicator (see Table X), the extent of NRM integration in the glossary of Textbook A was judged to be strong, and allocated a *classification* level of C-, indicating weak insulation between NRM and Life Sciences in the glossary of this textbook. The absence of a glossary in Textbook B meant that this textbook could not be analysed under this category, and was allocated a *classification* level of ‘O’ (See Section 12.6).

Indicator h: Percentage of NRM concepts in the index

The scope and depth of a textbook’s contents are also mirrored in its index. Only textbook A had an index, so this indicator could not be used in the analysis of Textbook B. The procedure involved individual scrutiny of each word in the index to determine whether it was a NRM concept or not. The total number of NRM concepts was tallied, and their percentage contribution to the overall total number of concepts in the index calculated.

The number of items listed in the index of Textbook A mounted to a total of 366, of which 58 (16%) were NRM concepts. Examples of NRM concepts that were listed in the index included ‘biodiversity protection,’ ‘ecotourism’ and ‘traditional healers’ (see Section 8.8.5). According to the scaling grid of this indicator (see Table 10.4), the extent of NRM integration in the index of Textbook A was judged to be strong, and was allocated a *classification* level of C-, indicating weak insulation between NRM and Life Sciences in the index of this textbook. The absence of an index in Textbook B meant that this textbook could not be analysed under this category. Therefore this indicator was scored at a *classification* level of ‘O’ (see Section 12.6), meaning there was no data /insufficient data to conduct its analysis.

Overall Results

The overall extent of NRM integration in Textbook A and B is illustrated in the radar diagrams below.

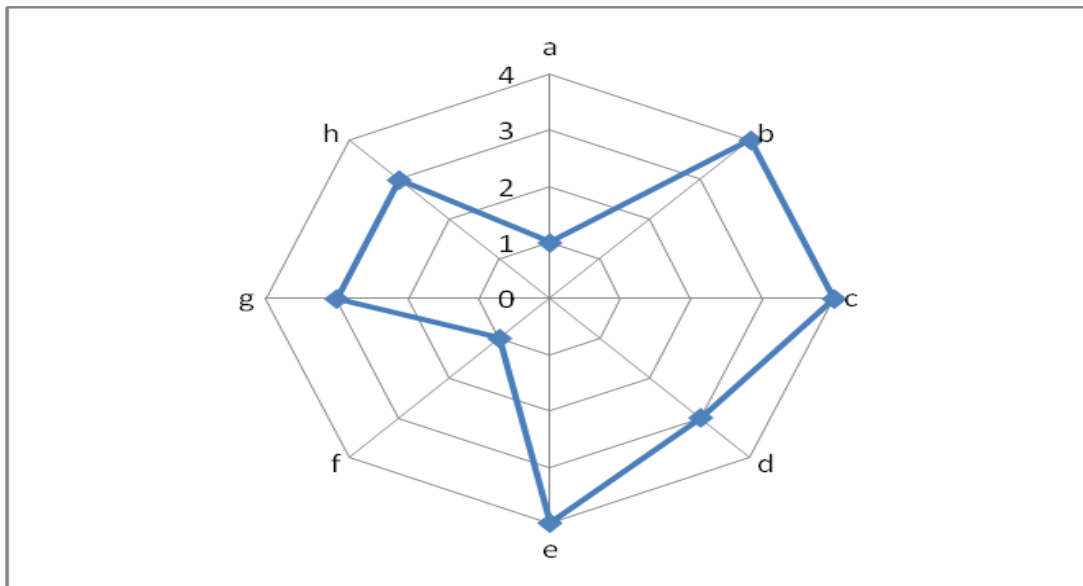


Figure 10.1 The overall extent of NRM integration in Textbook A

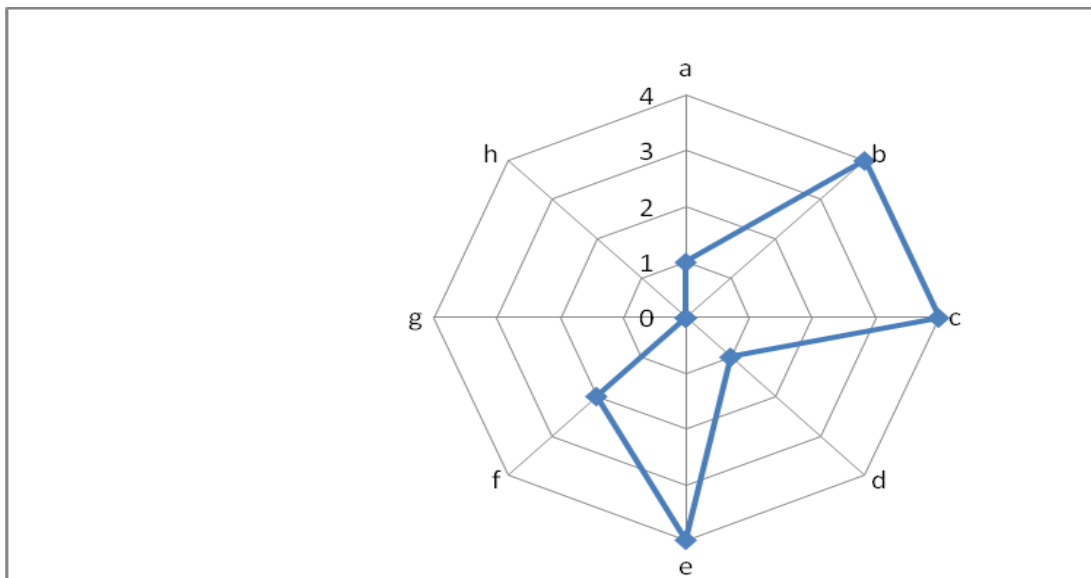


Figure 10.2 The overall extent of NRM integration in Textbook B

Key to classification levels: **0:** insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators **a:** Nature of reference to NRM on the book cover; **b:** Percentage of illustrations based on NRM; **c:** Percentage of activities based on NRM; **d:** Percentage of revision questions based on NRM; **e:** Percentage of case studies based on NRM; **f:** Percentage of practical assessment tasks based on NRM; **g:** Percentage of NRM concepts in the glossary; **h:** Percentage of NRM concepts in the index

10.4.2 The analysis of the in-service training workshops

As explained in Section 10.3.2, I used the results of the first phase of analysis to identify key aspects (criteria) of the in-service training workshops under which the analysis was

conducted. The results from the first phase also formed the source of data on the performance of the selected indicators with regard to the integration of NRM in the in-service training workshops. The results that I obtained from the analysis of the extent of NRM integration in the selected criteria of the in-service workshops that are run by Mr C are presented below, as per indicator.

Indicator a: Agent's training in environmental education or NRM

I used this indicator to analyse Mr C's educational background in environmental education or NRM. The argument I used in this analysis is that such training would equip Mr C with the knowledge, skills and attitude that are necessary to promote and implement environmental learning in the in-service programmes that he runs for the Life Science teachers under his responsibility. I analysed the performance of this indicator with regard to the integration of NRM based on the biographic data on Mr C that I obtained from the semi-structured interview I had with him. From the interview I held with Mr C, I found out that although he was highly qualified, he had no educational background in NRM, or any other form of environmental education. Mr C. commented thus about his educational background:

I did my BSc in 1983, and because of circumstances I decided to do my Masters in Public Administration, up to 1987. I was supposed to finish in 1987, but in 1987 I just came to South Africa and I stopped. I am left with only my thesis and final exam, second year. So I am incomplete Masters as you can see. And when I came here I did my HD (Higher Diploma) and I also went for BEd. Then since I moved from Mthatha to KWT and because of departmental involvement, I had no chance to even complete my thesis in BEd.

Based on the scaling grid for this indicator (see Table 10.4), the extent of NRM integration in Mr C's education and training background was judged to be very weak, and was scored at a *classification* level of C+ +, indicating very strong isolation between NRM and Mr C's education and training background.

Indicator b: Agent's experience in implementing environmental education or NRM training programmes

I used this indicator to analyse the extent of NRM integration based on Mr C's experience of running training programmes that promote NRM or other forms of environmental learning in schools. The indicator is based on the premise that the more experienced Mr C has in running these programmes, the more likely he is to incorporate them into the in-service programmes

that he runs for the Life Sciences teachers under his responsibility. The data that I used to analyse this indicator came from the semi-structured interview that I had with Mr C.

Mr C said he had been with the Curriculum Chief Directorate for almost six years, and had also taught Biology for over ten years in the former Transkei. Although he indicated he had experience in running teachers' workshops, the focus was on meeting the regulatory requirements of the curriculum, rather than promoting environmental learning in schools. Mr C had no experience at all in running environmental education or NRM training programmes.

During the interview Mr C explained his work with schools thus:

Basically we do have various programmes for the schools, subject related as well as admin (administration) related. Once there is opening of the schools and we need to go for readiness and how the schools are ready to open, whether the timetable is made, all those things, management tasks...Then basically when it comes to subject specific, that is where we concentrate on, to give them the pace setters ...We run a sort of workshop whereby the teachers come to know ... the assessment technique, how assessment should be done and how assessment should be planned, how the work should be carried on over the year and how many tasks, what are the different types of assessment, how those assessment need to be covered in a given period within a year. So we just make it clear to the teachers, and carry on with the task

Based on the scaling grid for this indicator (see Table 10.4), the lack of the necessary experience to run NRM or environmental education training programmes, or prior experience for supporting teachers with the integration of NRM places Mr C's experience at a *classification* level of C+ +, indicating very strong isolation between the training programmes he runs and NRM.

Indicator c: Aims of the workshops conducted for the Life Sciences teachers

Workshops are a common form of in-service training for teachers. This indicator is based on the premise that the higher the number of teacher workshops held on environmental education or NRM, the stronger the extent of NRM integration in the in-service training programme. When asked about the number of times he visits Peddie schools, Mr C replied that it was as often as once every two weeks. However, when it came to giving the reasons for these visits, he named monitoring of teachers, moderation of the teachers' continuous assessment programmes for Grade 12 Life Sciences, and distribution of teaching resources. He did not mention environmental learning as a reason for visiting the Peddie schools. In

addition during the interviews that I held with the Grade 10 Life Sciences teachers, they expressed lack of guidance on how to integrate environmental learning into their teaching. The teacher from School D said he had attended only one workshop so far on the Grade 10 Life Sciences curriculum, and it was on how to prepare learning programmes for the subject.

I attended two workshops that were organised by Mr C for the Life Sciences teachers in the Peddie Circuit Education Office. The first workshop was on preparation of learning programmes in Life Sciences. Twenty Life Sciences teachers were present. Most of the time was taken up by Mr C explaining the procedure to follow when preparing a learning programme. The second workshop that I attended which was run by Mr C for the Peddie Life Sciences teachers involved moderation of the previous term's Life Sciences examination. They were 16 teachers involved. Mr C explained to me that the cross-checking of the marked scripts has to be done as part of the monitoring and moderation of the teachers' continuous assessment programmes, and that it was done only for Grade 12. No reference was made of NRM or other forms of environmental education during these workshops (see Appendix 4).

According to the scaling grid of this indicator (see Table 10.4), the lack of workshops on NRM or environmental learning in the in-service training programmes run by Mr C corresponds with a *classification* level of C + +, which indicates very weak integration of NRM in these workshops, or very strong isolation between the workshops and NRM

Indicator d: Nature of Life Sciences equipment/apparatus donated to schools by the district education office

In the interview, Mr C mentioned that he has access to funding which allows him to purchase educational resources which he allocates to schools under his responsibility. He mentioned that since most of the schools in Peddie are under Section 21, which gives them control over their financial affairs (see Section 6.5.4) he does not buy textbooks for them. During the interview Mr C said:

... what the teacher needs, basic things, assuming that they do have textbooks, because our curriculum is not about supply of text books. These days ... schools they have their own budget in schools which can be utilized to buy what the school needs. That is why we advise them to make use of these funds which are available in the school account. At the same time I also plan what ... additional thing (educational resources) which I could request from the department ... from the curriculum budget.

Mr C mentioned that in 2007 he had bought Biology study guides, and 55 microscopes and their user manuals which he had distributed to various schools in the Peddie Circuit Education Office.

None of the items donated by Mr C to the schools are directly linked to the teaching and learning of NRM. He could, for example, have bought water quality and soil testing kits, and gardening tools for the schools. Based on the scaling grid for this indicator (see Table 10.4), there is very weak integration of NRM in the educational resources that are given by Mr C to the schools, which corresponds with a *classification* level of C+ +, indicating very strong isolation between NRM and the educational resources that are supplied to schools by Mr C

Indicator e: Nature of the Life Sciences pedagogic documents that are produced by the district education office

During the interview, Mr. C mentioned that he normally prepares documents which he distributes to the Life Sciences teachers under his control, meaning that his office is a recontextualising site, and Mr C is a recontextualising agent (see Section 7.7.2). During the interview Mr C stated that:

... and then when there certain areas of difficulties we organize...the actual training or orientation programmes. We don't actually call (it) training these days because training means something to be given by a registered institution. What we are doing is actually orientation. We just get the material from the department or develop some material ourselves ...

This indicator analyses the extent to which NRM is integrated in the Grade 10 Life Sciences documents that are produced by Mr. C and are distributed to the schools under his jurisdiction. I obtained additional data for this indicator from the classroom observations that I conducted at the four case study schools (see Chapter 11).

However, the only Grade 10 Life Sciences documents I was able to get from Mr C were photocopies of national and provincial documentation. In addition, the teachers in the study admitted to working with only provincial and national documents. In none of the class visits that I conducted did I observe the teachers using texts other than school textbooks (see Section 11.6). This points to a lack of Grade 10 Life Science pedagogic texts that are conceptualised and produced by the King William's Town District Education Office. This

meant that this indicator could not be evaluated, and was therefore allocated a *classification* ‘O’ (see Section 12.6).

Overall Results

The radar diagram shown below illustrates the overall extent of NRM integration in the Grade 10 Life Sciences in-service teacher training workshops run by the King William’s District Education Office for the Grade 10 Life Sciences teachers in the Peddie Circuit Education Office.

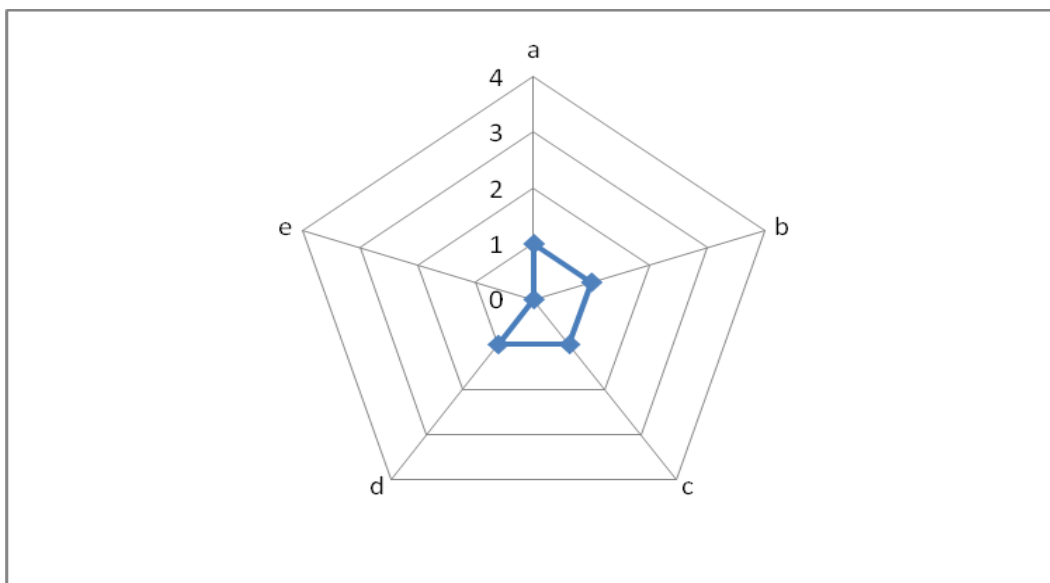


Figure 10.3: The overall extent of NRM integration in the in-service training workshops for Life Sciences teachers

Key to classification levels: **0:** insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Indicator Key: **a:** Agent’s training in environmental education or NRM; **b:** Agent’s experience in implementing environmental education or NRM training programmes; **c:** Aims of the workshops conducted for the Life Sciences teachers; **d:** Nature of Life Sciences equipment/ apparatus donated to schools by the district education office; **e:** Nature of the Life Sciences pedagogic documents that are produced by the district education office

10.5 CONCLUSIONS

This chapter described the analysis of the extent of NRM integration in the second major recontextualising sub-field of pedagogic discourse, the PRF. The first aim of the chapter was to introduce the items which were analysed as part of the PRF discourse. These were two Grade 10 Life Sciences textbooks that were available at the four case study schools, and two teacher training workshops that were run for the Life Sciences teachers in the Peddie Circuit

Education Office, under which the four case study schools fall. The second aim of the chapter was to describe the analysis procedure that was followed. As was for the case of the ORF texts, this consisted of five distinct steps of: criteria identification; indicator selection; construction of scaling grids; generating data on indicator performance with regard to NRM integration in each criterion; grading indicator performances according to Bernstein's *classification* scale; and construction of radar diagrams to display the results concerning the overall extent of NRM integration in the analysed item. The third aim of the chapter was to describe the research tools which were used in the analysis. As for the analysis of the ORF texts, the analytical tools consisted of indicators and their scaling grids (see Section 8.8). In the case of the textbooks eight indicators were used in the analysis, most of which were quantitative. The analysis of the in-service teacher training programme involved five qualitative indicators. Data on indicator performances with regard to the extent of NRM integration in each criterion was obtained from careful examination and reading of the texts in the case of the textbooks, and from a semi-structured interview held with Mr C who was responsible for the teacher training workshops. Additional data were also obtained from a questionnaire filled in by Mr C. The last aim of the chapter was to present the results of the analysis. The results were presented per indicator, and radar diagrams were used to illustrate the overall extent of NRM integration in the analysed items.

The next chapter analyses the extent of NRM integration in the next field of pedagogic discourse, the reproduction field, which is constituted by the four schools which took part in the study.

CHAPTER 11

THE ANALYSIS OF THE EXTENT OF NRM INTEGRATION IN THE REPRODUCTION FIELD

11.1 INTRODUCTION

As was explained in Chapter 1, the aim of this study was to analyse the extent of NRM integration in three fields which constitute pedagogic discourse. I started by analysing the extent of NRM integration in various official Grade 10 Life Sciences pedagogic documents, which form part of ORF discourse (Chapter 9). Next I analysed the extent of NRM integration in the PRF, which involved two Grade 10 Life Sciences textbooks, and two teacher training workshops (see Chapter 10). Agents in schools use documents and the training provided by the ORF and PRF to inform their activities and practices both outside and inside the classroom. These activities and practices together with their accompanying documents or texts form part of the reproduction field discourse (RFD). In this chapter I analyse the extent to which the reproduction field (which is represented in the study by the four case study schools) integrate NRM into texts, activities and practices. I describe the elements of the RFD which formed the basis of the analysis. I discuss the analytical tools which I used, and the procedure that I followed, to obtain data on the extent of NRM integration in each of the RFD items which were selected for analysis. Lastly I present the overall results of the analysis for each of the four schools which took part in the study.

11.2 THE ANALYSIS PROCESS

For the analysis of the extent of NRM integration in the reproduction field, I separated those activities, practices, and pedagogic texts which are central to the teaching and learning of NRM, from those which are less central but which nevertheless influence the teaching and learning of NRM. Therefore the analysis was conducted at two separate levels: school level, and classroom level. During the school level analysis, I focused on those activities, practices and documents that are part of normal school life but take place or exist outside the classroom. They included administrative, organisational and extracurricular school activities and practices and any associated documentation produced by the school. At the classroom level, I analysed those activities, practices and documents that occur or are produced inside the classroom. These included the teachers' Grade 10 Life Sciences lessons, their class notes, and any other written work that relates to Grade 10 Life Sciences, including the learners' own

written work such as class work, projects, tests and examinations. I had to make sure that the activities, practices and pedagogic texts that I chose to analyse were not out of context for rural disadvantaged schools. For example I could not base the analysis on the schools' video collection, or on the book titles in the school library, since such educational resources are rarely found at the type of schools the study was investigating (see Section 6.5.4).

The procedure that I followed to analyse the extent to which NRM is integrated in the activities, practices and documents of the reproduction field was basically the same as that which I used in the analysis of the ORF and PRF, and which was described in detail in Section 8.8. Having first decided on the unit or sub-unit of analysis, I then had to identify the criteria under which a particular unit or sub-unit of analysis was to be analysed (see Section 8.8.2). As before, each selected criterion was linked to one indicator, which I then used to describe the status of that criterion with regard to the extent of NRM integration (see Section 8.8.3). Again I took special care with the selection of the criteria which structured the analysis of each selected item, and with the indicators of the extent NRM integration, which constituted the analytical tools. For example, the criteria had to be key representative features of school and classroom practices in disadvantaged rural education contexts. The selected indicators had to be easy to understand and use, in addition to being based on easily accessible data (see Section 8.8.3). As before each indicator was linked to a scaling grid whose construction was based on Bernstein's *classification levels* (see Section 8.8.4). I used the scaling grid as a basis for allocating a particular *classification* level to each indicator, depending on its performance with regard to the integration of NRM. Where a particular indicator could not be assessed due to insufficient lack of the necessary data, a *classification* level of 'O' was allocated to that indicator (See Section 12.6).

11.3 THE ANALYSIS OF THE EXTENT OF NRM INTEGRATION AT SCHOOL LEVEL

11.3.1 Introduction

In this section I identify the criteria which structured the school level analysis. I discuss the rationale for the selection of the criteria, present the indicator frameworks used during the analysis, and describe how I used them to analyse the extent of NRM integration in the various out of class activities, practices and documents.

11.3.2 The analysis procedure

The analysis followed the same basic steps which were outlined in Section 8.8. As explained earlier, the first step involved the selection of criteria which were to be used to structure the analysis (see Section 8.8.2). The framework which formed the basis of the analysis of the extent of NRM integration at school level consisted of nine different criteria (see Table 11.1).

The first criterion that was used to structure the analysis of the extent of NRM integration at school level was that of ‘school’s vision/mission statement.’ The South African Schools Act of 1996 (RSA, 1996a) mandates school management teams (which comprise of the school principals, senior teachers, and representatives of learners in the case of high schools) with the responsibility of overseeing learning, teaching and assessment activities at school. School governance, which is concerned with the non-teaching and non-learning activities of schooling, is the responsibility of the school governing bodies (consisting of the principals, selected representatives of key stakeholders such as teachers, parents and non-educators). Since the first nationwide elections for school governing bodies in 1997, most of South Africa’s schools now have school governing bodies (Naidoo, 2005).

According to the South African Schools Act of 1996 (RSA, 1996a), one of the responsibilities of a school’s school governing body is to develop a mission statement with the participation of the school community. A school’s mission statement puts in writing what the school community considers to be the school’s values, purpose and direction. Ramadiro and Vally (2005) point out that schools should endeavour to make the mission statement representative of the school community so that the mission statement can hold the school community together. Morphew and Hartley (2006) see the process of articulating an institution’s mission as having two potential benefits. The first potential benefit is the creation of a shared common purpose, which has the capacity to inspire and motivate those within an institution, and to communicate the institution’s characteristics and values to outsiders. The second benefit is that it allows members of the institution to distinguish between those activities which conform to the institution’s imperatives, and those which do not. Weiss and Piderit (1999) maintain that like in other organisations, mission statements in schools serve as an essential part of the strategic planning process.

The second criterion that was used to structure the analysis of the extent of NRM integration at school level was that of 'school policy'. A school policy may be defined as a written statement which acts as a guideline to ensure consistency and compliance in the organisation and running of a school. The South African Schools Act of 1996 mandates school governing bodies with the responsibility to develop and implement school policies. The Act stipulates extensive powers to the school governing bodies over such school matters as the admission and exclusion of learners, payment of school fees, code of conduct for both teachers and learners, choice of school subjects and extra curricular activities. The decentralisation of school governance is an attempt by the government to give greater autonomy to local communities in the running their schools, to promote democratic local control of the decision- making process, and to respond to community needs (Naidoo, 2005).

The third criterion that was used in the analysis was that of educational resources. Effective use of educational materials by educators enhances teaching and learning (South Africa. DoE, 1998c). Educational materials, also variously referred to as educational resources or learning support materials come in various forms, for example textbooks, fact sheets, maps, science kits, newspapers, magazines, video, audiotapes and computer software. The National Department of Education in South Africa is committed to the provision of high quality educational material to schools in South Africa (South Africa. DoE, 1998c), and has developed seven basic principles to inform the development of educational materials, which include inter alia the promotion of learner-centred teaching, the development of critical and problem solving skills, and that of environmental awareness and respect for the environment. Lotz-Sisitka and Russo (2003) recognise five different categories of educational materials that support environmental learning, including those that: support learners to investigate their environments; provide new information; support action-taking; develop critical thinking skills and foster deliberation. With the advent of C2005 (see Section 6.6), educators in South Africa are expected to develop their own learning materials. However, in the Review Report on C2005 (South Africa. DoE, 2000) it is noted that most teachers in South Africa do not have the time, resources and skills to do so. The South African Schools Act of 1996 (RSA, 1996a) allocates the school governing bodies of Section 21 schools such as the four case study of this research project, powers to manage their financial affairs, including the maintenance of school buildings, the payment of services to the school, and the purchase of textbooks and other educational materials and equipment.

The fourth criterion used during the analysis was that of school space. School grounds have traditionally been seen as areas of play and sport (Malone & Tranter, 2003). The experiential approach to learning that is encouraged in South Africa's post-apartheid curriculum reforms (see Section 6.6) has created renewed interest in the concept of school gardens as an educational resource. Desmond, Grieshop and Subramaniam (2004) define garden-based learning as an instructional strategy that utilises gardens as a teaching tool. According to these authors, school gardens hold potential for:

- Providing teaching materials,
- Improving learners knowledge and skills in food production, nutrition, and natural resource management,
- Supplementing school feeding schemes,
- Enhancing food security in the community, and
- Increasing community involvement in schools.

Desmond, Grieshop and Subramaniam (2004) maintain that school gardens can be used to introduce an experiential component to the traditional curriculum, thus enhancing the quality of the educational experience provided to learners. They also see school gardens as having the potential to enhance the development of social, moral practical and life skills among learners. The Greening of the Nation project which is run by the South African National Biodiversity Institute, provides schools with gardens and assists teachers in using them as a resource in the teaching and learning process, and in strengthening learners' knowledge of biodiversity (Jenkins, 2007). Desmond, Grieshop and Subramaniam (2004) point out that garden-based learning is especially useful in environmental education, and in the teaching of scientific concepts, and should be viewed as an integral part of a school's educational plan, and be financed accordingly.

The fifth and sixth criteria used in the analysis, namely 'Environmental clubs' and 'Eco-Schools programme' relate to efforts made by schools to enhance environmental learning (see Section 6.8). Shazna and Ahmed (2003) define a school environmental club as a voluntary group of learners and teachers which functions in a school to promote environmental sustainability. Due to limited time, resources and funds, environmental education is often overlooked in the formal school curriculum (McDuff, 2000). School

environmental clubs perform the useful function of creating opportunities for learners to engage in environmental learning outside the constraints of the formal curriculum and classroom. School environmental clubs can be the means by which environmental awareness is created, skills acquired, attitudes built, and action taken towards solving local environmental problems. They help to extend the borders of environmental education beyond that of the formal education system (Shazna & Ahmed, 2003). Examples of activities commonly engaged in by school environmental clubs include recycling programmes, improvement of the school yard, tree planting, and school gardening. School environmental clubs also provide learners with opportunities to engage in projects that make a difference in their communities (McDuff, 2000).

The Eco-Schools programme encourages teachers and learners to improve the quality of their environment through curriculum-based learning and action (see Section 6.8). The programme acts as a vehicle through which learners actively engage with sustainable development issues in their school and community. Schools registering with this programme are supplied with a tool kit with which teachers work to design lesson plans and learner-centred activities which contribute to environmental sustainability in the school and its surrounding community.

The remaining two criteria that were used to analyse the extent of NRM integration at school level, namely that of 'School celebrations' and 'Recognition of excellence' are behavioural manifestations of school culture. Increasing attention is being paid to the concept of school culture as its role in school effectiveness, learner achievement and school reform is recognised. Van der Westhuizen, Mosoge, Swanepoel, and Coetsee (2005) categorised the various elements that constitute school culture into two groups, namely the tangible and the intangible. The tangible elements of school culture include the school's philosophy, beliefs, and values, which form the foundation of individual and group behaviour in a school. The tangible factors of school culture serve to strengthen the established individual and group behaviour in a school. Van der Westhuizen et al. (2005) further sub-divide the tangible elements of school culture into three groups of: verbal (language and stories); visual (facilities and symbols) and behavioural (rituals, ceremonies and tradition). In their analysis of learner achievement in secondary schools in the Mpumalanga Province of South Africa, Van der Westhuizen et al. (2005) found that schools with low achievement rates paid no or little attention to the behavioural aspects of school culture (among other factors).

The criteria and their corresponding indicators which were used in the analysis of the extent of NRM integration at school level are shown in the table below.

Table 11.1: The criteria and indicators used to analyse the extent of NRM integration at school level

Criteria	Indicator	Indicator Type
1. School's vision and mission statements	a. Nature of reference to NRM in the school's vision/mission statements	Qualitative, facilitative
2. School policy	b. Nature of reference to NRM in the school policy	Qualitative, facilitative
3. Educational resources	c. Purchase of NRM-related educational resources by the school	Qualitative, facilitative
4. School space	d. Condition and use of the school garden for NRM-related practices and activities	Qualitative, status
5. Environmental clubs	e. Learner participation in NRM-related school environmental clubs	Qualitative, status
6. Eco-Schools programme	f. School's participation in the eco-school programme	Qualitative, status
7. School celebrations	g. Celebration of NRM-related environmental days by the school	Qualitative, status
8. Recognition of excellence	h. Recognition of high achievement in NRM activities and practices	Qualitative, status

I obtained data on the extent of NRM in each of above selected criteria from two sources (see Section 8.7). The first source of data was the semi-structured interviews that I conducted with the school principals (see Appendix 8), and the Grade 10 Life Sciences teachers (see Appendix 9) at the four case study schools. The second source of data was the field notes taken during class visits to the Grade 10 Life Sciences classes. I then followed the rest of the procedure as outlined in Section 8.8. This involved selection of suitable indicators with which I described the extent of NRM integration in each criterion (see Section 8.8.3). As described in Section 8.8.4 this was followed by the construction of scaling grids for the indicators (see Table 11.2) which I used to grade the performance of the indicators with regard to extent of NRM integration in each criterion, according to *classification* levels. Finally I constructed a radar diagram (see Section 8.8.6) to visually illustrate the overall extent of NRM integration at each school.

Table 11.2: The scaling grid used to grade the performance of the indicators used during the analysis of the extent of NRM integration at school level

Indicator	C+ + (very weak NRM integration)	C+ (weak NRM integration)	C- (strong NRM integration)	C - - (very strong NRM integration)	O (necessary data absent / insufficient)
a. Nature of reference to NRM in the school's vision / mission statements	No reference at all to NRM/natural environment	Contains references general to both school governance and NRM	Implicit reference to NRM	Explicit reference to NRM	School lacks mission/vision statement
b. Nature of reference to NRM in the school policy	No reference at all to NRM natural environment	Contains references general to both school governance and NRM	Implicit reference to NRM made	Explicit reference to NRM	School lacks written policy
c. Condition and use of the school garden for RM-related practices and activities.	School lacks proper fencing/ garden/special room/corner etc for NRM	School is fenced and has established a school garden but is not yet used for NRM	School fully fenced and has functional garden which is regularly used by teachers and learners for NRM	School is fully fenced, has established a garden, a special room e.g. resource centre / tool shed, etc. for NRM	School lacks space for school garden
d. Purchase of NRM-related educational resources by the school.	Purchased only Life Sciences textbooks	Purchased Life Sciences textbooks and a few other items which are general to both Life Sciences and NRM e.g. Video, TV, photocopier etc	Purchased Life Sciences textbooks and a few NRM-related texts such as posters, pamphlets and fact sheets	Purchased Life Sciences textbooks numerous NRM-related texts / specialised equipment and apparatus such as water quality kits, etc	School lacks access to any type of funding
e. Learner participation in NRM-related environmental clubs	Only sports clubs exist. No environmental clubs at all operate at the school.	Various environmental clubs been established at the school but none are NRM-related.	NRM-related clubs been established but are not fully operational and suffer from poor membership	Active membership to various NRM-related environmental clubs exist competitions and fund raising activities held	No clubs /societies at all exist at the school
f. School's participation in the Eco-School programme	School once joined the programme but later dropped out without earning the green flag or eco-status	School once joined the programme. A few teachers were involved. School earned the green flag but later dropped out	School has been a member of the programe for a few years. Only a few teachers involved, but has never earned the green flag	Has been an Eco –School for a number of years and annually earns the green flag. Many teachers at school involved in the programme	School is not a member. Teachers and principal are unaware of this programe

Indicator	C+ + (very weak NRM integration)	C+ (weak NRM integration)	C- (strong NRM integration)	C - - (very strong NRM integration)	O (necessary data absent/ insufficient)
g. Celebration of environmental days by the school	Principal/teachers aware of environmental days although they are not celebrated.	Irregular school acknowledgement of some environmental days but no school celebrations	Irregular school celebration of some environmental days	School regularly holds competitions, exhibitions etc to celebrate many environment days	Principal/Life Sciences teachers not aware of environmental days and are not celebrated
h. Recognition of high achievement in NRM activities and practices	Competitions and awards only in sports, academics and culture. but not in NRM/no awards for achieving in NRM	No NRM competitions or awards but recognition in kind e.g. praise, special mention at assembly etc	NRM-related competitions occasionally held leading to awards	School organises regular NRM competitions leading to prestigious awards at end of season/year	There is no formal recognition of high achievement in any field.

11.4 THE ANALYSIS OF THE EXTENT OF NRM INTEGRATION AT CLASSROOM LEVEL

11.4.1 Introduction

As explained earlier, the objective for this part of the research project was to analyse the extent of NRM integration in those aspects of the reproduction field discourse that take place or are produced inside the classroom (see Section 12.2). The units of analysis which formed the basis of the analysis were the Grade 10 Life Sciences lessons, the Grade 10 Life Sciences written work, and the schools' end-of-year Grade 10 Life Sciences examination papers. In this section I explain the procedure that I followed to obtain data on the extent of NRM integration in each of the above objects of analysis. The procedure that was used followed the five basic steps which were outlined in Section 8.8.

11.4.2 The Grade 10 Life Sciences lessons

Five criteria structured the analysis of the Grade 10 Life Sciences lessons. My selection of the criteria was informed by the principles which underpin the National Curriculum Statement for Grade 10 Life Sciences (see Section 6.6) and the active learning approach to environmental learning (see Section 6.8).

The first criterion used in the analysis of the lessons was that of 'Lesson Content'. This criterion responds to the curriculum requirements for Life Sciences lessons to develop a high level of knowledge and skills among learners, and to promote environmental and social

justice (see Section 6.6). The second criterion that was used was that of ‘Oral Questions’. This criterion is linked to the active learning framework which can be used by teachers to probe learners’ prior knowledge, and to continually monitor the development of their understanding and competences during the lesson (see Section 6.8). The third criterion that was used was that of ‘Teaching and Learning Materials’. This criterion was linked to OBE and the active learning framework’s requirements for teachers and learners to use a variety of teaching and learning materials during lessons as a means of providing additional information during lessons (see Section 6.8). The fourth criterion, which was ‘Written Notes’ was linked to the curriculum requirement of learners to be actively engaged during lessons (see Section - 6.8). The last criterion that was used in the analysis was that of ‘Assessment Tasks’. In the active learning framework the need to know and monitor what has been learned and achieved during the lesson is emphasised (see Section 6.8).

As explained before, each criterion was linked to one indicator which was used to describe the status of the criterion with regard to extent of NRM integration (see Section 8.8.3). The five criteria and their associated indicators which were used to analyse the extent of NRM integration in the lessons are shown in the table below.

Table 11.3: The criteria and indicators used to analyse the extent of NRM integration in the Grade 10 Life Sciences lessons

Criteria	Indicator	Type of indicator
1. Lesson content	a. Nature reference to NRM in the lesson topic	Qualitative, status
2. Oral questions	b. Nature of reference to NRM in the questions asked during the lesson	Qualitative, status
3. Teaching and learning materials	c. Types of teaching and learning materials and their use during the lesson	Qualitative, facilitative
4. Written notes	d. Nature of reference to NRM in the notes written on the board during lesson	Qualitative, status
5. Assessment tasks	e. Nature of reference to NRM in the assessment tasks	Qualitative, status

The data on the performance of the selected indicators with regard to the integration of NRM in the criteria was obtained from two sources. The first source of data was the classroom observations that I conducted on a sample of Grade 10 Life Sciences lessons at each of the four schools (see Section 8.7). I spread the visits out across two school terms to ensure a varied coverage of what was taught during the visits. I visited the schools three or four times

after making prior arrangement with the teachers concerned. I audio-taped all the lessons (see Appendix 10) and also took field notes on what I observed (see Appendix 6). During the classroom visits I was interested in the integration of NRM within the lesson in terms of their content, the questions asked during the lesson, the notes written on the blackboard, the teaching and learning materials used, and content of the assessment tasks that were set by the teachers. These aspects of the lessons formed the criteria under which the lessons were analysed.

The second source of data that I used was the diaries of two Grade 10 learners at each of the four schools (see Section 8.7). After seeking permission from the teachers concerned, I requested two Grade 10 learners to keep a daily record of what took place during the Grade 10 Life Sciences lessons in terms of the topic taught, notes written on the blackboard, and any assessment tasks given out by the teacher. The learners did this over a period of one school term (see Appendix 11).

I then constructed scaling grids for the indicators as explained earlier (see Section 8.8.4), which I used to grade the performance of the indicators with regard to the integration of NRM according to *classification* levels (see Table 11.4). Lastly, I used radar diagrams (see Section 8.8.6) to illustrate the overall extent of NRM in the sampled lessons at the four case study schools.

Table 11.4: The scaling grids used to grade the performance of selected indicators during the analysis of the extent of NRM integration in the Grade 10 Life Sciences lessons

Indicator	C + + (very weak integration)	C+ (weak integration)	C- (strong integration)	C- - (very strong integration)	O (necessary data absent / insufficient)
a. Nature reference to NRM in the lesson topics	All specific to Life Sciences/none on NRM	References are general to both Life Sciences and NRM	Implicit references made to NRM	Explicit reference made to NRM	Lessons lacked focus, topic was unclear. Indicator performance could not be analysed
b. Nature of reference to NRM in the questions asked during the lesson	Majority of questions specific to Life Sciences/very few on NRM	Majority of questions made references general to both Life Sciences and NRM	Majority of questions made implicit reference to NRM	Majority of questions made explicit reference to NRM	No questions at all asked during lesson. Indicator performance could not be analysed
c. Types of teaching and learning materials and their use during the lesson	Only Life Sciences textbooks used. No other educational materials used	Used textbooks and other aids which contain information general to both Life Sciences and NRM	Used textbooks, and other educational resources such as posters, fact sheets etc which contain information specific to NRM	Used various types such as textbooks, posters, fact sheets etc. in addition to NRM tool kits e.g. soil and water quality test kits	Total lack of the use of any educational resource. Indicator performance could not be analysed
d. Nature of reference to NRM in the notes written during the lesson	Most sets of notes refer only to Life Sciences	Most sets of notes contain references general to both Life Sciences and NRM	Most sets of notes contain implicit references to NRM	Most sets of notes contain explicit reference to NRM	No notes written down at all. Indicator performance could not be analysed
e. Nature of reference to NRM in the assessment tasks	All assessment tasks based on Life Sciences/none refer to NRM	Majority of assessment tasks made references general to both Life Sciences and NRM	Majority of assessment tasks contain implicit reference to NRM	Majority of assessment tasks contain explicit reference to NRM	No/few assignment tasks given out. Indicator could not be analysed.

11.4.3 The Grade 10 Life Sciences written work

Two types of texts formed the basis of the analysis of the extent of NRM integration in the Grade 10 Life Sciences written work. The first written texts were the teachers' Grade 10 Life Sciences class notes. These class notes were obtained from each teacher (where available) and photocopied. Three criteria structured the analysis of the extent of NRM integration in the teachers' notes, which were: 'Lesson topic', 'Page contents' and 'Illustrations'. The second type of Grade 10 written work that was analysed was the learners' class work. None of the teachers kept a portfolio of their Grade 10 Life Sciences learners' work. Therefore, I requested from the Grade 10 Life Sciences teachers at each school all the written assessment tasks done by two of their best students (see Appendix 12). I treated this work as a true record of the written assessment tasks set by the teachers for the Grade 10 Life Sciences learners. Two criteria structured the analysis of this work, namely that of 'Class work questions', and 'Research project.'

As explained in Section 8.83, each criterion was linked to one indicator which described the status of that criterion with regard to the extent of NRM integration. The criteria and their associated indicators which were used to analyse the extent of NRM integration in the Grade 10 Life Sciences written work are shown in Table 11.5 below.

Table 11.5: The criteria and indicators used to analyse the extent of NRM integration in the Grade 10 Life Sciences written work.

Criteria	Indicator	Indicator Type
1. Lesson topic	a. Percentage of topics which contain references to NRM	Quantitative, status
2. Page contents	b. Percentage of pages which contain references to NRM	Quantitative, status
3. Illustrations	c. Percentage of illustrations based on NRM	Quantitative, status
4. Class work questions	d. Percentage of class work questions based on NRM	Quantitative, status
5. Project topic	e. Nature of reference to NRM in the Life Sciences project(s)	Qualitative, status

The next step involved the construction of a scaling grid for each indicator (shown in Table 11.6 below), which was then used to allocate *classification* levels to each indicator depending on its performance with regard to the integration of NRM (see Section 8.8.4).

Table 11.6: The scaling grids used to grade the performance of the indicators used in the analysis of the extent of NRM integration in the Grade 10 Life Sciences written work

Indicator	C ++ (very weak integration)	C+ (weak integration)	C- (strong integration)	C- - (very strong integration)	O (necessary data absent / insufficient)
a. Percentage of topics which contain references to NRM	0%, all topics are specific to Life Sciences	Less than 5% of the taught topics contain reference to NRM	5-10% of the taught topics contain references to NRM	More than 10% of the topics taught refer to NRM	Insufficient number of topics taught so indicator could not be evaluated
b. Percentage of pages with NRM content	0%, all pages refer only to Life Sciences	Less than 5% of pages contain reference to NRM	5-10% contain reference to NRM	More than 10% contain reference to NRM	Insufficient written work so indicator could not be evaluated
c. Percentage of illustrations based on NRM	0%. All illustrations are specific to Life Sciences	Less than 5% of illustrations are based on NRM	5-10% of illustration are based on NRM	More than 10% of illustrations are based on NRM	Very few/no illustrations at all contained in the notes, so indicator could not be evaluated
d. Percentage of questions based on NRM	All questions based on Life Sciences	Less than 5% of the questions are based on NRM	5-10% of the questions are based on NRM.	More than 10% of the questions are based on NRM.	Very little/no class work done, so indicator could not be evaluated
e. Nature of reference to NRM in the Life Sciences project(s)	Most are specific to Life Sciences only	Most are general to both Life Sciences and NRM	Most based on themes that contain implicit reference to NRM	Most are based on themes that contain explicit reference to NRM	No projects done, so indicator could not be evaluated

11.4.4 The schools' end-of-year Grade 10 Life Sciences examination papers

The last pedagogic texts of the reproduction field which were analysed were the schools' 2007 end-of-year examination papers for Grade 10 Life Sciences (see Appendix 13). Although all four papers collected were based on the National Curriculum Statement framework, they showed great variation in content and format, not only between the four schools, but also between the two years of examination at the same school. For example, the duration of the papers varied between two to three hours; the number of questions between

four and six; and the maximum allocated marks between 100 and 200. I decided to use the 2007 examination papers since they represented the latest available Grade 10 Life Sciences end-of-year examination format at the schools. I used the same criteria, indicators and scaling grids to analyse the extent of NRM integration in these examination papers as the ones used in the analysis of the nationally set Grade 10 Life Sciences examination exemplars (see Section 9.5.4). This was because both the exemplars and schools' examination papers were concerned with the same purpose (end-of-year assessment in Grade 10 Life Science), and the exemplars had been widely distributed to schools to serve as a template to the teachers' own examination papers (see Section 9.2.4).

11.5 RESULTS OF THE SCHOOL LEVEL ANALYSIS

The rationale for the selection of each indicator and the results of the analysis of the extent of integration of NRM at each of the four schools in the study are presented below. Since the results are very similar across the four schools, to avoid unnecessary repetition, the results are presented per indicator, rather than per school.

Indicator a: Nature of reference to NRM in the school's vision/mission statements

One of the requirements of post-apartheid school governance reforms has been for schools to formulate their vision and mission statements (Section 11.3.2). These mission and vision statements provide information and guidance to teachers, learners and other key stakeholders on what has been decided upon as the core purpose of the school's educational activities. This indicator was used to analyse the extent of NRM integration at school level by considering the explicitness of any reference made to NRM in the vision and mission statements of the four schools that participated in this study. The assumption made was that explicit reference to NRM within the schools' vision and mission statements reflects a concerted attempt to bring NRM and the schools' goals and objectives closer together, which implies very strong NRM integration, or very weak insulation between NRM and the schools' goals and objectives. On the other hand, lack of any reference to NRM implies very weak NRM integration, or very strong insulation between NRM and the schools' goals and objectives, as stated in the vision and mission statements.

All four schools in the study had their vision and mission statements prominently displayed in the school staffroom or in the principal's office. In all four cases the statements were handwritten in bold letters, and were in English. In none of the vision and mission statements

was there explicit or implicit mention of NRM or the natural environment. For example, the Vision Statement for School A is to:

... engage all stakeholders in the community, parents, learners, educators and the private sector to ensure that there is effective teaching and learning all the time ...

That of school D stated that:

... the community of this school is committed to efficient education and capacity building of our children which will enable them to become effective and competent citizens ...

The same lack of any reference to NRM or the natural environment was also evident in the schools' mission statements. For example, that of school A is to:

... mould the child to be a responsible adult (and) to develop learners' skills and talents (and) to give learners an internationally recognized education ...

That of school B states:

... to provide good quality education required for the diverse needs of society (and) to develop critical thinking and analytical skills required in the new millennium.

While the schools' vision and mission statements lacked any explicit or implicit reference to NRM, they contain references to concepts which are general to both Life Sciences and NRM, for example 'responsible adult', 'develop learners' skills and talents' and 'develop critical and analytical skills (see Section 8.8.5). Based on the scaling grid of this indicator (see Table 11.2), the extent of NRM integration in all the four schools' vision and mission statements was judged to be weak, and was allocated a *classification* level of C+, indicating strong insulation between NRM and the schools' vision and mission statements.

Indicator b: Nature of reference to NRM in the school policy

The South African Schools Act of 1996 (RSA, 1996a) gave school governing bodies powers to set school policy on a diverse range of issues that relate to schooling at their respective schools (see Section 11.3.2). Every school in South Africa is expected to have a school policy. This indicator analyses the extent of NRM integration in the schools' policy

statements based on how explicitly they refer to NRM, the assumption being that the more explicit reference to NRM is in the school policy, the stronger the extent of NRM integration.

Only three of the four schools in the study had school policies. School A and C had their school policies pinned onto the wall of the staffroom. For School D copies of the school policy were kept in the principal's office. The principal of School B said the school did not have a school policy as yet. In all the three cases the school policies were written in English. None of the school policies that were examined contained implicit or explicit reference to NRM, or to the school's natural environment.

Based on the scaling grid of this indicator (see Table 11.2), the extent of NRM integration in the school policy statements of schools A, C and D was judged to be very weak, and was graded at *classification* level C+ +, indicating very strong insulation between NRM and the schools' policy statements. This indicator could not be used to analyse the extent of NRM at School B because this school did not yet have a school policy in place. Therefore, for this indicator, this school was given a *classification* score of 'O' meaning that the lack of the necessary background data precluded the use of this indicator during the analysis of the extent of NRM integration at this school (see Section 12.6).

Indicator c: Condition and use of the school garden for NRM-related practices and activities

A school may establish a special space within the school grounds or within its buildings that is devoted to the learning and teaching of a particular subject. For rural under-resourced schools, a school garden offers an excellent opportunity for NRM-based learning and teaching (see Section 11.3.2). For example, school gardens can be used to help learners acquire knowledge and skills that are necessary for the cultivation of indigenous vegetables, and water and soil conservation during drought. This indicator analyses the extent of NRM integration at school level based on the establishment and use of a school garden for NRM-based teaching and learning. The assumption made is that a school's allocation of a specific space to the teaching and learning of NRM mirrors the status the school attaches to NRM-based learning.

In the rural areas of the Eastern Cape, proper fencing of the school yard is a prerequisite for the establishment of a school garden. The school fence guards the school yard and its

contents from unnecessary intrusion from human trespassers and stray domestic animals. All the four schools in the study were fenced with barbed wire or aluminum fine mesh nets. The condition of the fencing varied between the four schools. In School A the school fencing was recently repaired, and the area behind one of the classroom blocks ploughed, although it was not fenced off. The school's principal explained that nothing had been planted so far due to lack of funds. Being a new school, School B was surrounded by a very strong and well-built fence. Within the school yard a section had been fenced off. The school's principal explained that fencing around this area was such that the area was inaccessible to tractors, which is why the school could not start their school garden. At school C, although the school fence was old, it was well maintained. The school had ploughed a section of the school yard, but it was not fenced off and had nothing growing in it. The fence around School D was old and broken in some places, and the school's principal explained that they could not establish a school garden until they got funds to repair the school fence first. She noted:

The garden is still a problem of vandalism because the school yard is not okay. We are expecting the animals from around to come in ... We have goats coming in now, they just sleep here, almost every day. Otherwise we are trying with the parents to straighten the fence.

Only School C complained of a shortage of classrooms as a result of a strong wind which blew the roof off three of their classrooms. The rest of the schools had classrooms which were being used for purposes other than teaching and learning, especially for the storage of old books and furniture. All the walls of the buildings at the four schools were devoid of any posters, notices or displays.

Hence although there was intent for a school garden at three of the schools, none of the four schools had a functional school garden, or any other special space such as a room or wall which was exclusively used for NRM activities and practices. Based on the scaling grid for this indicator (see Table 11.2), the extent of NRM integration in the schools' space was judged to be very weak at all the four schools, and was graded at a *classification* level of C+ +, indicating very strong isolation between NRM and the schools' use of space.

Indicator d: Purchase of NRM-related educational resources by the school

According to the South African Schools Act of 1996, public schools in South Africa are categorized into Section 20 and Section 21 schools. As was explained in Section 6.5.3,

Section 21 schools are schools which, inter alia have been granted financial autonomy from the provincial education department, and are free to spend their funds as determined by their financial committee, which consists of members from the school governing board and school management team. A school's budgeted expenditure reflects its priorities as determined by its financial committee. This indicator analyses the extent of NRM integration at the four schools based on the types and numbers of educational resources that are specific to the teaching and learning of NRM which have been purchased with school funds. The assumption made is that the higher the number and types of NRM-related educational resources that are purchased with school funds, the stronger the integration of NRM.

All four schools have been granted Section 21 status within the last four years. During the interviews, all the four school principals complained about insufficient funding and late payments of school funds. The principal of School C stated that the funds allocated to his school were insufficient for essential duties at the school, let alone to fund NRM-related practices and activities. The interviews also revealed the different ways in which the schools had used their funds the previous year. All four principals said they had used the school funds to buy school textbooks and stationery. School A used part of the school funds to renovate the school's classroom block. The principal of School D said they had bought a small photocopier and had renovated the principal's office and the school staffroom. School C had bought a television set and video player, in addition to netball and football kits. All this expenditure was not specific to the teaching and learning of NRM. However, the principal for School B admitted to spending money on transport to take some learners to the Double Drift Game Reserve on a tour, but explained that that core reason for the trip was entertainment rather than NRM. He commented thus on NRM-related expenditure at his school:

... it is not the main, it is not core business, at the peripheral, having a little bit, but is not termed NRM ...

What also emerged from the interviews was that the four schools purchased mainly school textbooks for the teaching of Life Sciences, and no other printed educational resources such as posters, pamphlets and fact sheets. For example, when asked about the availability of other types of teaching and learning materials for Life Sciences lessons at his school, the Grade 10 Life Sciences teacher at School A had this to say:

... I have not seen them, but way back in the 1990s ... there were some posters especially dealing with agriculture ... those things have been destroyed.

Although there was purchase of educational resources other than textbooks at some of the schools, none were specific to the teaching and learning of NRM (such as water and soil testing kits, and gardening equipment). However, the TV, and video player purchased by School C, and the photocopier that was purchased by School D can be used to mediate learning in both Life Sciences and NRM. It is apparent that at all four schools, the use of school funds to purchase educational resources which are specific to NRM features lower down on schools' list of expenditure priorities. Based on the scaling grid for this indicator (see Table 11.2), the integration of NRM in the schools' expenditure priorities was very weak for Schools A and B, which were allocated a *classification* score of C+ +, indicating very strong insulation between NRM and the educational items purchased by the two schools. The extent of NRM integration in the educational items purchased by School C and D was judged to be weak, and was given a *classification* level of C+, indicating strong insulation between NRM and the two schools' expenditure priorities.

Indicator e: Learner participation in NRM-related environmental clubs

Establishing school clubs or societies is a strategy that is often used by schools to enrich the curriculum on offer to learners (see Section 11.3.2). The existence of a particular society/club at a school and its membership can be used as a measure of the status accorded by the school to the knowledge, skills and values that that particular society/club embodies. This indicator analyses the extent of NRM integration at school level based on the types of environmental clubs that exist at the four schools and the level at which learners participate in them. The assumptions made is that the higher the number of NRM-related environmental societies/clubs, and the higher level at which learners participate in their activities, the stronger the extent of NRM integration.

Interviews with the four school principals revealed that although the four schools offered football, netball and choir music, none had managed to establish an environmental club or society of any sort at their school. For example, the principal of School D referred to environmental clubs as 'a new concept for us', while that of School C admitted that he had 'heard of environmental clubs but was not well acquainted with them'. Based on the scaling grid for this indicator (see Table 11.2), the integration of NRM at school level was judged to

be very weak for all the four schools, and was scored at a *classification* level of C+ +, indicating very strong isolation between NRM and the clubs that exist at the four schools.

Indicator f: School's participation in the Eco-School programme

The Eco-Schools programme encourages teachers and learners to improve the quality of their environment through curriculum-based learning and action (see Section 11.3.2). The programme acts as a vehicle through which learners actively engage with sustainable development issues in their school and community. Schools registering with this programme are supplied with a tool kit with which teachers work to design lesson plans and learner-centered activities which contribute to environmental sustainability in the school and its surrounding community. This indicator analyses the extent of NRM integration at school level based on the school's level of participation in the Eco-Schools programme. The assumption made is that a school's regular and consistent registration with the Eco-Schools programme, coupled with full participation in the programme reflects a commitment to NRM integration at the school.

Responses obtained from the four school principals and the Grade 10 Life Sciences teachers showed that not only were the four schools not participants in the eco-schools programmes, but also that they were unaware of the existence of such a programme. Hence this indicator could not be used to analyse the extent of NRM integration at all the four schools. Using the scaling grid for this indicator (see Table 11.2), all four schools were allocated a *classification* score of 'O' indicating the absence of the necessary data to grade the performance of the indicator with regard to the integration of NRM (see Section 12.5).

Indicator g: Celebration of NRM-related environmental days by the school

South Africa celebrates environmental days as a means of creating awareness around particular environmental issues and risks (see Section 11.3.2). Examples of such days include Arbor Week (1-7 September), Water Week (third week of March), and Wetlands Day (2 February). This indicator analyses the extent of NRM integration based on the number of NRM-related environmental days that are celebrated by the schools and the style in which they are celebrated. The assumption made is that the higher the number of NRM-related environmental days that are celebrated, and the more participatory the celebrations are, the more integrated NRM is in the schools' out of class activities and practices.

From the responses of the four school principals and Grade 10 Life Sciences teachers, it was very clear that none of the four schools celebrates environmental days of any sort. The principal of School D was unsure of the concept of environmental days. He commented thus:

I have heard of water day, but what is going on I do not know. I hear of us preserving water, but nothing else.

The other three principals seemed to be more familiar with the concept although their schools did not celebrate environmental days. For example, the principal of School B said the only day celebrated at their school was Casual Day (23 September), when learners wear casual clothes to raise funds for their clubs. However, the Grade 10 Life Sciences teacher at school C said that sometimes when he hears of such days over the radio he discusses them with his learners but does not go beyond that. None of the schools celebrated environmental days with mass rallies, competitions or displays. Using the scaling grid of this indicator (see Table 11.2), the extent of NRM integration in the school celebrations at School A, B, and D was judged to be very weak, and was allocated a *classification* score of C+ +, indicating very strong isolation between NRM and the schools' celebrations. The overall extent of NRM integration in the school celebrations at School C was judged to be weak, and allocated a *classification* score of C+, indicating strong isolation between NRM and celebrations at that school.

Indicator h: Recognition of high achievement in NRM activities and practices

Recognition of high achievement by learners (and sometimes by teachers) is a normal feature of school life (see Section 11.3.2). Annual awards such as trophies, certificates and other forms of recognition are usually handed out to high achievers in various aspects of school life, including academics, sports, and culture. Such recognition need not be material, especially in those educational contexts where funds are a limiting factor. Recognition may also occur in the form of elevating involved learners to positions of leadership, such as football or netball captain and choir leader. This indicator analyses the extent of NRM integration at school level by examining how excellence in NRM activities and practices is recognized at the four schools. The assumption made is that the stronger the integration of NRM at the schools, the more likely high achievement in NRM will be recognized and rewarded.

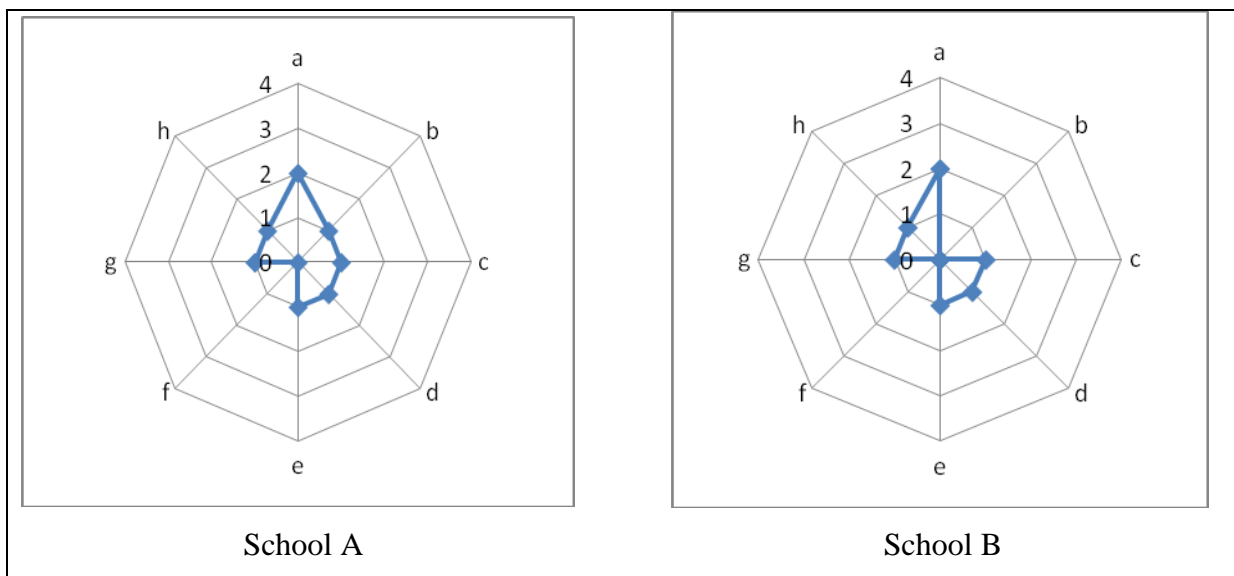
Responses from the four school principals showed that the culture of formal recognition of high achievement through the annual award of trophies and certificates is not well developed at the four schools. The Grade 10 Life Sciences teacher at School C noted that:

... there is a way, a form of praise, not necessarily giving awards in that form, but we do praise that particular learner ... when they perform such.

Although all the four principals admitted to staging annual competitions between different classes at their schools, these involved mainly outdoor sports, such as football, netball and rugby, and beauty pageants, but not NRM activities and practices. Based on the scaling grid for this indicator (see Table 11.2), the extent of NRM integration in the recognition of high achievement at the four schools was judged to be very weak, and was allocated a *classification* score of C+ +, indicating very strong isolation between NRM and the schools' recognition of high achievement in out of class activities and practices.

Overall Results

The radar diagrams below illustrate the overall extent of NRM integration in the out of class activities, practices and documents at the four schools.



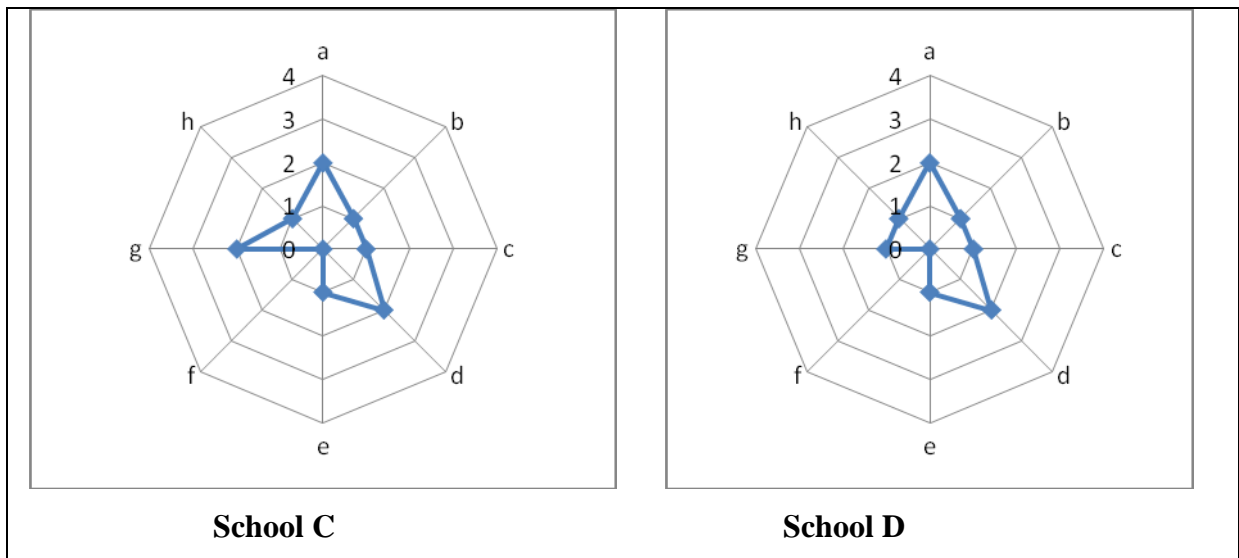


Figure 11.1 The overall extent of NRM integration in the out of class activities, practices and documents at the four case study schools

Key to classification levels: **0:** insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators **a:** Nature of reference to NRM in the school’s vision mission statements; **b:** Nature of reference to NRM in the school policy; **c:** Condition and use of the school garden for NRM-related practices and activities; **d:** Purchase of NRM-related educational resources by the school; **e:** Learner participation in NRM-related environmental clubs; **f:** School’s participation in the Eco-Schools programme; **g:** Celebration of environmental days by the school; **h:** Recognition of high achievement in NRM activities and practices

11.6 RESULTS OF THE CLASSROOM LEVEL ANALYSIS

11.6.1 The Grade 10 Life Sciences lessons

This section presents the results of the analysis of the extent of NRM integration in a sample of Grade 10 lessons that were observed at the four case study schools (see Section 8.7.1). A total of 15 lessons were analysed: four at School A and C and D, and three at School B. Since the lessons were observed after prior arrangement with the teachers, they were treated as representing the teachers’ best classroom practices. The results are presented per indicator per school.

Indicator a: Nature reference to NRM in the lesson topics

This indicator analysed the extent of NRM integration based on the teachers’ inclusion of NRM concepts or themes into the lesson that was being taught. The assumption made is that the more explicit references to NRM are during a Life Sciences lesson, the stronger the integration of NRM. Table 11.7 summarises the main topics of the lessons which were observed during the study.

Table 11.7: Main topics of the observed Grade 10 Life Sciences lessons

Lesson	School A	School B	School C	School D
1	1. Natural resource types and their uses 2. Water pollution	1. Cell structure 2. Animal and plant cells	1. Ecosystem structure 2. Abiotic factors 3. Soil structure and composition	1. Ecosystem structure and functioning
2	1. Respiration 2. Breathing mechanism	1. Cell division 2. Stages of mitosis	1. Biosphere reserves	1. Digestion
3	1. Ecosystem structure and functioning 2. Biotic and abiotic factors	1. Digestion	1. Nutrient recycling 2. Food chains	2. Photosynthesis
4	1. Classification of organisms 2. Scientific nomenclature,	*	1. Photosynthesis experiments 2. Leaf starch testing	1. Classification of organisms
Comments	Lesson 1 makes explicit reference to NRM	All topics are specific to Life Sciences	Lesson 2 makes explicit reference to NRM	Lesson 1 is general to both Life Sciences and NRM

*No class visit was made.

Of the four lessons which were observed at School A, one lesson (Lesson 1) contained explicit reference to NRM. This lesson involved listing of the various natural resources, and their uses by humans and other species, and a discussion on water pollution (see Section 8.8.5). The rest of the observed lessons at School A consisted of topics which are specific to Life Sciences. At School B all the observed lessons were based on topics which are specific to Life Sciences and contained no reference at all to NRM. At School C, Lesson 2 which was based on 'Biosphere Reserves' contained explicit reference to NRM, while Lesson 1 and 3 were based on topics which are general to both Life Sciences and NRM. Of the four lessons which were observed at School D, one contained topics which were general to both Life Sciences and NRM (Lesson 1), and the remaining four lessons were based exclusively on Life Sciences.

Based on the scaling grid of this indicator (see Table 11.4), the overall extent of NRM integration in the lessons topics that were taught to learners during the class visits at School A and School C was judged to be very strong and allocated a *classification* level of C- -, indicating very weak overall isolation between Life Sciences and NRM. For School D the overall extent of integration in the topics that were taught during the observed lessons was judged to weak and given a *classification* score of C+, indicating strong isolation between NRM and Life Sciences. The extent of NRM integration at all the three observed lessons at School B was judged to be very weak, and allocated a score of C+ +, indicating very strong isolation between NRM and Life Sciences in these lessons.

Indicator b: Nature of reference to NRM in the questions asked during the lesson

Questioning is a recognized teaching strategy for enhancing participatory learning during lessons (see Section 11.3.2). The questions, which may originate from teachers or learners, serve many functions, ranging from simple recall of knowledge, to the testing of higher mental activities such as application, analysis and synthesis of information. This indicator analyses the extent of NRM integration in a lesson depending on the nature of questions that were asked during the lesson, the assumption being that the more the questions explicitly refer to NRM, the stronger the extent of NRM integration.

Analysis of the field notes taken during the class visits at all four case study schools showed that questioning was a common strategy, although the frequency of questioning varied between different teachers, and between different topics by the same teacher. The highest number of questions recorded during a lesson was 25, and occurred during Lesson 1 at School B. In two of the observed lessons (Lesson 2 at School C, and Lesson 4 at School D) no questions were posed by teachers (or learners). In all cases the questions were direct and short, and required one-word or single sentence answers. All the questions asked during the lessons were from the teachers. Table 11.8 presents a summary of the number and types of questions posed by the teachers during the observed lessons.

Table 11.8: Number and types of questions recorded during the observed Grade 10 Life Sciences lessons

Lesson	School A	School B	School C	School D
1	2 / 5	0 / 25	0 / 8	0 / 2
2	0 / 4	0 / 2	0 / 0	0 / 4
3	0 / 7	0 / 12	2 / 3	0 / 7
4	0 / 3	*	0 / 3	0 / 0
Comments	Two questions on NRM asked	No questions on NRM asked	No questions on NRM asked	No questions on NRM asked

NB: The first figure shows the number of questions which refer to NRM. The second figure shows the total number of questions asked during the lesson.

At School A, a total of twenty one questions were asked during the observed lessons of which two contained explicit reference to NRM. These questions were:

- What are natural resources?
- Who can give me examples of natural resources?

Two of the sixteen questions asked during the observed lessons at School C also explicitly referred to NRM. They were:

- What will happen to the buffalo? (when all the zebras have died)
- Will the number of buffalo increase or decrease?

During Lesson 3 of School A, and Lesson 1 of School C, questions which were general to NRM and Life Sciences were asked. These were questions about ecosystem structure and functioning, for example:

- What are decomposers?
- What is an ecosystem?
- Which is one is a producer in the food chain?

However, the majority of the questions that were asked during all the observed lessons at all four schools were specific to Life Sciences, for example:

- What do we call the term when we put the same organisms together?
- Is it the only thing you know about plants and animal (cells)?
- After digestion starch forms what?
- What solution are we going to add? (when testing for starch in leaves), and
- Plants are autotrophic, so animals are ...

Based on the scaling grid of this indicator (see Table 11.4), the overall extent of NRM integration in the questions which were asked during the observed lessons at all the four schools was judged to be very weak, and given a *classification* score of C+ +, indicating very strong overall isolation between NRM and Life Sciences in the questions.

Indicator c. Types of teaching and learning materials and their use during the lesson

Teachers and learners are required to make use various teaching and learning materials such as textbooks, posters, pamphlets, newspapers, magazines, videos and toolkits to access knowledge during lessons, thereby enhancing the quality and effectiveness of the teaching and learning that occurs (see Section 11.3.2). This indicator analyses the extent of NRM integration in the lessons based on availability and use of different types of NRM-based teaching and learning materials during the lessons. The assumption made is that use by teachers or learners of various types of teaching and learning materials that specifically focus on NRM reflect very strong NRM integration, while the lack of such educational materials point to very weak NRM integration.

Table 11.9 presents a summary of the types of teaching and learning materials that were available during the observed lessons.

Table 11.9: Types of teaching and learning materials used during the observed Grade 10 Life Sciences lessons

Lesson	School A	School B	School C	School D
1	1. Teacher's notes 2. Blackboard 3. Learners' notebooks	1. Teacher's notes 2. Blackboard 3. Learners' textbooks	1. Teacher's notes 2. Learners' textbooks 3. Learners' notebooks 4. A 2-litre plastic bottle with water and soil	1. Teacher's textbook 2. Blackboard 3. Learners' textbooks 4. Learners' notebooks
2	1. Teacher's notes 2. Blackboard 3. Learners' notebooks	1. Teacher's textbook 2. Blackboard 3. Learners' notebooks	1. Blackboard 2. Learners' textbooks 3. Learners' notebooks	1. Teacher's notes 2. Blackboard 3. Learners' Notebooks
3	1. Teacher's notes 2. Blackboard 3. Learners' notebooks	1. Teacher's textbook 2. Blackboard 3. Learners' textbooks	1. Photocopied diagram of biosphere reserves 2. Blackboard 3. Learners' notebooks	1. Teacher's textbook 2. Blackboard 3. Learners' textbooks
4	1. Teacher's notes 2. Blackboard 3. Learners' notebooks	*	1. Teacher's notes 2. Blackboard 3. Learners' textbooks	1. Teacher's notes 2. Blackboard 3. Learners' notebooks

* No class observation was conducted.

The blackboard, teachers' notes and learners' notebooks were the most commonly used educational resources during the observed lessons at all four schools, and most of the lesson time was taken up by teacher talk, writing of notes on the blackboard by the teachers, and learners copying notes into their notebooks. Teachers and learners rarely consulted their textbooks during the lessons. For example, at School D most of the learners had textbooks on their desks during Lesson 1 although little use was made of them during the lesson. At School A during Lesson 1, the teacher regularly referred to his notes when talking and writing on the blackboard. In none of the lessons that were observed were additional educational resources such as posters, newspapers, magazines used. Regarding the use of toolkits, in only one lesson (Lesson 1 of School C) did the teacher make use of a tool kit during the lesson. In this particular lesson, the tool kit consisted of a plastic bottle which was half-filled with water and soil. The tool kit was used to demonstrate the composition of soil and was general to both Life Sciences and NRM.

Using the scaling grid of this indicator (see Table 11.4), the overall extent of NRM integration in the availability and use of educational materials during the observed Grade 10 Life Sciences at School A, B and D was judged to be very weak, and was allocated a *classification* score of C+ +, indicating very strong isolation between NRM and Life Sciences in the educational materials that were available and used during the observed lessons. At School C, the overall extent of NRM integration in the learning materials that were used during the observed lessons was judged to be weak and allocated a score of C+, indicating strong overall isolation between NRM and the learning materials.

Indicator d: Nature of reference to NRM in the notes written during the lesson

One of the common activities that takes place during lessons is that of writing down notes by teachers and learners. This indicator analyses the extent of the integration of NRM in the lessons depending on the nature of reference made to NRM in the notes that were written on the blackboard by the teacher. If these notes contain explicit references to NRM, it is interpreted as representing very strong NRM integration, while the lack of any reference to NRM in the notes points to very weak NRM integration.

The copying down of notes was a common classroom activity during the observed lessons at all the four schools, although the extent to which it was carried out differed between different teachers, and for a given teacher, between different lessons. For example, during all the lessons that were observed at Schools A and D, the teachers extensively wrote on the blackboard, while during Lesson 3 of School C only a few notes were written on the blackboard. In almost all the cases these notes were copied by learners into their own note books, although the extent they were able to do so appeared to be limited by lack of proper notebooks for the subject. For example, some learners were observed tearing papers from other notebooks to copy the Life Sciences notes that were written on the blackboard. Yet others were observed writing the notes at the back of notebooks of other classroom activities, such as class work, or other subjects. Table 11.10 provides a summary of what was written on the blackboard by teachers during the observed lessons.

Table 11.10: Major themes of the notes that were written on the blackboard during the observed Grade 10 Life Sciences lessons

Lesson	School A	School B	School C	School D
1	Notes on types and uses of natural resources and water pollution	Diagrams of a plant and animal cell	Notes describing ecosystem structure, energy flow, abiotic factors and soil composition	Notes and diagram describing ecosystem structure
2	Notes explaining breathing in mammals	Diagrams and notes describing stages of cell division	Diagram of biospheres and biomes	Diagram of alimentary canal, and notes on food digestion
3	Notes and diagram explaining ecosystem structure and functioning	Diagram of alimentary canal and notes on food digestion	Diagram of food chain involving grass, buffalo, mice and vulture	Notes describing photosynthesis experiment
4	Notes explaining classification and names of living organism	*	Notes describing photosynthesis experiment	Notes on classification of living organism
Comments	Lesson 2, 3 and 4 notes are specific to Life Sciences	All lesson notes are specific to Life Sciences	Lesson 1 and 3 notes are general to both NRM and Life Sciences	Lesson 2, 3 and 4 notes are specific to Life Sciences

* No class observation was conducted.

At School A, during Lesson 1, notes which explicitly referred to NRM were written on the board. These notes contained references to natural resource types, their uses, and water pollution (although very briefly). For the remaining three lessons, all the notes that were written on the board referred to Life Sciences only. At School B, all the notes which were written on the blackboard during the three observed lessons were specific to Life Sciences. At School C, during Lesson 2 notes which explicitly referred to NRM (Biosphere reserves) were written on the board, while the notes written in Lesson 1 and 3 contained references which were common to Life Sciences and NRM (see Section 8.8.5). At School D, the notes in three of the four lessons which were observed focused exclusively on Life Sciences.

Using the scaling grid for this indicator (see Table 11.4), the overall extent of NRM integration in the notes that were written on the blackboard during the observed lessons at

School A, B and D was judged to be very weak, which corresponds with a *classification* level of C+ +, indicating very strong overall isolation between NRM and Life Sciences in the notes. In the case of School C, the overall extent of NRM integration in the notes which were written on the board was judged to be weak, and given a *classification* score of C+, which indicates strong overall isolation between NRM and Life Sciences in the lessons.

e. Nature of reference to NRM in the assessment tasks

Short assessment tasks done during class time or as homework form part of the daily informal assessment that Life Science teachers are expected to use as a means of monitoring learner progress throughout the lesson. This indicator analyses the extent of NRM integration in the Grade 10 Life Science lessons depending on the themes of the assignment tasks that were assigned to the learners during the observed lessons. The assumption made is that explicit reference to NRM in the assignment tasks that were set during the observed lessons implies very strong NRM integration, while the absence of any reference to NRM counts as a very weak NRM integration.

Analysis of the field notes that were taken during the classroom visits showed that class work was the main form of daily assessment at Schools A, B, and C. However, the frequency with which it was assigned varied, taking place on all the days of the class visits (School B), to only a few of those days (School A). At School D no form of daily assessment including class work was assigned to the learners on all of the days of the class visits. Table 11.11 below is a summary of the major themes of the assignment tasks that were given to learners by their teachers during the class visits at the four schools.

Table 11.11: Major themes in the assessment tasks given to learners during the observed Grade 10 Life Sciences lessons

Lesson	School A	School B	School C	School D
1	Listing of uses of natural resources	Listing of differences between animal and plant cells	No task given	No task given
2	No task given	Making of model of dividing cell from waste materials	Filling in gaps in diagram of Biosphere reserves and biomes	No task given
3	Fill in gaps in food chain diagram	Discussion of process of digestion	Filling in gaps in diagram on nutrient recycling	No task given
4	No task given	*	Diagram on photosynthesis experiment	No task given
Comments	Lesson 1 assignment task was based on NRM	No assignment tasks set on NRM	Lesson 2 assignment task was based on NRM	No assignment set during all the observed lessons

The nature of the assessment tasks that were done during the observed Grade 10 Life Sciences lessons differed between visits and between different schools. Complex tasks like the modeling of cell division from waste materials (Lesson 2 of School B), or lengthy descriptions such that of digestion (Lesson 3 of School B) were relatively rare. What was more common were short tasks requiring single words or short sentences, for example Lesson 1 of School A and Lesson 3 of School C. The only assessment tasks that contained explicit reference to NRM were in Lesson 1 of School A (although learners were merely required to list various natural resources and their uses) and Lesson 2 at School C (where learners were asked to work on a diagram on biosphere reserves). The remaining assessment task in School A and those at School C were specific to Life Sciences (see Section 8.8.5). All the assessment tasks which were set during the observed lessons at School B were specific to Life Sciences.

Using the scaling grid of this indicator (see Table 11.4), the overall extent of NRM integration in the assessment tasks at School B and C was judged to be very weak, and was allocated a *classification* score of C+ +, indicating very weak overall isolation between NRM and Life Sciences in the assessment tasks which were set during the observed lessons at these schools. The absence/lack of enough assessment tasks during the class visits at School D and

A, and in the diaries of the Grade 10 Life Sciences learners who participated in the study meant that there was insufficient or no data on which to base the analysis of this indicator. Both schools were therefore allocated a *classification* score of ‘O’ (see Section 12.6).

Overall Results

The results of the analysis of the extent of NRM integration in the assessment tasks that were given to learners during the observed lessons are illustrated in the radar diagrams below.

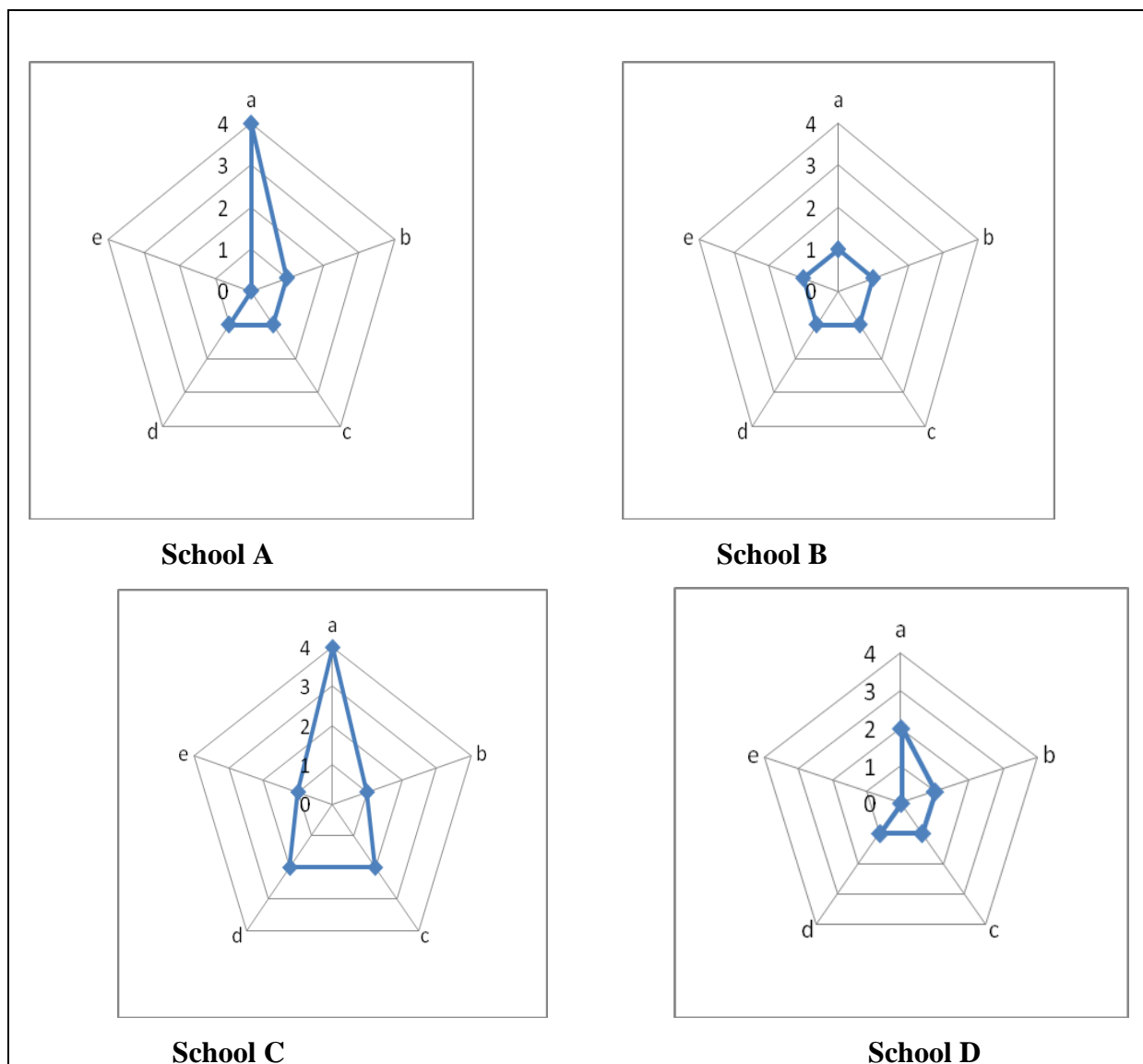


Figure 11.2 The overall extent of NRM integration in the Grade 10 Life Sciences assessment tasks at the four case study schools

Key to classification levels 0: insufficient data for analysis; 1: C ++ (very weak NRM integration); 2: C+ (weak NRM integration); 3: C- (strong NRM integration); 4: C- - (very strong NRM integration)

Key to indicators

a: Nature of reference to NRM in the lesson topics; **b:** Nature of reference to NRM in the questions asked during the lesson; **c:** Types of teaching and learning materials and their use during the lesson; **d:** Nature of reference to NRM in the notes written during the lesson; **e:** Nature of reference to NRM in the assessment tasks set during the lesson.

11.6.2 The Grade 10 Life Sciences written texts

This section presents the results of the analysis of the extent of NRM integration in a sample of Grade 10 Life Sciences written texts obtained from the four case study schools. As was explained in Section 11.4.3 the teachers' and learners' written texts were combined and analysed as a single unit. The results of the analysis are presented per indicator.

Indicator a: Percentage of topics which contain references to NRM

Learning Outcome 3 of the Grade 10 Life Sciences curriculum (Life Sciences, technology, the environment, and society) offers teachers the opportunity to integrate NRM (and other environmental) concepts into topics which would otherwise be entirely biological (see Section 6.7). For example, in the topic of 'reproduction' the need to control human populations can be used as an entry point into the conservation of the world's natural resources. Similarly, inclusion of the use and conservation of indigenous plants can serve to make the topic 'cancer treatment' more contextual to rural learners. Thus in principle, the introduction of NRM concepts to the Grade 10 Life Sciences learners need not be restricted to the two learning areas of 'Environmental Studies', and 'Diversity, Change, and the Continuity of Life', but can instead be spread right across the entire Grade 10 Life Sciences curriculum. This indicator analyses the extent of NRM integration at classroom level based on the occurrence of NRM themes in the topics that had so far been taught to the Grade 10 class. The assumption made was that the higher the frequency of NRM concepts in the taught Life Sciences topics, the stronger the extent of NRM integration in the Grade 10 Life Sciences, which would otherwise be purely biological.

The data for this indicator were obtained from the learners' diaries since they offered a more accurate picture of what was actually taught and when, than the teachers' notes. However, the two learners from School D failed to submit their dairies, so this part of the study excluded School D. To avoid unnecessary repetition, only one of the two learners' diaries from each of the three remaining schools was analysed.

The selected diary from School A was kept from the beginning of January 2008 to mid-April of the same year during which a total of 33 entries were made. 45% of these entries reported that there had been no Life Sciences lessons for the Grade 10 class. The number of topics recorded as being taught during this period was three (Respiration, Gaseous exchange and Photosynthesis). Analysis of the Life Sciences notes recorded by the learner in the diary revealed only Life Sciences concepts, and none for NRM.

Based on the scaling grid for this indicator (see Table 11.6), the extent of NRM integration into the topics as taught by the teacher from School A was very weak, and was scored at *classification* level C+ +, indicating very strong isolation between NRM and what the teacher had taught so far.

The selected learner from School B kept her diary from early January to late April 2008, and made a total of 45 entries, out of which 33 indicated no Life Sciences lessons had taken place. The topics recorded by the learners as being taught by the teacher during this period were microscopy, cell division and digestion. The notes taken by the learner included no concepts on NRM. Based on the scaling grid for this indicator (see Table 11.6), the integration of NRM into the topics taught by the teacher at School B was also judged to be very weak, i.e. of *classification* level C+ +, indicating very strong isolation between NRM and what the teacher had taught.

The diary record for School C indicated that between January and early June, the total number of Grade 10 Life Sciences lessons taught was twelve, during which nine topics were recorded by the learner as having been taught to her class. Only one (8%) of these lessons included NRM concepts. This lesson consisted of class work which was based on soil conservation. Based on the scaling grid for this indicator (see Table 11.6), the overall integration of NRM into the topics taught by the teacher at School C was high i.e. of *classification* level C-, indicating weak isolation between NRM and the topics the teacher had taught.

Indicator b: Percentage of pages which contain reference to NRM

It is common practice for some teachers to prepare notes of their subjects which they use as a guide during their teaching. The contents of these notes represent what the teacher deems important enough to be taught to the learners. The use of this indicator to analyse the extent

of NRM integration is based on the assumption that the higher the proportion of pages with NRM content in the teachers' notes the stronger the extent of NRM integration. The data for this indicator were taken from the teachers' class notes for Grade 10 Life Sciences. However, only teachers from Schools A, C and D had these types of notes. The teacher at School B said she did not keep a record of her class notes. The class notes from School A covered 33 pages, of which 4 pages (12%) contained references to NRM. The latter notes referred to traditional herbs, conservation and soil management. For schools C and D, the class notes were 22 and 35 pages, respectively, none of which contained any reference to NRM. Based on the scaling grid of this indicator (see Table 11.6), the overall extent of NRM integration in the teachers' Grade 10 Life Sciences class notes of School A was judged to be very strong, and allocated a *classification* level C- -, which indicated very weak overall isolation between NRM and Life Sciences in the teacher's notes. For both School C and D the overall extent of NRM integration was judged to be very weak, and at classification level C+ +, indicating very strong isolation between NRM and the teachers' notes. The absence of class notes at School B meant that the necessary data for this indicator were absent, and the indicator was allocated a *classification* score of 'O' (see Section 12.6).

Indicator c: Percentage of illustrations based on NRM

The teachers' class notes again provided the data for this indicator. The assumption made was that the higher the number of NRM-based illustrations in the teachers' notes, the stronger the extent of NRM integration. The class notes from School D contained the highest number of illustrations (18) while the illustrations in the class notes from School A and C numbered seven each. All the illustrations were of diagrams of Life Sciences concepts, and there were no tables, graphs or flow charts. None of the illustrations from the three sets of teacher's notes were based on NRM. Based on the scaling grid for this indicator (see Table 11.6), the class notes of all the three schools were judged to show very weak NRM integration i.e. were at the *classification* level C + +, indicating very strong isolation between NRM and Life Sciences in the illustrations which were contained in the teachers' notes. Again, School B was allocated a *classification* value of 'O' due to the lack of Grade 10 Life sciences class notes (see Section 12.6).

Indicator d: Percentage of class work questions based on NRM

The *Life Sciences Subject Assessment Guidelines* (DoE, 2007b) encourage daily assessment of learners as a mean of creating opportunities through which they can improve on the

required competencies. In the four schools that took part in this study, class work was the most common form of this type of assessment. The inclusion of questions on NRM within the set class work reflects the teacher's NRM integration efforts into daily assessment: the higher the number of such questions, the stronger the extent of NRM integration. The data for this indicator came from the learners' Life Sciences class work books. To avoid unnecessary repetition, after careful scrutiny, one class work book was selected from the two that were submitted by the teacher of each school. The total number of questions contained in the book was determined, with sub-questions being counted as separate questions. The number of questions that were based on NRM was counted and their overall percentage calculated.

The class work book from School A contained the highest number of questions (91), all of which were specific to Life Sciences. Of the 33 questions contained in the class work book from School D, none was based on NRM. Based on the scaling grid of this indicator (see Table 11.6), the extent of NRM integration in the class work questions from both schools was judged to be very weak, and allocated a *classification* score of C+ +. The class work questions from School B numbered 77, out of which one was based on NRM (1%). This latter question asked learners to name the methods used to prevent soil erosion. The class work book from School C contained only 25 questions, of which two were on NRM (8%). These questions asked learners about biodiversity conservation and soil management.

Based on the scaling grid of this indicator, the overall extent of NRM integration in the class work questions was judged to be weak for School B (*classification* level C+), and strong for School C (*classification* level C-).

Indicator e: Nature of reference to NRM in the Life Sciences project(s)

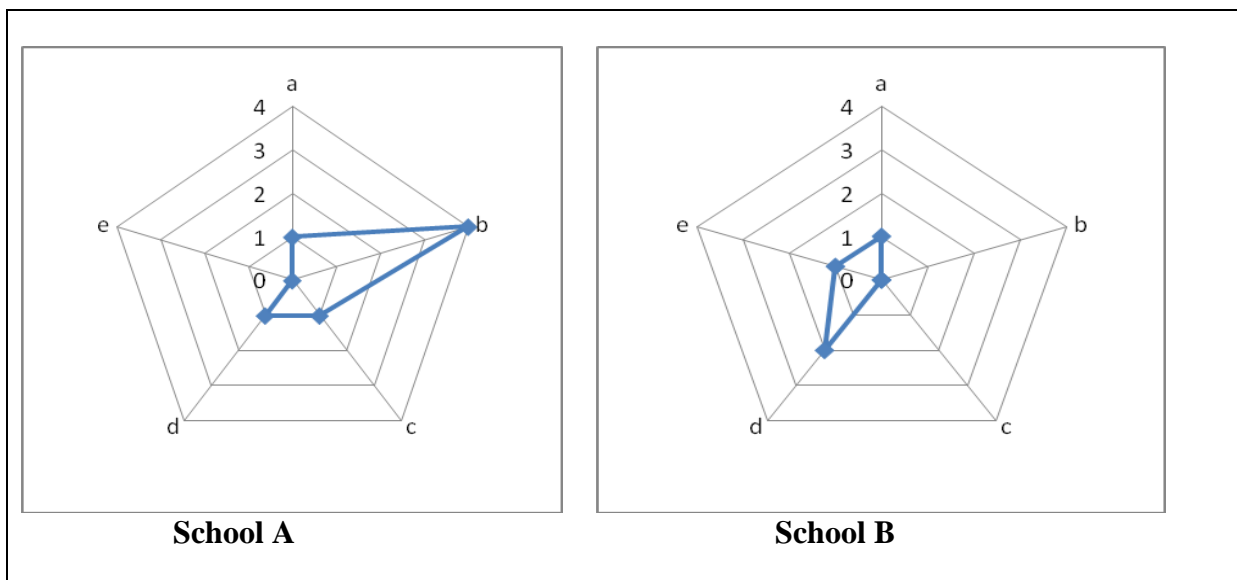
The *Life Sciences Subject Assessment Guidelines* also stipulates that the Grade 10 learners should conduct at least one research project during the year, which should account for 20% of their continuous assessment mark for this subject (South Africa. DoE, 2007b). Although the guidelines do not come with a list of possible research projects for Grade 10 learners, they include recommendations that research projects be investigative in nature, address the three Learning Outcomes of Life Sciences and encourage learners to access information from various sources (South Africa. DoE, 2007b). Teachers have a choice between providing learners with a list of suitable research topics from which they make their preferred choices, or selecting one particular research topic to be done by all learners. This indicator was used to

analyse the extent of NRM based on the assumption that projects which explicitly refer to NRM represent very strong NRM integration.

The data for this indicator were obtained from the interviews held with the teachers, and from inspection of entry records in the learners' diaries (where available). Responses from the teachers showed that in 2007, none of them had used research projects as a form of assessment. However, while the learners' diary records from Schools A and C contained no reference to research projects for 2008, that from School B described a project which required learners to construct an animal cell from waste materials. Using the scaling grid for this indicator (see Table 11.6), the extent of NRM integration in this research project was judged to be very weak, and allocated a *classification* score C+ +, indicating very strong isolation between NRM and Life Sciences in the research project. For the three remaining schools, the lack of project work at the schools meant that there were no data for this indicator, which was therefore allocated a *classification* value of 'O' (see Section 12.6).

Overall Results

The diagrams below illustrate the overall extent of NRM integration in the Grade 10 Life Sciences written texts at the four case study schools.



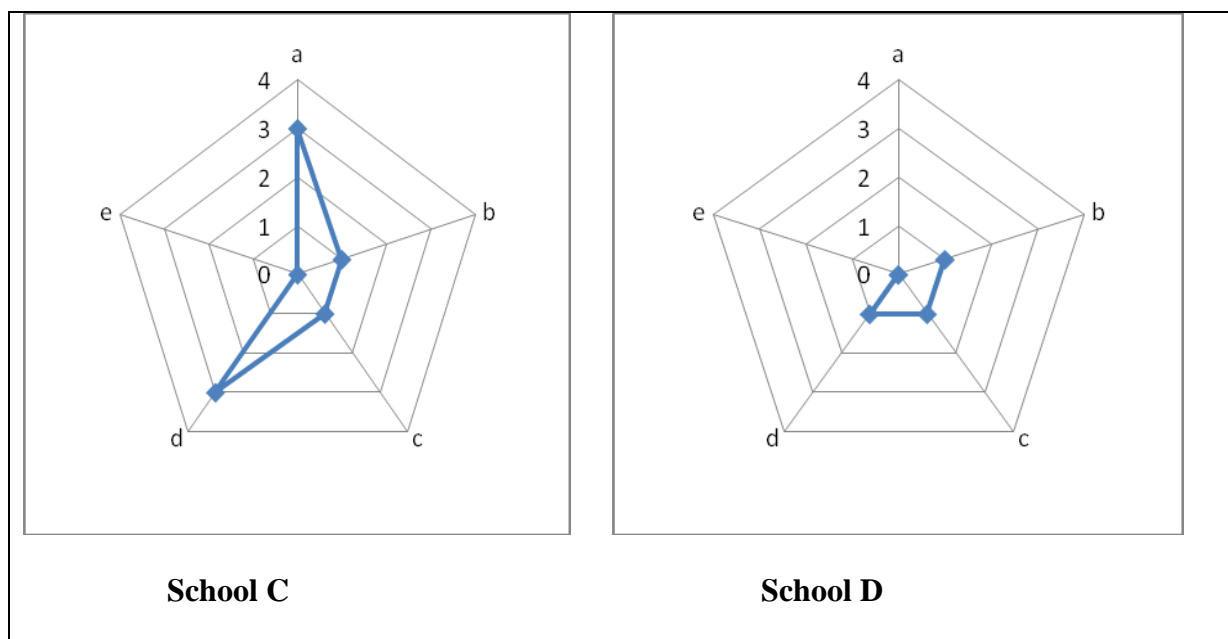


Figure 11.3 The overall extent of NRM integration in the Grade 10 Life Sciences written texts at the four case study schools

Key to classification levels

0: insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators

a: Percentage of topics which contain reference to NRM; **b:** Percentage of pages which contain reference to NRM; **c:** Percentage of illustrations based on NRM; **d:** Percentage of class work questions based on NRM; **e:** Nature of reference to NRM in the Life Sciences project(s)

11.6.3 The schools’ end-of-year Grade 10 Life Sciences examination papers

This section presents the analysis of the extent of NRM integration in the schools’ end-of-year examination for Grade 10 Life Sciences for the year 2007. As explained earlier, this analysis involved the same criteria and indicators as the ones that were used in the analysis of the national examination exemplars (see Section 9.5.4). The results are presented per indicator.

Indicator a: Percentage of questions based on NRM

This indicator analysed the extent of NRM integration in the examination papers based on the premise that the higher the proportion of NRM-based questions contained in a paper, the stronger the extent of NRM integration. The examination paper from School C had the highest proportion of such questions (20%), followed by School A (5%). Based on the scaling grid of this indicator (see Table 9.8), the extent of NRM integration was judged to be very strong (*classification level C- -*), and strong (*classification level C-*) for Schools C and A,

respectively. Both Schools B and D contained no questions on NRM, which places them at *classification* level C+ +, indicating very strong isolation between NRM and Life Sciences in the questions contained in these schools' examination papers.

Indicator b: Percentage of marks allocated to questions based on NRM

This indicator was used to analyse the extent of NRM integration based on the assumption that the higher the marks allocated to NRM-based questions, the stronger the examination paper's extent of NRM integration. Marks allocated to questions which were based on NRM formed 19% and 4% of the total marks for the question paper from Schools C and A, respectively. The question papers from Schools B and D contained no questions based on NRM. Based on the scoring grid of this indicator (see Table 9.8), the extent of NRM integration in the examination papers from Schools C and A was judged to be very strong (*classification* level C- -), and strong (*classification* level C-), respectively. The extent of NRM integration in the examination papers from Schools B and D was judged to be very weak (*classification* level C+ +), indicating very strong isolation between NRM and Life Sciences in the allocation of marks in both examination papers.

Indicator c: Percentage of illustrations based on NRM

The use of illustration such as drawings, tables, graphs or flow charts to convey scientific information is a common practice in the Life Sciences examinations. The examination questions may ask the learner to either draw the required illustration, or the paper may contain already drawn illustrations on which questions are based. This indicator analyses the extent of NRM integration based on the argument that the higher the percentage of NRM-based illustrations in the examination paper, the stronger the extent of NRM integration. The examination paper from school A could not be analysed using this indicator because the paper contained no illustrations at all. Based on the scaling grid for this indicator (see Table 9.8), this paper was therefore given a *classification* level of 'O'. The question papers from Schools B, C, and D contained five, six and one drawing(s) respectively, none of which were based on NRM. For example, the single illustration in the paper from D was that of a human skeleton, while all the illustrations in the paper from School B were on cell structure. Based on the scaling grid for this indicator, the extent of NRM integration in the examination papers from the three schools was judged to be very weak, and was allocated a *classification* score of C+ +, indicating very strong isolation between NRM and Life Sciences in the illustrations used in these schools' examination papers.

Indicator d: Percentage of investigations based on NRM

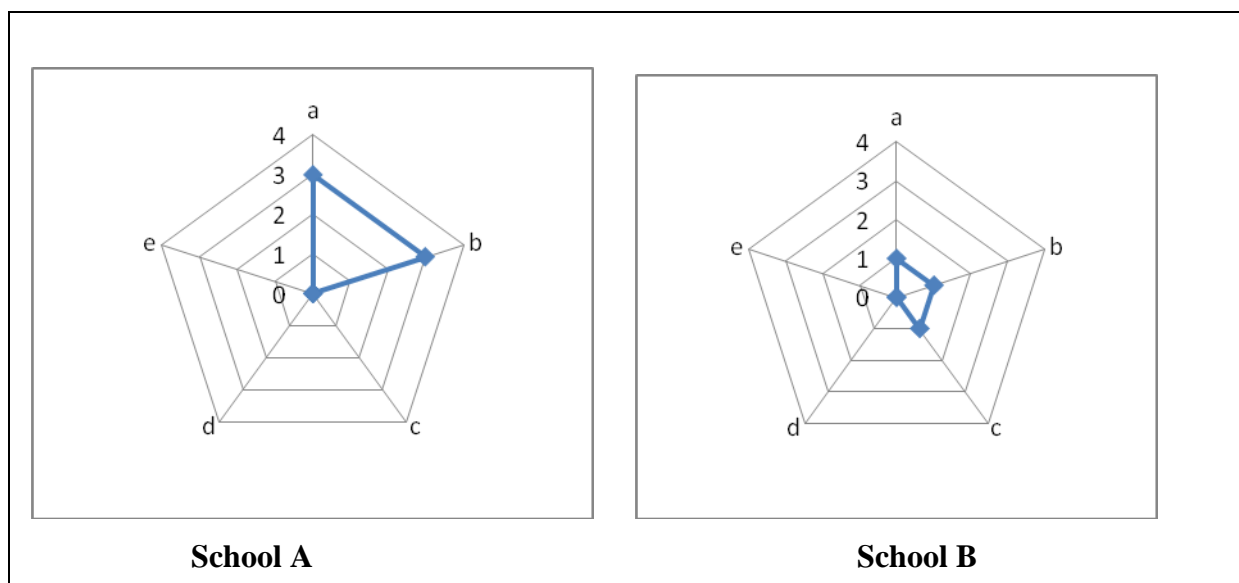
This indicator was used to analyse the extent of NRM integration based on the assumption that the higher the percentage of NRM-based investigation contained in the question papers the stronger the extent of NRM integration. None of the four examination papers contained questions which were based on investigations. Therefore the extent of NRM integration based on this indicator could not be established, and based on the scaling grid for this indicator (see Table 9.8), a *classification* score of ‘O’ was allocated to all four questions papers.

Indicator e: Nature of reference to NRM in the essay question

This indicator analyses the extent of NRM integration in the examination papers based on the nature of reference to NRM within the compulsory essay question (see Section 9.2.4). The assumption made was that explicit reference to NRM in the essay question reflects very strong NRM integration, while lack of any reference to NRM in the essay question depicts very strong isolation between the Life Sciences discourse and that of NRM. Close scrutiny of the four examination papers showed that none of them contained essay type questions. Hence the extent of NRM integration based on this indicator could not be determined due to the absence of the necessary data. Based on the scaling grid for this indicator (see Table 9.8) a *classification* level of ‘O’ was allocated to each examination paper.

Overall Results

The overall extent of NRM integration in the schools’ end-of-year examination papers for Grade 10 Life Sciences for 2007 is illustrated in the radar diagrams below.



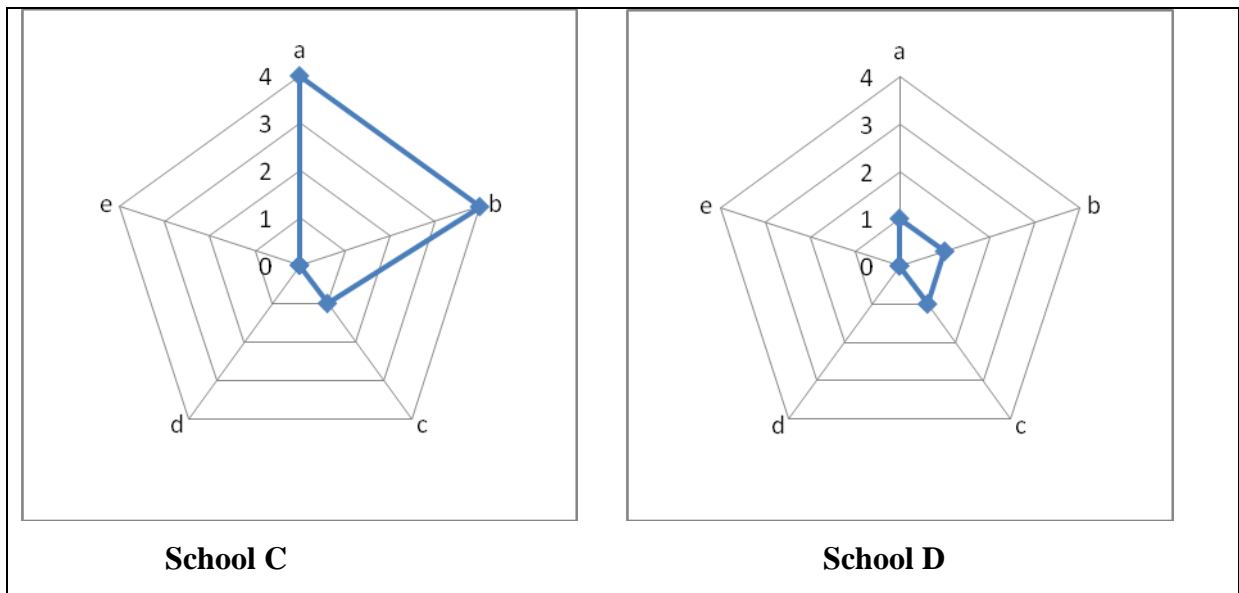


Figure 11.4 The overall extent of NRM integration in the schools' end-of-year examination papers for Grade 10 Life Sciences for 2007

Key to classification levels

0: insufficient data for analysis; **1:** C ++ (very weak NRM integration); **2:** C+ (weak NRM integration); **3:** C- (strong NRM integration); **4:** C- - (very strong NRM integration)

Key to indicators

a: Percentage of questions which are based on NRM; **b:** Percentage of marks allocated to questions based on NRM; **c:** Percentage of illustrations based on NRM; **d:** Percentage of investigations based on NRM; **e:** Nature of reference to NRM in the essay question

11.7 CONCLUSIONS

This chapter analysed the extent of NRM integration in the reproduction field, which, as discussed in Section 1.5 and Section 7.7.2, forms the third and last field of pedagogic discourse. The analysis was conducted separately at school level, and at classroom level, using the same type of analytical tools and procedures as were used in the analysis of the ORF and PRF texts and activities (see Chapter 9 and 10). The analysis of the extent of NRM integration at school level involved out of class school activities, practices and documents. Eight criteria structured the analysis of the extent of NRM at this level, which were: school's vision and mission statements, school policy, educational resources, school space, environmental clubs, Eco-Schools programme, school celebrations and recognition of excellence. The analysis of the extent of NRM integration at classroom level involved 'best of practice' Grade 10 Life Science lessons at the four case study schools, Grade 10 Life Sciences written texts, and the schools' end-of-year Grade 10 Life Sciences examination paper for 2007. The criteria used to analyse the lessons were: lesson content; oral questions; teaching and learning materials; written notes; and assessment tasks. The criteria used to

analyse the written texts were: lesson topic; page contents; illustrations; class work questions; and project topic. The schools' end-of-year Grade 10 Life Sciences examination papers were analysed under the same criteria as the national examination exemplars that were analysed as part of the official Grade 10 Life Sciences texts. These criteria were: question topics; allocation of marks; illustrations; investigations; and essay question. As described in Section 8.8, each criterion was linked to one indicator which was used to describe the condition of that criterion with regard to the extent of NRM integration. Each indicator had a scaling grid which was used to grade the performance of that indicator in terms of *classification* levels. As before the overall extent of NRM integration both at school level and at classroom level was illustrated with the aid of radar diagrams, for each of the four case study schools.

The next chapter summarises the results of the analysis of the extent of NRM integration in the different items which were analysed in the ORF, PRF and reproduction field. It also compares the extent of NRM integration between the ORF, the PRF and the reproduction field, and discusses the implications of the results have for the curriculum implementation process regarding NRM discourse within the Grade 10 Life Sciences curriculum in Eastern Cape's under- resourced rural schools.

CHAPTER 12

DISCUSSION

12. I INTRODUCTION

As explained earlier, this study was motivated by a need to address the specific educational requirements of rural communities in the Eastern Cape Province (see Chapter 1), which placed the study's core interest area within the field of rural education. Chapter 2 (Rural Education) was devoted to analysing the major challenges and trends regarding rural education in South Africa. The need to bring to the fore curriculum and other qualitative aspects of rural education discourse was discussed in Section 1.3.3. Chapter 3 (Curriculum) was written in an attempt to provide illumination and better understanding of the main issues regarding the curriculum debate in South Africa, and how they have impacted on education and environmental learning, especially in South Africa's rural disadvantaged education sector. Contextualising learning through a focus on local natural resources is one strategy by which curriculum relevance in Eastern Cape's rural schools can be enhanced (see Section 1.3.3). Chapter 4 (Natural Resource Education) was written with the aim of illustrating major trends in environmental learning thinking and approaches in South Africa, and how they have influenced natural resource education classroom practices, especially in South Africa's rural poor schools. One major development in environmental learning discourse has been the adoption of an integrated approach. Chapter 5 (Curriculum Integration) provided an analysis of the curriculum integrationist movement, and identified the lack of a research base as one of the major challenges in the field. The chapter also served as an introduction to Basil Bernstein's sociological approach to curriculum integration research, which formed the basis of the investigations which were carried out in the study.

The major goal of the study was to analyse the extent of NRM integration in the different fields which constitute pedagogic discourse, according to Bernstein (1990, 1996) (see sections 1.6 and 7.7.2). The extent of NRM integration at different levels of pedagogic discourse acted as a 'lens' through which the trajectory of the curriculum recontextualisation process involving NRM discourse within the Grade 10 Life Sciences curriculum, in a rural under-resourced education context was investigated. Three main fields of pedagogic discourse, namely the ORF, the PRF, and the reproduction field were introduced in Chapter 1 and discussed in more detail in Chapter 7. Chapter 8 detailed the analytical tools and the

procedures that were used to obtain data on the extent of NRM integration in various ORF, PRF and reproduction field documents, practices and activities that were analysed as part of the study's investigations. Chapter 9 discussed the analysis of the extent of NRM integration in the ORF documents and presented the results. Chapters 10 and 11 analysed and presented the results of the extent of NRM integration in the PRF and in the reproduction field, respectively.

This chapter summarises the major findings of the previous three chapters, with the aim of linking them together into a coherent picture. The chapter also serves as a space for discussing and reflecting on the major findings of the study in the contexts of past similar studies, the study's theoretical underpinnings, and a wider study context. I will summarise and discuss the research findings under the main headings of the extent of NRM integration in the:

- Official recontextualising field (ORF),
- Pedagogic recontextualising field (PRF), and
- Reproduction field

12.2 THE EXTENT OF NRM INTEGRATION IN THE ORF

12.2.1 Introduction

As was explained in Chapter 9, the ORF Grade 10 Life Sciences texts that were analysed were produced by the National Department of Education, and by the Provincial (Eastern Cape) Department of Education. The National Department of Education texts that were analysed were:

- *National Curriculum Statement Grades 10-12 (General) Life Sciences* (South Africa. DoE, 2003),
- *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programme Guidelines* (South Africa. DoE, 2007a),
- *National Curriculum Statement Grades 10-12 (General) Life Sciences Subject Assessment Guidelines* (South Africa. DoE, 2007b), and
- *The National Curriculum Statement Grade 10 Life Sciences examination exemplars* (Paper 1 and 2) (South Africa. DoE, 2006).

The study showed that overall the NRM discourse was very strong in the national Grade 10 Life Sciences texts, although differences existed between the individual texts (see Section 9.7). The overall extent of NRM integration was highest in the *National Curriculum Statement (NCS) Grades 10-12 (General) Life Sciences Learning Programme Guidelines* (see Section 9.7.2), and in the *National Curriculum Statement (NCS) Grades 10-12 (General) Life Sciences* (see Section 9.7.1), where three of the indicators that were used in the analysis registered very strong extent of NRM integration. Compared to the rest of the national documents, the extent of NRM integration was lowest in the *National Curriculum Statement Grade 10-12 (General) Life Sciences Subject Assessment Guidelines*, where only one of the five indicators registered very strong NRM integration, and two indicators showed very weak NRM integration (see Section 9.7.3). Apart from this document, indicators which recorded weak/very weak extent of NRM integration were either absent (as in the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programme Guidelines*) or in the minority (as in the *National Curriculum Statement Grades 10-12 (General) Life Sciences* and in the *National Curriculum Statement Grade 10 Life Sciences examination exemplars*).

The strong status accorded to the NRM discourse in the majority of the national official Grade 10 Life Sciences curriculum documents can be explained by Bernstein's propositions. According to his model of pedagogic discourse (Bernstein, 1996), the production of pedagogic discourse is informed by the dominant principles of society. Bernstein explains that these principles are generated at the state level, and are influenced by the fields of physical production, symbolic control, and international thinking and practices. These principles constitute the generative regulative discourse (GRD) of which South Africa's Constitution forms part. Agents of the state within and associated with the National Department of Education converted the principles underpinning the GRD into specific educational policies concerning the teaching, learning and evaluation of NRM within the Grade 10 Life Sciences curriculum in a process which Bernstein (1996) calls primary contextualisation.

What Bernstein's model of pedagogic discourse informs us is that the origin of the NRM discourse that features so strongly in the national Grade 10 Life Sciences pedagogic texts can be traced back to the country's basic principles of power and control and social order that are embedded in the country's GDR/Constitution (see Section 7.7.2). This fact is also alluded to in the *National Curriculum Statement (NCS) Grades 10-12 (General) Life Sciences* (South

Africa. DoE, 2003), where it is stated that the curriculum is underpinned by the principles of environmental justice which is derived from the country's Constitution. South Africa's Bill of Rights specifies the need to have the environment protected for the benefit of present and future generations, through reasonable legislative and *other measures* that prevent ecological degradation, and secure ecologically *sustainable development of natural resources* (italics mine) while ensuring justifiable economic and social development (RSA, 1996d, p. 1251).

The above named principles were delocated from the Constitution by Grade 10 Life Science curriculum planners within the National Department of Education, and other agents (see Section 7.7.2) and converted into NRM discourse within the Grade 10 Life Sciences curriculum. However, drawing on the ideas of Bernstein (1990, 1996) and Neves and Morais (2001a), this transfer of the dominant principles of society into NRM pedagogic discourse was not a mechanical process since it created a space for ideological changes to the discourse. According to Singh (1997) ideological changes cause changes to power and control relationships which not only affect the knowledge content of the discourse, but also its organisation, transmission and acquisition.

12.2.2 The Provincial Grade 10 Life Sciences texts

The provincial Grade 10 Life Sciences pedagogic texts which were analysed were:

- *The Subject Framework for Grades 10-12* (Eastern Cape Department of Education, 2006a),
- *The Assessment Syllabus for Life Sciences Grades 10-12* (Eastern Cape Department of Education, 2006b), and
- *The National Curriculum Statement Grades 10-12 Life Sciences Resource Pack* (Eastern Cape Department of Education, 2006c).

The three provincial texts showed variations in the overall extent of NRM integration (see Section 9.8). The overall extent of NRM integration was strongest in the *Subject Framework for Grades 10-12*, and the *National Curriculum Statement Grades 10-12 Life Sciences Resource Pack*, where the majority of the indicators used during the analysis recorded strong/very strong extent of NRM integration (see Sections 9.8.2 and 9.8.3). The overall extent of NRM integration was weakest in the *Assessment Syllabus for Life Sciences Grades*

10-12 where only one out of the nine indicators used to analyse this document showed very strong NRM integration, and seven indicators showed weak NRM integration (see Section 9.8.1).

When the texts produced at national level are compared with those that were produced at provincial level, the former showed stronger overall extent of NRM integration. Of the 21 indicators used to analyse the four national documents, the majority (16:76%) fell in the category of strong/very strong extent of NRM integration, while those which registered very weak NRM integration were the minority (2:10%). Of a total of 18 indicators which were used to analyse the three provincial documents, only 8 (44%) showed strong/very strong NRM integration, the majority of the indicators (9:50%) falling in the weak/very weak NRM integration category. These results point to a definite decrease in the status of the NRM discourse in the provincial Grade 10 Life Sciences texts when compared to that in the national texts.

The provincial Department of Education functions as a subfield of the ORF, and its agents and agencies further recontextualise the Grade 10 Life Sciences curriculum, and the NRM discourse that is embedded in it. It is interesting that the recontextualisation process at provincial level led to change (a definite overall weakening) in the extent of NRM integration within the Grade 10 Life Sciences curriculum texts. The causes of this weakening were not part of this research project, and as such can only be speculated on here.

The degree to which the agents and agencies of the provincial ORF are able to stamp their pedagogic ideology on the Grade 10 Life Sciences curriculum (and its accompanying NRM discourse) depends on a number of factors. Morais (2006, p. 8) notes that rather than being stable, the dominant principles that shape the GRD are subject to contestation and resistance from various agents and agencies in the ORF. Hence the degree of autonomy that exists between various subfields of the ORF, and that between agents in a given subfield is a key factor in the recontextualising process. It could be that the Eastern Cape Department of Education enjoys some autonomy from the National Department of Education, allowing a different set of ideologies and interests to influence the recontextualisation of the NRM discourse within the Grade 10 Life Sciences curriculum. Lotz-Sisitka (personal communication, April, 14, 2008) points out that the environmental education lobbying groups, the EEPI and EECI, were more active at national level than provincial level in the

post-apartheid curriculum reform process. Another possible contributory factor to the general weakening of the NRM discourse within the Grade 10 pedagogic discourse at provincial level could be the fact that contextual factors in the department such as funding, skills and resources make it difficult for the agents/agencies at this level of pedagogic discourse to reproduce the curriculum messages contained in the ORF texts, as shown by the failure to provide further elaboration of the Assessment Standards in one of the provincial Grade 10 Life Sciences documents (see Section 9.8.2). Yet another possible contributory factor mentioned by Morais (2006) is the resistance and inertia among the political and administrative agents of the provincial ORF.

The discussion of the structure and organisation of the National Department of Education, and that of the Provincial Department of Education in the Eastern Cape (see Section 6.5) showed the different agencies and agents that are concerned with the Grade 10 Life Sciences curriculum. As noted by Bernstein (1996), the existence of multiple recontextualising sites and contexts contributes to a higher degree of recontextualisation, which creates potential opportunities for change. The fact that Grade 10 Life Sciences curriculum documents contained different overall extents of NRM integration could be evidence of the relative autonomy enjoyed by the various recontextualising sites concerned with the Grade 10 Life Sciences curriculum within these departments.

12.3 THE EXTENT OF NRM INTEGRATION IN THE PRF

As explained in Section 10.2.1, the analysis of the extent of NRM integration in the PRF involved two Grade 10 Life Sciences textbooks, and in-service teacher professional development programmes in the form of two workshops for Life Sciences teachers.

12.3.1 Textbooks A, and B

I analysed two textbooks (Textbooks A and B) as examples of Grade 10 Life Sciences pedagogic texts that were produced in the PRF, that were available at the four case study schools of this research project. In both textbooks, the indicators that showed strong/very strong extent of NRM integration formed the majority (see Section 10.4.1). For Textbook A this figure was six indicators out of the eight indicators which were used in the analysis (75%), while in Textbook B the corresponding figure is three out of the six indicators which were used (50%). Hence the results showed that in both textbooks, the NRM discourse was strong, although it was much stronger in Textbook A than in Textbook B

The results also showed that there was unevenness in the strength of the NRM discourse within the two textbooks when compared to that in the national ORF texts. While the percentages of indicators which recorded strong/very strong NRM integration in Textbooks A and in the national texts are comparable (75% and 76%, respectively), the corresponding percentage in Textbook B is markedly lower. Thus it appears that between the national ORF and Textbook A, the overall strength of the NRM discourse in the Grade 10 Life Sciences curriculum was more or less the same, while in the case of Textbook B, the NRM discourse lost some of its strength.

The school textbooks represented pedagogic texts that were produced after the first recontextualisation process, which takes place in the PRF. According to Bernstein (1996, 2000), in addition to textbook publishing houses, the PRF is constituted by other agents such as university education departments, NGOs, teacher unions and state departments other than the education department. What emerged from this study is that the two textbooks were the sole PRF texts that were available at the four case study schools. Grade 10 Life Sciences pedagogic texts produced by other agents and agencies within this field were conspicuous by their absence in all four schools. Bernstein (1996) refers to a struggle between the various agents and agencies of the PRF for the control of the recontextualisation process, so as to determine the content of pedagogic discourse and how that content is transmitted and evaluated. As far as the four schools in the study are concerned, within the PRF, the content and form of the NRM pedagogic discourse within the Grade 10 Life Sciences curriculum seems to be solely controlled by the publishers of the Textbooks A and B.

The central role played by school textbooks in curriculum reform contexts, especially in disadvantaged education contexts, was highlighted by Taylor, Muller, and Vinjevold (2003), and in the Review Committee Report on C2005 (South Africa. DoE, 2000). One of the recommendations made by the Review Committee Report on C2005 towards effective curriculum reform implementation is the provision of high quality school textbooks. Good quality textbooks are especially important in poor and under-resourced education contexts, since they provide under privileged learners with access to higher knowledge forms which their under qualified and inexperienced teachers might lack (Taylor, Muller & Vinjevold, 2003). In NMF (2005, p. 86) it was noted that without textbooks and other educational materials, children learn only what they are told by their teachers, and do not have the opportunity to discover information for themselves.

The lack of relevant textbooks and other educational materials in South Africa's rural schools has been reported in by numerous studies, one recent example being that by NMF (2005), where 71% of the teachers interviewed cited lack of teaching aids as one of their most important problems. The school principals of the four schools which participated in this study complained about the lack of funds to buy enough textbooks for their schools (see Section 6.5.4). In addition, the Review Committee Report on C2005 (South Africa. DoE, 2000) noted that the quality of textbooks in South Africa is inconsistent. The Review Committee Report on C2005 made a number of recommendations towards improved provision of quality textbooks to schools. They include increased funding to schools to purchase more textbooks and other educational materials; the establishment of mechanisms which speed up the delivery of textbooks to schools; providing textbook publishers with guidelines on expected textbook content for each subject; and training teachers in textbook selection so that they are able to make informed textbook choices.

Equally important as the availability of quality school textbooks, is their productive use by teachers and learners, especially during class. Taylor and Vinjevold (1999) cited several examples of reports on classroom practice in South Africa's poor schools where teachers and learners failed to make adequate use of the textbooks they had in their possession. Similar observations were made during this study (see Section 11.7.1). The need for effective use of textbooks was highlighted by Taylor, Muller and Vinjevold (2003). Similarly, the Review Committee Report on C2005 (South Africa. DoE, 2000), the NEEP-GET and *Learning for Sustainability* projects recommended that teachers be trained in the effective use of textbooks and other educational materials during teaching.

Bernstein (1990, 1996) stresses the importance of the 'space' between the ORF and the PRF, and between the various agents and agencies of the PRF, since they may have opposing ideological positions. He notes that there is a tendency for governments the world over to reign in the PRF, thereby exerting more direct influence on the 'what' and 'how' of classroom practice. I did not investigate this dimension of the recontextualising process. However a comparison of the extent of NRM integration in the textbooks and in one of the more accessible national Grade 10 Life Sciences texts, the exemplar examination papers, provides useful insight into this relationship.

Being nationally produced textbooks, it can safely be assumed that the publishers of Textbooks A and B made use of the national Grade 10 Life Sciences texts (rather than the provincial documents) in the writing of these textbooks. That in both textbooks the overall extent of NRM integration was high is a telling factor about the influence of the ORF, at least as far as the NRM discourse within the Grade 10 Life Sciences curriculum is concerned. One does not need to look further than the Grade 10 Life Sciences national examination exemplars, which had four of the five indicators used in the analysis registering strong/very strong extent of NRM integration (see Section 9.7.3). Bernstein (1990, p. 202) observes that ‘... the state through highly centralized curricula and system of assessment (...) can severely limit the influence of the pedagogic recontextualising fields’. It could be that the Grade 10 Life Sciences ORF is exerting its control on the PRF through the centralised assessment system for the subject, forcing agents and agencies in the PRF to adhere to the official NRM discourse within the Grade 10 Life Sciences curriculum. It can also be tentatively concluded that since the two textbooks differed in the extent (and pattern) of NRM integration, the two publishing houses which issued the two textbooks enjoy a certain degree of autonomy from each other. Although this did not form part of this study, further insight into the relationship between the ORF and the textbook publishers in the PRF can be gained by comparing the NRM themes which are covered in the official Grade 10 Life Sciences texts with those contained in the Grade 10 Life Sciences textbooks.

12.3.2 The teacher in-service training workshops

I analysed the extent of NRM integration in the in-service teacher training workshops run by the King William’s District Education Office, where Mr C who is a Senior Subject Specialist for Life Sciences is stationed (see Section 10.3). The four case study schools of this project fall under the King William’s District Education Office (see Section 6.5.3). According to Bernstein’s model of the fields of pedagogic discourse, the King William’s District Education Office represents a recontextualising site within the PRF, and Mr C is a recontextualising agent at this site. As reported in Section 10.3.2, I used five indicators to analyse the extent of NRM integration in the workshops that were run by Mr C for the Life Sciences teachers in the Peddie Circuit Education office, where the four case study schools are located.

The results indicated very weak overall extent of NRM integration in these workshops, with four of the five indicators used in the analysis recording very weak extent of NRM integration (see Section 10.4.2). The study also revealed the lack of production of Grade 10

Life Sciences pedagogic texts at this recontextualising site, apart from the photocopying of ORF documentation for distribution to schools.

Taylor, Muller and Vinjevold (2003) view districts as the most appropriate level of government to initiate and sustain school reform, due to their proximity to schools. Janse van Rensburg and Lotz-Sisitka (2000) identified five major competencies required of curriculum support staff at district level, which include: providing professional support to teachers; informing teachers of new regulations and policies; monitoring of teachers' work; and performing various other administrative duties. However, Janse van Rensburg and Lotz-Sisitka (2000) noted that many districts in South Africa are ill equipped to perform these functions. Their overall conclusion was that the capacity of district education offices to implement educational policies was severely lacking in South Africa's poor provinces. It was reported in (NMF, 2005) that the few visits made to schools by district officials were more to do with administration than pedagogy and curriculum. In the Review Committee Report on C2005 (South Africa. DoE, 2000) factors which are named as hindering the capacity of district officials to carry out their duties effectively were: organisational problems; shortage of qualified staff; lack of training; and inadequate funding. Similar problems were noted in NEEP-GET (2005), in addition to lack of clarity over job descriptions, work overload, and a general lack of motivation among district staff. Especially relevant to this study, was the noted lack of environmental education training for most of the curriculum support staff at district level, coupled with a general absence of the required skills to conduct effective professional development activities for teachers. While strides have been made towards the professional development of curriculum support staff in a limited number of South Africa's districts through such initiatives such as the *Learning for Sustainability* and NEEP-GET projects (see Section 6.8), there is a need for similar projects in the rest of South Africa's poor districts, coupled with strategies which ensure their sustainability once external funding is over, or when participating staff leave for other positions.

12.4 THE EXTENT OF NRM INTEGRATION IN THE REPRODUCTION FIELD

As explained in Section 11.2, the analysis of the extent of NRM integration in the reproduction field was split into school level analysis, and classroom level analysis.

12.4.1 The school level analysis

At school level the analysis involved the extent to which NRM was integrated into out of class school activities, practices and documents at the four case study schools (see Section 11.2). The analysed items consisted administrative, organisational and extracurricular school activities and practices and any associated documentation produced by the school. Eight criteria structured the analysis of the extent of NRM integration at school level, and the analytical tools consisted of eight indicators with their corresponding scaling grids (see Section 11.3.2).

None of the eight indicators used in the analysis registered strong/very strong extent of NRM integration at any of the four schools (see Section 11.5). The majority of the indicators recorded very weak NRM integration for all four case study schools. This means that all the analysed out of class activities, practices and documents at all the four schools integrated little or no NRM.

12.4.2 The classroom level analysis

As explained in Section 11.4, the classroom level analysis involved a sample of Grade 10 Life Sciences lessons, Grade 10 Life Sciences written texts, and the schools' end-of-year Grade 10 Life Sciences examination paper for 2007.

A total of 15 lessons were observed during the study, and all of them were treated as 'best practice lessons' since prior arrangements were made with the teachers before conducting the class visits. Of the five indicators which were used in the analysis, only one 'Nature of reference to NRM in the lesson topics' registered very strong extent of NRM integration, and this was only at School A and School C, and during only one lesson (see Section 11.7.1). The rest of the indicators (for which data were available) registered weak/very weak extent of NRM integration at all the four schools, which resulted in very weak overall extent of NRM integration in the observed lessons for all the four schools. The overall extent of NRM integration in the observed lessons was particularly weak at School B where all the indicators that were used in the analysis registered very weak NRM integration.

The Grade 10 Life Sciences written texts which were analysed consisted of the teachers' Grade 10 Life Science class notes, and the learners' class work. As explained before, these texts were combined and analysed together as a single unit (see Section 11.7.2).

The results showed very weak overall extent of NRM integration in the written texts of all the four schools, especially at Schools A, B, and D, where the majority of the five indicators used in the analysis showed weak/very weak extent of NRM integration (see Section 11.7.2). Of the four schools which took part in the study, the overall extent of NRM integration in the Grade 10 written texts was strongest at School C, where two of the five indicators registered strong NRM integration. This means that in the majority of all the written texts that were analysed, there was little or no mention of NRM. The results also showed that some indicators could not be used to analyse the extent of NRM integration in the Grade 10 Life Sciences written texts due to the absence of the necessary data in the written texts. This was especially so for the indicator ‘Reference to NRM in the Life Sciences project(s)’ whose necessary data were absent in texts of three of the four schools. Only one school (B) had the appropriate data for the use of this indicator in the analysis, but even then, it registered very weak extent of NRM integration.

As explained before, I analysed the schools’ end-of-year Grade 10 Life Sciences examination papers using the same five indicators that I had used in the analysis of the national examination exemplars (see Section 11.4.4). The results showed that although there were variations in the extent of NRM integration across the school examination papers of the four schools, the overall strength of the NRM discourse in each paper was very weak (see Section 11.7.3). The overall extent of NRM in the examination papers of School B and D was particularly very weak, with all the three indicators for which data were available registering very weak extent of NRM integration. The NRM discourse was strongest in the examination papers of Schools C and A, where two of the five indicators used in the analysis fell in the category of strong/very strong extent of NRM integration. The results also showed that for all the four examination papers, two indicators ‘Percentage of investigations that are based on NRM’ and ‘Nature of reference to NRM in the essay question’ could not be used in the analysis due to the absence of the necessary data, were allocated a classification score of ‘O’ (see Section 12.6).

12.5 DISCUSSION OF THE RESULTS

Two major issues emerged from the findings on the extent of NRM integration in the reproduction field. The first one concerns the occurrence of a number of key criteria of NRM integration in some of the items which were analysed for which there were no data on which to base the analysis. This happened for particular criteria across all four schools, or for

different criteria within a given school. This was especially so during the analysis of the school's Grade 10 Life Sciences written texts, and the end-of-year Life Sciences examination papers (see Section 11.7).

How to deal with the absence of data for key criteria in an item posed a major challenge. In the first instance, it forced me to reconsider my earlier research design approach in which I had let the criteria which structured the analysis emerge from the data that were available. For example, during the analysis of the ORF and PRF texts (see Chapters 9 and 10, respectively), I carefully scrutinised each document, and supplemented by literature review work on educational policy in South Africa and pedagogical approaches in environmental education (see Section 6.7 and 6.8), I came up with what I considered to be key criteria of the documents under which the analysis was to be conducted.

However, this time around, during the analysis of the extent of NRM integration in the Grade 10 Life Sciences lessons, written texts and school examination papers, informed by literature in the fields of South Africa's education policy and environmental education, I let what *should be there* determine the criteria under which I conducted the analysis, rather than what *was actually there*. For example, although none of the schools' written work included a research project, according to *National Curriculum Statement Grades 10-12 (General) Life Sciences Subject Assessment Guidelines* (South Africa. DoE, 2007b), research projects are one of the major assessment tasks in Grade 10 Life Sciences. Therefore the criterion of 'Research project(s)' was included in the analysis of the written texts. Similarly, the criterion of 'Essay question' was included in the analysis of the schools' end-of-year examination papers, although none of the schools' end-of-year examination papers contained essay-type questions, since according to official policy, as is stated in the assessment guidelines, and is reflected in the national Grade 10 Life Sciences examination exemplars, assessment in Grade 10 Life Sciences should include such questions.

As a result of adopting this approach to the analysis, I found that Bernstein's four-point scale was no longer entirely adequate for the analysis of the extent of NRM integration. This was because this scale starts with a minimum notch of 'very weak', which presupposed not only a certain minimum extent of integration, but also *the existence of the necessary data in every instance where the extent of integration is being analysed*. This was not always so in this research. Examples of criteria for which there was insufficient data or no data at all on which

to base the analysis included the 'Research project(s)', and 'Illustrations' during the analysis of the Grade 10 Life Sciences written texts, and the criteria of 'Illustrations', 'Investigations' and 'Essay question' during the analysis of the schools' end-of-year Grade 10 Life Sciences examination papers. The lack of the necessary data meant that only partial analysis of the extent of NRM integration could be carried out on those texts, lessons etc. I wanted this absence of key data and the resultant non-analysis of key criteria in the lessons or texts etc. to be reflected in the overall extent of NRM integration that emerged from the analysis. Hence my decision to include an extra category of 'O' to cater for those cases where key criteria of NRM integration could not be analysed due to missing or insufficient data.

The lack of fit between Bernstein's *classification* scale and South Africa's education context is not something new. The unsuitability of Bernstein's original scale of *classification* (and *framing*) to analyse models of pedagogy in South Africa's disadvantaged classrooms has been commented on by Hugo et al. (2006) (see Section 7.9 where this was discussed in detail). For example, during classroom observations in a working class classroom in the Western Cape Province of South Africa, Hoadley (2005) was compelled to expand Bernstein's scale of framing (F+ +; F+; F-; and F- -) by another notch of 'F⁰', to capture those instances when there was a breakdown in the pedagogic delivery system, resulting in a lesson whose quality was questionable. On the other hand, there are researchers who have found Bernstein's scale of *classification* and *framing* too broad and have whittled it down to three or two notches. For example, Bertram (2005) and Neves and Morais (2001a) compared curriculum documents of different time periods using the three point scales of C+ +; C + and C -, and F+ +; F +; and F- for *classification* and *framing*, respectively. Hugo et al. (2006) take a different route to the problem altogether and recommend that the Bernstein's scale of *classification* be used in conjunction with Bloom's Revised Taxonomy. This later approach to overcoming the limitations of Bernstein's *classification* scale is suitable for those studies that seek to analyse the nature of the (NRM) knowledge that is being transmitted during pedagogic discourse. I did not apply this approach to my study because my focus was on analysing the extent of NRM integration, rather than the quality of the NRM knowledge that features in that integration.

The second major issue that emerged from the reproduction field findings was the disjuncture between the underlying messages carried by the ORF texts and the school textbooks regarding the teaching and learning of NRM, and what was actually taking place at the four

schools, both inside and outside the classroom. That in most cases the Grade 10 Life Sciences teachers at the four schools recontextualised the ORF texts and the textbooks, and decided to leave out the strong NRM discourse in their teaching and evaluation practices speaks volumes about the nature of ‘space’ between the reproduction field, and the ORF, or the PRF (as represented by the textbook publishers). Bernstein (1996) maintains that the context of the school and the effectiveness of external control over it are decisive factors in the recontextualisation process at reproduction field level. Similar views are held by Neves and Morais (2001a) who point out more factors that affect the implementation of the official discourse in the reproduction field, for example, the ideology of the teacher, and the fact that the teachers may simply fail to read or follow what is stated in the curriculum documents. These authors further note that the absence of an effective monitoring mechanism creates opportunities for teachers to effect change to the official discourse if they do not identify with the pedagogic ideology that underlies that discourse.

Using a ‘different’ language, but carrying a similar message, Ruhinda (2004) identified the lack of funding, shortages of appropriate teaching and learning materials, educators’ inadequate knowledge about environmental education, and ineffective teacher support especially from the education department and parents, as the major factors which constrained environmental learning and teaching at two schools in the Lusikisiki District of the Eastern Cape. Maila’s (2003) list of challenges to the implementation of environmental learning in schools included lack of support for environmental learning by the school community, educators’ lack of skills and experience with the development and use of teaching and learning relevant to environmental education, the negative perceptions accorded environmental learning, unclear job descriptions for educators regarding their role in environmental learning, and historical and structural factors. Which of the above named factors were at play during the recontextualising process of the NRM discourse within the Grade 10 Life Sciences curriculum at the four case study schools of this study is an issue that demands further investigation.

12.6 CONCLUSIONS

This chapter served three major functions. The first function was to summarise the study’s major findings regarding the extent of NRM integration in the three of the fields that constitute pedagogic discourse, which are the ORF, the PRF and the reproduction field. The analysis of the extent of NRM integration in the ORF involved national and provincial Grade

10 Life Sciences documents. The results from the analysis of the national documents revealed very strong overall extent of NRM integration in the *National Curriculum Statement Grades 10-12 (General) Life Sciences Learning Programme Guidelines* and in the *National Curriculum Statement Grades 10-12 (General) Life Sciences*, where most of the indicators used in the analysis registered strong/very strong extent of NRM integration. Among the national documents that were analysed, the overall extent of NRM integration was lowest in the *National Curriculum Statement Grade 10-12 (General) Life Sciences Subject Assessment Guidelines*, where indicators which registered strong/very strong NRM integration were in the minority. These results indicated very weak overall isolation between NRM and Life Sciences in three of the four national ORF documents which were analysed.

Of the three provincial documents which were analysed, the overall extent of NRM integration was strongest in the *Subject Framework for Grades 10-12* and the *National Curriculum Statement Grades 10-12 Life Sciences Resource Pack*, where the majority of the indicators showed strong/very strong NRM integration. In one provincial document, the *Assessment Syllabus for Life Sciences Grades 10-12*, the overall extent of NRM integration was very weak, with seven of the eight indicators used in the analysis registering weak/very weak extent of NRM integration. These results indicated very weak overall isolation between NRM and Life Sciences in two of the three provincial documents which were analysed.

At the PRF level, the study analysed two Grade 10 Life Sciences textbooks and an in-service teacher professional development programme run for Grade 10 Life Sciences teachers in the Ngqushwa Local Municipality where the four case study schools are located. The results from the textbook analysis showed very strong overall extent of NRM integration, especially in Textbook A, where six of the eight indicators used in the analysis registering strong/very strong NRM integration. These results point to very weak overall isolation between NRM and Life Sciences in the two textbooks. Regarding the in-service teacher professional development programme, the results revealed very weak overall NRM integration, with four of the five indicators used in the analysis registering very weak NRM integration, which means that there was strong isolation between NRM and Life Sciences in the in-service programme.

The analysis of the extent of NRM integration in the reproduction field was separated into school level analysis, which involved out of class school activities, practices and documents,

and classroom level analysis, which involved Grade 10 Life Sciences lessons, written texts and the schools' end-of-year Grade 10 Life Sciences examination papers for 2007. At all four case study schools, the majority of the indicators used during the school level analysis registered weak/very weak extent of NRM integration, which indicated very strong overall isolation between NRM and the schools' out of class activities, practices and documents. The observed Grade 10 lessons at all four schools showed very weak overall extent of NRM integration with most of the indicators used in the analysis registering weak/very weak NRM integration. Similar results were found in the schools' Grade 10 written texts, where apart from School C, most of the indicators used in the analysis registered very weak NRM integration. The analysis of the schools' end-of-year Grade 10 Life Sciences examination papers revealed very weak overall NRM integration, especially at Schools B and D where all the indicators for which data were available registered very weak extent of NRM integration. These results indicated very strong overall isolation between NRM and classroom practice at all the four schools.

The chapter also compared the extent of NRM integration across the three fields of pedagogic discourse, and offered possible explanations. While the overall extent of NRM integration was very strong in the ORF texts, that in the teacher training workshops conducted at PRF level, and at the reproduction field was very weak. Drawing on Bernstein's idea of primary contextualisation (1996, 2000), the chapter attributed the strong NRM discourse in the national ORF documents to the principles of environmental justice and social justice which are enshrined in South Africa's Constitution. In attempting to explain the weakening of the NRM discourse in the teachers' workshops and in the reproduction field, the chapter drew mainly on Bernstein's ideas of recontextualisation, the importance of the nature of the 'space' between the various recontextualising sites and their contexts in determining the direction of the curriculum interpretation process. The chapter also drew on past research conducted on classroom practice and curriculum support at district level in South Africa.

Lastly, the chapter demonstrated the lack of fit between Bernstein's four-point *classification* scale and the context of South Africa's schooling system. A category of 'O' was used to represent instances where the analysis of the extent of NRM integration in key criteria of some of the items could not be conducted due to the lack/ insufficient data.

The next chapter draws on all the preceding chapters to provide a critical synthesis of the whole study. It makes recommendations towards the strengthening of the NRM discourse within the Grade 10 Life Sciences curriculum and towards its effective implementation in a rural under-resourced educational context.

CHAPTER 13

SYNTHESIS, RECOMMENDATIONS AND CONCLUSIONS

13.1 INTRODUCTION

This study set out to analyse the extent of NRM integration in different fields of pedagogic discourse in a rural disadvantaged education context, with the aim of gaining insight into the curriculum recontextualisation process in this educational context (see Section 1.6). The analysis of the extent of NRM integration in the ORF, PRF and reproduction field was described in Chapters 9, 10 and 11, respectively, while Chapter 12 summarised and discussed the major findings of the study. This chapter has several aims. The first aim is to provide a synopsis of the study, including the research goals and questions, theoretical framework, the items which were analysed, and the research tools and the procedures that were used during the analysis. The second major aim of the chapter is to synthesise the study's major findings into a coherent picture regarding the extent of NRM integration and the recontextualisation of NRM discourse in rural disadvantaged pedagogic contexts. Another aim of the chapter is to make use of the study's findings as a platform to highlight the study's major contributions, and to make recommendations towards more effective NRM integration and recontextualisation in a rural disadvantaged education context. The chapter also aims to serve as 'space' for reflecting back on the entire research process and the study's limitations, and for highlighting opportunities for further research which the study has opened up.

13.2 RESEARCH GOALS, OBJECTIVES AND QUESTIONS

As stated in Section 1.6, the major research goal of the study was to gain a better understanding of the extent of NRM integration at different levels of pedagogic discourse in a rural under-resourced education context. The study also used the extent of NRM integration in the Grade 10 Life Sciences curriculum (and other school activities, practices and documents) (see Sections 11.3 and 11.4), as a 'lens' through which the recontextualisation process concerning NRM discourse was viewed, analysed and described.

As outlined in Section 1.6, the study had three major objectives, which were to analyse the extent of NRM integration in the:

- Grade 10 Life Sciences pedagogic texts that are produced by the official recontextualising field (ORF),
- Grade 10 Life Sciences pedagogic texts and in-service teacher professional development programmes that are produced/conducted in the pedagogic recontextualising field (PRF),
- Grade 10 Life Sciences lessons and pedagogic texts, and
- Out of class school activities and practices and documentation.

I set six research questions to help me achieve the above research objective (see Section 1.6), which were:

- To what extent do the Grade 10 Life Sciences pedagogic texts that are produced by the National Department of Education integrate NRM?
- To what extent do the Grade 10 Life Sciences pedagogic texts that are produced by Eastern Cape's provincial Department of Education integrate NRM?
- To what extent do the Grade 10 Life Sciences pedagogic texts and the in-service teacher professional development programmes that are produced/conducted by the King William's Town District education office integrate NRM?
- To what extent do the Grade 10 Life Sciences textbooks that are used by teachers and learners at rural disadvantaged schools in the Eastern Cape integrate NRM?
- To what extent do rural disadvantaged schools in the Eastern Cape integrate NRM into their out of class school activities, practices and documents?
- To what extent do teachers at rural disadvantaged schools in the Eastern Cape integrate NRM into their Grade 10 Life Sciences classroom practices?

13.3 THE THEORETICAL FRAMEWORK

The theoretical framework that underlined this study was discussed in Chapter 7. The study was based on Bernstein's ideas concerning the sociology of the curriculum. Bernstein's model of the fields of pedagogic discourse provided the theoretical framework that formed the main basis of the study. According to Bernstein (1990, 1996) the transformation of specialist academic knowledge (such as NRM) into pedagogised knowledge involves three major distinct fields of the ORF, PRF and reproduction. This model of the education field as a relay system facilitated my understanding and coherent description of the structure and

organisation of the system that is responsible for the creation of NRM discourse, and its transformation and transmission as pedagogic discourse.

I also made use of Bernstein's theory of recontextualisation to conceptualise the study (see Section 7.7.3). Bernstein (1990, 1996) refers to recontextualisation as the process by which knowledge is modified by selection, simplification, condensation or elaboration as it is transferred from one educational site to another. This theory provided a vantage point from which to view, understand, and explain the changes that occurred to the extent of NRM integration in the different fields of pedagogic discourse that were analysed.

Bernstein's construct of *classification* provided another theoretical 'lens' through which I viewed the extent of NRM integration in the various curricular items that were analysed (see Section 7.7.4). Bernstein (1990, 1996) uses this concept to conceptualise power relations between different categories in a pedagogical context, for example, between different subjects in a given curriculum. Bernstein (1990, 1996) postulates that the more power that is associated with a particular subject in a given curriculum, the more insulated it is from the rest of the subjects in that curriculum. The concept of classification also formed the theoretical basis from which I analysed the extent of integration of NRM in various texts, Grade 10 Life Sciences lessons and out of class school activities and practices. Bernstein's scale of classification/integration (C++; C+; C-; C- -) (see Section 7.7.4) formed the theoretical basis of the analytical tools that were used during the analysis, and also provided me with the language with which to describe the extent of NRM integration in the various items that were analysed. I included an extra category of 'O' for cases where the extent of NRM integration in particular key aspect of a unit or sub-unit of analysis could not be analysed because the necessary data were not available, or occurred in insufficient quality or quantity (see Section 12.6).

13.4 THE ANALYTICAL TOOLS

Two major factors influenced the choice of analytical tools for the study. They were the need for an interpretive approach to the analysis process, and that of providing rich and easy to understand descriptions of the extent of NRM integration at the end of the analysis. The two major analytical tools of the study were indicator frameworks, and their accompanying scaling grids (see Section 8.8). Each item that was analysed had its own set of indicators of the extent of NRM integration, and each indicator had its own scaling grid. The nature and

number of indicators in a given indicator framework depended on the nature of the item that was being analysed. Some indicators were qualitative, and were based on interpretive analysis of the items, while others were quantitative and were based on frequency counts of individual words or phrases in the item (see Section 8.7.4). I used the indicators to describe the status of key aspects (criteria) of the items under analysis with regard to the extent of NRM integration. The scaling grids were used to grade the performance of the indicators according to Bernstein's scale of classification, with each grade of performance of a particular indicator corresponding to a particular classification level (see Section 8.8.4). This approach to the analysis of the extent of NRM integration provided a more interpretive and broad based approach to the analysis process than would have been possible had I solely depended on frequency counts of NRM concepts within the text/lesson/activities/practices that were analysed. The radar diagrams that were used to display the results acted as a strong visual and communication tool regarding the extent of NRM integration not only between the different items that were analysed, but also between the different criteria of a given analysed item (see Section 8.8.5).

13.5 THE RESEARCH PROCEDURE

Although the study involved the analysis of different items, the procedure that was followed during the analysis was basically the same. As described in Section 8.8, this procedure consisted of five distinct steps, which were:

- Identification of key criteria which structured the analysis of each item,
- Selection of suitable indicators of the extent of NRM integration for each criterion in a given item,
- Construction of a scaling grid for each indicator based on Bernstein's *classification* scale,
- Use of the scaling grid of each indicator to grade the indicator performance with regard to the integration of NRM in a given criterion, and
- Illustration of the overall extent of NRM integration for each item in form of radar/spider diagrams.

The analysis of the extent of NRM integration in the ORF involved four national and three provincial Grade 10 Life Sciences documents (see Chapter 9, while that in the PRF involved

two Grade 10 Life Sciences textbooks, and an in-service teacher professional development programme (see Chapter 10). The analysis of the extent of NRM integration in the reproduction field involved out of class activities, practices and documents, and Grade 10 Life Sciences classroom practice and texts (see Chapter 11).

13.6 THE RESEARCH FINDINGS

13.6.1 Introduction

- The research findings are summarised here under the general headings of:
- The extent of NRM integration in the ORF (see Chapter 9 for full details),
- The extent of NRM integration in the PRF (see Chapter 10 for full details), and
- The extent of NRM in the reproduction field (see Section Chapter 11 for full details).

13.6.2 The extent of NRM integration in the ORF

Three of the four official Grade 10 Life Sciences documents produced by the National Department of Education registered very strong NRM integration, with most of the five indicators used in the analysis showing strong/very strong extent of NRM integration (see Section 12.2). These documents were the:

- *National Curriculum Statement (NCS) Grades 10-12 (General) Life Science* (South Africa. DoE, 2003),
- *National Curriculum Statement (NCS) Grades 10-12 (General) Life Sciences Learning Programme Guidelines* (South Africa. DoE, 2000c), and
- *National Curriculum Statement Grade 10 Life Sciences examination exemplars* (South Africa. DoE, 2006).

The NRM discourse was very strong in the above documents, indicating very weak insulation between NRM and Life Sciences. Among the national documents which were analysed, the extent of NRM integration was weakest in the *National Curriculum Statement Grade 10-12 (General) Life Sciences Subject Assessment Guidelines* (South Africa. DoE, 2007b), where two indicators showed very weak NRM integration (see Section 9.7).

Among the provincial Grade 10 Life Sciences documents which were analysed, the overall extent of NRM integration was strongest in the *Subject Framework for Grades 10-12* (Eastern Cape Department of Education, 2006b) and in the *National Curriculum Statement Grades 10-12 Life Sciences Resource Pack* (Eastern Cape Department of Education, 2006c), where the majority of the indicators used during the analysis recorded strong/very strong extent of NRM integration. The overall extent of NRM integration was weakest in the *Assessment Syllabus for Life Sciences Grades 10-12* (Eastern Cape Department of Education, 2006a), where seven of the nine indicators used to analyse this document showed weak NRM integration (see Section 12.2.2).

The majority (76%) of the indicators used to analyse the national documents registered strong/very strong extent of NRM integration, while for the provincial documents the majority (50%) of the indicators fell in the categories of weak/very weak extent of NRM integration. This points to a distinct weakening of the NRM discourse within the provincial Grade 10 Life Sciences documents when compared to their national counterparts (see Section 12.2.2).

13.6.3 The extent of NRM integration in the PRF

The PRF texts were represented by two Grade 10 Life Sciences textbooks (Textbooks A and B) (see Section 10.2.1). Both textbooks registered very strong overall extent of NRM integration, indicating very weak overall isolation between NRM and Life Sciences. Between the two textbooks, the overall extent of NRM was stronger in Textbook A where six of the eight indicators used during the analysis showed strong/very strong extent of NRM integration. While the overall extent of NRM integration in Textbook A was comparable to that in the national ORF texts which were analysed, that in Textbook B was much lower (see Section 12.3.1).

All the five indicators that were used to analyse the extent of NRM integration in the in-service teacher training workshops that were run by the District Education Office registered very weak extent of NRM integration, indicating very strong overall insulation between NRM and Life Sciences in these programmes (see Section 10.4.2 and 12.4).

13.6.4 The extent of NRM integration in the reproduction field

The school level analysis, which involved out of class school activities, practices and documents, showed very weak extent of NRM integration for the majority of the indicators at all the four schools. None of the eight indicators used in the analysis registered strong/very strong extent of NRM integration at any of the four schools (see Section 11.5 and 12.5.1). The extent of NRM integration in the Grade 10 written texts was very weak, especially for Schools A, B and D where most of the five indicators used in the analysis registered very weak NRM integration. Although there were variations in the extent of NRM integration in the school examination papers of the four schools, the overall strength of the NRM discourse in each paper was very weak (see Section 11.4.4 and 12.5.2). At Schools C and A which registered the strongest overall extent of NRM in the examination papers, only two of the five indicators that were used in the analysis registered strong/very strong extent of NRM integration. The extent of NRM integration was weakest in the examination papers of School B and D where all the three indicators for which data were available registered very weak NRM integration. Some indicators could not be used in the analysis at some of the schools due to the absence of the necessary data (see Section 11.5 and 11.7), and were placed in a special category of 'O' (see Section 12.6).

13.7 SIGNIFICANCE OF THE STUDY

13.7.1 Introduction

I will discuss the significance of this study under the general headings of the:

- Extent of NRM integration in the Grade 10 Life Sciences curriculum,
- Curriculum recontextualisation in a rural disadvantaged education context,
- Validation of Bernstein`s theories,
- Indicator frameworks as analytical tools in curriculum integration research, and
- Radar diagrams as illustrative tools in curriculum integration research.

13.7.2 The extent of NRM integration in the Grade 10 Life Sciences curriculum

The study revealed that although the overall extent of NRM integration was very strong in the official Grade 10 Life Sciences curriculum documents that were analysed (see Sections 12.2), this was not reflected in the in-service training workshops that were organised for the Grade 10 Life Sciences teachers (see Section 12.3), and in the school activities, practices and

documents of the four case study schools (see Section 12.4). These results reaffirm the mismatch between official educational policy and practice which characterises South Africa's post-apartheid educational landscape (see Section 1.5).

Dyer (1999) points out that without attention being paid to implementation, curriculum innovations run into unexpected outcomes, while at the same time lessons from past innovations are lost and are not used to inform new policies. The practice also leads to the unfortunate separation of curriculum implementation from policy formulation, and the belief that those who formulate curriculum policy are not responsible for its implementation. Yet, the 'the success of any education policy lies in its implementation' (Niewenhuis, 1997, as quoted in Dyer, 1999, p. 46).

The practice of neglecting curriculum implementation has a long history in the evolution of curriculum thought, and research on curriculum implementation came to the fore only during the 1960s and 70s (Snyder, Bolin & Zumwalt, 1992). During the formative years of the curriculum field, curriculum implementation was automatically assumed. All that was required was for the curriculum to be adopted, and the rest was expected to fall in place. Increasingly this view came under close scrutiny as researchers began to question the underlying assumptions that conceptualised the process from text into classroom practices as being 'automatic, linear and unproblematic' (Fullan & Pomfret, 1977, p. 337). It was gradually realised that the adoption of curriculum policies did not mean that they would automatically be implemented as planned (Snyder, Bolin & Zunwalt, 1992).

The complexity of the curriculum implementation field was soon to reveal itself. For one, the very term 'curriculum implementation' does not sit well with all researchers. Snyder et al. (1992) name three broad perspectives from which researchers view curriculum implementation, depending on their basic beliefs about the nature of curriculum knowledge and change, and the role of the teacher. They are the: fidelity; mutual adaptation; and enacted perspectives (see explanations below). However, although this distinction between the perspectives clarifies thinking about curriculum implementation, Snyder et al. recommend that they should be viewed from a perspective of a continuum, with the fidelity and enacted perspectives at opposite ends of the continuum. Positions on the continuum influence not only how curriculum implementation is conceptualised, but also views about how to research this process, and the type of research questions that can be asked.

The fidelity approach is the traditional approach to curriculum implementation, and despite its numerous recognised flaws it still dominates the field, mainly due to the dominance of the behavioural approach to curriculum in education systems all over the world (see Section 3.6). Researchers who hold this perspective to curriculum implementation see curriculum knowledge as being produced by experts who are situated external to the school. The role of the teacher is to deliver the curriculum to the learners according to the specifications that are laid down by curriculum experts. Curriculum is regarded as a concrete product to be implemented by teachers. Of concern to researchers who are grounded in this perspective is the degree to which the curriculum which is implemented differs from that which is written in the official texts, and the factors which influenced this deviation. Within this perspective researchers may pose research questions such as: To what degree has the curriculum been implemented as planned? What factors facilitated or hindered the implementation process? (Snyder et al., 1992).

According to Snyder et al (1992), the above do not feature as major research questions for researchers at the opposite end of the curriculum implementation continuum, the enacted curriculum perspective. For them, curriculum is an ongoing process that is created in classrooms between teachers and learners, with or without the aid of externally produced curriculum documents. The issue of curriculum implementation does not arise for these researchers, since curriculum and its implementation are one and the same thing. Curriculum reform involves change to the teacher's and learner's thinking, feeling, assumptions and attitudes, not only changes to the curriculum content and materials. Within this curriculum implementation perspective, researchers are interested in finding out the knowledge and skills which teachers and learners found useful during their individualised construction of curriculum. Within the fidelity perspective, the main focus for curriculum policy makers is how to minimise variations in the curriculum that is implemented in the classrooms. Under the enacted curriculum perspective, the focus of the policy makers shifts to the extent by which teachers and learners are capable of or can be trusted to come up with socially desirable curriculum goals (Snyder et al., 1992).

The curriculum implementation field becomes even more complicated when the mutual adaptation perspective is taken into account. Snyder et al. (1992) explain that this perspective views curriculum implementation as a process involving adaptation of curriculum as developed by external experts, by the curriculum users to suit local contexts. As stated

earlier, this perspective is mid-way between the fidelity and enacted perspective, and comes in different variants depending on whether there is a bias towards the fidelity or enacted perspective. Under this guise, the teacher's role in shaping curriculum is acknowledged, while research is geared towards gaining insight into the different variations of curriculum that occur and their associated contextual factors. Researchers are interested in finding out the necessary skills and knowledge needed to successfully adapt curriculum to particular local contexts (Snyder et al., 1992).

In their concluding chapter on curriculum implementation, Snyder et al. (1992) consider future research demands that each curriculum implementation perspective requires. For the fidelity perspective, it is the development of more sophisticated research instruments to better determine the gap between the intended and implemented curriculum, and the factors which contribute to this gap. For the mutual adaptation perspective, it is the need for more ethnographic studies at school to capture the complexities of school life, of which little is known. The enacted curriculum perspective calls for more action-based research by individual teachers to analyse the curriculum meanings that they co-create with their learners. Whichever perspective one adopts, it has the potential to contribute to the growth of curriculum implementation as a field that is worthy of academic pursuit.

By analysing the extent of NRM integration at different levels of pedagogic discourse, this study provided insight into the curriculum implementation process involving Eastern Cape's rural poor schools. This will hopefully contribute to better alignment between official NRM discourse and the contexts under which these schools operate.

13.7.3 Curriculum recontextualisation in a rural disadvantaged education context

As explained in Section 1.6, this study used the extent of NRM integration as a 'lens' through which to view and study the trajectory of the curriculum recontextualisation process in a rural disadvantaged educational context. This study is significant in that it provided insight into the curriculum recontextualisation process involving four rural disadvantaged schools in the Eastern Cape Province. In other words, the study illuminated aspects of the relay system by which educational knowledge, specifically NRM within the Grade 10 Sciences curriculum, is transformed into pedagogic discourse and transmitted across the education system before reaching the classroom of the four rural disadvantaged schools. The study contributed to a better understanding of classroom practices concerning NRM in a rural disadvantaged

education setting. The study also identified the major recontextualising sites in the educational knowledge relay system involving the four schools, and where the major interruptions or breakdowns in this relay system occur, namely between the schools and the ORF, the schools and the PRF, especially its subfield, the district education office. The study revealed the high degree of 'isolation' from the ORF and the PRF under which Schools A, B, C, and D operate, and the adverse effect this has on the interpretation and implementation of the official NRM discourse within the Grade 10 Life Sciences curriculum. The study also identified the Grade 10 Life Sciences textbook publishers as the dominant recontextualisers in the PRF, and exposed the very low profile of other recontextualisers such as NGOs, teachers' unions, and university education departments in this field. Better understanding of the location of various recontextualising sites, their agents and agencies, and their exact roles in the recontextualising process has the potential to contribute to more effective curriculum intervention practices that specifically target rural under-resourced schools in the Eastern Cape.

13.7.4 Validation of Bernstein's concepts

Two major critiques of Bernstein's work is that his concepts are stated in very abstract terms, is not backed up by empirical testing and support (Sadovnik, 1991), and that it is grounded mainly in the educational context of the UK, which does not necessarily apply to the rest of the world. The challenge of empirically validating Bernstein's theoretical constructs has been taken up by numerous researchers both outside and inside South Africa (Section 7.9), but mostly working outside the rural disadvantaged education/curriculum reform nexus in the Eastern Cape. This study was conducted with a broader view of empirically exploring and testing some of Bernstein's concepts within the context of rural under-resourced education in the Eastern Cape, although this never became a major research focus.

As discussed in Section 12.2.1, Bernstein's model of the structure of pedagogic discourse places a society's dominant principles, as determined by the ruling class (who in this case are representatives of South Africa's first democratically elected government) in a central position during the production and shaping of pedagogic discourse. The study showed South Africa's Constitution as a major contributor to the production of the NRM discourse within the Grade 10 Life Sciences curriculum, through its principles of environmental and social justice and that of sustainable natural resource management.

Another concept of Bernstein that was empirically tested by this study was his model of the universal structure and organisation of the pedagogic knowledge transfer systems, despite differing political ideologies (and socio-economic contexts). This study illuminated the structure and organisation of the relay system that is responsible for the production, transmission and assessment of NRM pedagogic discourse within the Grade 10 Life Sciences curriculum, in a rural disadvantaged education context, and found it to be generally compliant with Bernstein's model of three pedagogic fields of OPF, PRF, and the reproduction field (Section 7.7.2). Lastly, by analysing the changes to the extent of NRM integration that occurred across the different levels of this relay system, the study illuminated Bernstein's concept of curriculum recontextualisation, and tracked its trajectory in a rural disadvantaged Eastern Cape education context. The insight so gained into this process can be put to useful use during the designing and implementation of curriculum intervention strategies that specifically target this education context. The importance of such strategies as a means of overcoming the increasing marginalisation of South Africa's rural disadvantaged education sector cannot be over emphasized (see Chapter 2).

13.7.5 Indicator frameworks as analytical tools in curriculum integration research

Studies which seek to establish the status of a subject within a given curriculum, or that of a theme or topic within a given subject, are often based on frequency counts of items such as pages, images, sentences or words etc. (see Section 8.7.4). The end result of this narrow-based and quantitative approach to content analysis is a statistic, usually a percentage, which leaves much to be desired in terms of understanding the results, their visual display, and communication to less literate members of society. This study adopted a more qualitative and broad-based approach to the analysis of the extent of NRM integration. This approach which was described in Section 8.8 was based on initial identification of key aspects or criteria within the items which were to be analysed. This subdivided the analysed item into manageable parts which then formed the basis of the analysis. The extent of NRM integration in a given criterion was then determined with the aid of a set selected indicators, which were either qualitative or quantitative depending on the nature of the criterion. The indicators served to describe the extent of NRM integration in a given criterion (see Section 8.8.3). The performance of each indicator with regard to the extent of NRM integration was graded using its scaling grid, which indicated which indicator performance corresponded with which *classification* level (see Section 8.8.4). This approach contributed to the analysis process being both interpretive and comprehensive.

However, this approach to analysing the extent of (NRM) integration came with two major drawbacks. Firstly, the whole process was heavily dependent on the researcher's professional knowledge and experience, from the initial identification of the criteria which structured the analysis of the different items, to the final allocation of *classification* scores to particular indicator performances. The subjectivity of this was addressed through field-based reflexivity which was based on in-depth literature reviews and the development of conceptual frameworks which created platforms for criteria development, indicator selection, and interpretation of indicator performances. The conceptual frameworks were based on South Africa's education policies, validated concepts in effective school management, and in pedagogical approaches in environmental education and their histories. Because of the complexity of the approach taken to analyse the extent of NRM integration, it was necessary to provide a rigorous description to make the process clear and transparent (see Sections 8.8, 9.4, 10.2, 10.3, 11.3 and 11.4). Secondly, the analysis process is laborious as it involves a number of different steps before a final decision about the extent of integration can be made. Despite these limitations, the approach proved to be an open, transparent and robust alternative to frequency counts when analysing the extent of curriculum integration.

13.7.6 Radar diagrams as illustrative tools in curriculum integration research

Tools which are commonly used to illustrate different extents of curriculum or knowledge integration include narratives, graphs or mathematical indices. This study experimented with radar diagrams as a form of visual language for illustrating different extents of curriculum (NRM) integration (see Section 8.8.6). A major appeal in using radar diagrams to illustrate different extents of (NRM) integration was that they are easy to draw and understand, which makes them ideal for inexperienced researchers, such as teachers in rural under-resourced schools who are investigating their own curriculum integration practices through action research (see Jenkins, 2007). They allow a detailed display of the results obtained about the extent of integration, while at the same time facilitating their comparison across time and space. They are also a powerful visual communicating tool, and may add value to classroom based research, examples of which are beginning to develop in environmental education research in South Africa (see Jenkins, 2007; Ncula, 2007; Tundzi, 2009).

13.8 LIMITATIONS OF THE STUDY

13.8.1 Introduction

I will discuss the major limitations of this study under the general headings of:

- Theoretical factors,
- Research methodology, and
- Research context.

13.8.2 Theoretical factors

The first limitation of this study concerns the general bias towards the analysis of structural factors rather than that of human agency. This shortfall stems from the three Bernsteinian constructs that formed the theoretical basis of this study, namely, *classification*, recontextualisation, and the model of the fields of pedagogic discourse, which are all rooted in structuralism (Shilling, 1992). Bernstein's work has been critiqued for this approach to educational analysis which ignores the role of human agency, and attributes educational phenomena solely to social structures, which are perceived to be external to the individual. Shilling (1992) refers to the social world as involving dynamic interplay between social structures and human action, and maintains that structuralism impedes our understanding of the world. He calls for approaches to investigations of educational (and other social) phenomena that involve both the analysis of social structures and human agency. The implication for this study was that the analysis that was conducted could be judged to be partial since it focused mainly on content and the relations between them at the expense of the human element involved. I tried to counteract this bias by conducting interviews, drawing on research participants' views and experiences with the teaching of NRM within the Grade 10 Life Sciences curriculum, through conducting classroom observations, and by including learners in diary writing. However, the analysis did not take personal narratives of teachers or learners into account to any great extent, and did not, for example, consider teachers' existing knowledge of NRM or their feelings or experiences of teaching in rural schools.

Another limitation that resulted from the type of theoretical framework used in this study was that while data were generated on the extent of NRM integration in the various texts, school activities and practices, the study was unable to provide illumination on the quality of the NRM knowledge that was integrated. This shortfall of Bernstein's *classification* scale and

recontextualising theory when applied to South Africa's disadvantaged education contexts was discussed in Section 7.9. This meant that for example, all that could be said about the two textbooks that were analysed was their extent of NRM integration, but nothing at all about the quality of the NRM knowledge that they offered. Similarly, during the analysis of the data from the classroom observations, while I was able to analyse the extent of NRM that was integrated into the Grade 10 Life Sciences lessons, I was unable to distinguish those lessons in terms of the quality of NRM knowledge that was delivered to learners. As explained in Section 7.9, researchers interested in pursuing this dimension of curriculum integration research can make use of Paul Dowling's expanded version of Bernstein's *classification* schemata that takes into account the quality of knowledge that is integrated (see Dowling, 1998), or use Bernstein concurrently with Blooms Taxonomy of Knowledge (see Hugo et al., 2006).

Another limitation of this study is that since it was based on Bernstein's concept of *classification* and excluded that of *framing* (see Sections 7.7.4 and 7.8), it provided (some) illumination on the NRM and Life Sciences knowledge, but revealed nothing about the *control* of the transmission of this knowledge. It is relatively common for researchers whose investigations in education are framed by Bernstein's thinking, to work simultaneously with his concepts of *classification* and *framing* (see, for example Hoadley, 2005; Bertram, 2005). The research aims of such studies need to be distinguished from what the focus was in this research. Studies which make use of both *classification* and *framing* most often are directed towards describing modes of pedagogy in specific contexts or are concerned with investigating underlying sociological messages pertaining to both the content and its transmission that are contained in ORF or PRF texts or practice). My research aim was neither of these. During this study I made the 'content' what Bernstein calls the 'what of pedagogy' the sole research focus. How the transmission of that knowledge was controlled through selection, sequencing, pacing and evaluation, the 'how' of pedagogy (Bernstein, 1990, 1996) fell outside this research focus. Bernstein himself stresses the point that although the two concepts are closely aligned to each other, they vary independently of each other. By logical extension, they can also be investigated independent of each other, as for example in Neves and Morais (2001a), and in Bertram (2005).

13.8.3 Research methodology

A major limitation of the study concerns the ‘naturalness’ of the lessons that I observed as part of the research process. In other words how representative were these lessons of a typical Grade 10 Life Sciences lesson at a particular school? This issue arose because I first had to make prior arrangement with the teachers before I could visit their classes. In many cases during the class visits I could sense that a lesson was being especially acted out for me. Indeed on several occasions a class visit had to be cancelled because the teachers said they were not ready for me. In addition there was the effect of my presence in the class on the behaviour of the learners and teachers, although I tried to be as unobtrusive as possible. It is from such lessons that I had to draw conclusions about the teachers’ classroom practices with regard to the extent of NRM integration. As indicated earlier, I decided to treat these lessons as the teachers’ best practice lessons for the integration of NRM into the Grade 10 Life Sciences. However, the issue of how different these lessons were from a typical Grade 10 Life Sciences lesson at the four schools remained unsolved. Straddling of the classroom observations across two school terms was an attempt at getting access to Grade 10 Life Sciences lessons that covered different topics of the syllabus, since some topics are more suited to the integration of NRM than others. The use of the learners’ diaries also helped to give a broader view of what was taking place during the Grade 10 Life Sciences lessons at the four case study schools.

Another limitation issue concerns the quantity of data that were generated during for example, the analysis of the texts and the classroom observations. As explained in Section 8.7.3, during the first class visits I recorded everything that was taking place during the lessons. The subsequent class visits were more focused and looked at certain aspects of the lesson that were relevant to the integration of NRM, while ignoring the rest of the lesson. My quest for more focused recording of classroom data is likely to have resulted in a loss of data depth to a certain degree. I faced a similar situation when deciding on how best to present my research findings. My eventual decision to display the results in form of radar diagrams was influenced by inter alia my interest in communicating my findings to key stakeholders in a form that was fast and easy to understand. This decision could have contributed to loss of data depth in the findings since not all the data about the extent of NRM could be expressed in the form of radar diagrams. Careful descriptions of the data sets and analysis process however addressed this problem.

During the study I used interviews and observations as a means of allowing teachers and principals to express their own realities about the integration of NRM. However, my privileged educational and economic position over that of the research participants could have contributed to a power differential between us, forcing them to feed me with certain privileged interpretations over others. The ‘acted up’ lessons that I witnessed during the class visits are clear evidence of the unbalanced power relations that existed between me and the research participants. It is possible that what emerged from the interviews (and class visits) is not a completely true reflection of what the research participants knew, experienced or thought of, regarding the integration of NRM. Hence the use of different methods and sources to obtain information about the extent of NRM integration. In addition, being a former teacher of Life Sciences, and having taught in the same area, and under the same education context, I carried my own professional knowledge and experiences into the research process, which influenced how I interpreted the various texts and school activities, and practices that I analysed. This may also have impacted on the types of questions that I asked of the research participants, and the amount of probing I was ready to do since I was already very familiar with parts of the research situation I was investigating. Hence the need for careful field-based reflexivity during the study. As indicated in Section 8.8, this was a necessary aspect of developing the methodology, and I countered the problem of ‘bias’ by giving a rigorous account of the decision-making process

The case-study approach used in this study was also another source of limitation. The major limitation arising from this approach was that since the findings about the extent of NRM integration were based on only four schools, they are not necessarily representative of all the rural disadvantaged schools in the Peddie Education Circuit, let alone the rest of the Eastern Cape. This limitation was clearly stated at the outset of this study (see Section 8.6.2). This study was driven by a desire to provide descriptive information on the extent of NRM integration in a given particularistic setting, rather than that of generating generalisable data that could be applied to the rest of the school population in rural Eastern Cape. However, I provided rich contextual descriptions of the four schools and of my methodology to provide a base from which other researchers conducting similar research can make their comparisons, interpolations and conclusions.

Another possible limitation of the study concerns the procedure which was followed during the analysis of the different items (see Section 8.8). The various steps that formed part of the

analysis process, for example, identification of criteria which structured the analysis of individual items, the selection of suitable indicators, and their grading with regard to NRM integration, were influenced by my subjectivity and prior experience and knowledge. As explained in Section 13.7.5 and above, this was addressed through field-based reflexivity which informed the development of conceptual frameworks and created platforms for criteria development, indicator selection, and interpretation of indicator performances.

13.8.4 Contextual factors

A research project rarely proceeds in the exact direction and with the same pace as stated in the research proposal. Despite careful planning, there are contextual issues that emerge and negatively affect the research design of the study, thereby imposing limitations on the conclusions that can be drawn from the study. For this study, these contextual factors were:

- **Gaining access into the Grade 10 Life Sciences lessons.** While the original plan was to conduct as many as 15 classroom observations per school, this was not possible, mainly due to the teachers' unreadiness to let me into their classes. For ethical reasons I could not pressurize the teachers to let me into their classes as often as I wanted to. Mostly I let the teachers determine when they were ready for me to visit their classes, which greatly reduced the overall number of class visits that I was able to make during the study. Coupled to this were other interruptions to the schools' teaching programme caused by the teachers' in-service training, union meetings and other social functions. In the end I had to resort to two Grade 10 learners to keep daily records of the Life Sciences lessons. Although they never entirely replaced the purpose of the classroom observations, the diary entries made by the learners nevertheless provided a good record of the number of Life Sciences lessons that were actually taught, the topic of those lessons, and that of any class task that was given out by the teachers.
- **The high teacher turnover involving the Grade 10 Life Sciences classes.** For school C this happened three times in one year. This meant I had to make changes to the teachers' profiles where necessary, and redo the interviews. It also meant that teachers were burdened with heavy workloads and were not necessarily teaching the subject in which they were trained. Fortunately, the profiles of the affected teachers

were not vastly different from each other in terms of training and experience in environmental learning.

- **Ongoing changes to the organisation of Eastern Cape’s Department of Education.** New posts such as Chief Education Officer, and Chief, Senior and Principal Curriculum Specialists were created and staff appointed into previously vacant posts. I had to keep abreast of these changes (mainly through the press) to make sure that the research project was not overtaken by events. However, by the time I finished the study, these changes were yet to make any noticeable impact at classroom level at the four case study schools.

13.9 OPPORTUNITIES FOR FUTURE RESEARCH

As mentioned in Section 1.2, this study was motivated by concern over the relevance of education that is on offer to learners in the majority of South Africa’s rural under-resourced schools. The study was conducted on the premise that a focus on NRM in the curriculum of these schools stands to serve the double function of enhancing education relevance, and of contributing to the sustainable use of local natural resources. This study has contributed to knowledge about teaching, learning and evaluation of NRM within the Grade 10 Life Sciences curriculum at rural under-resourced schools in the Eastern Cape Province (see Chapter 12). This study has also improved knowledge of the curriculum recontextualisation process in a rural under-resourced education context. At the same time the study exposed key knowledge gaps that exist in this educational context, and that need to be researched before the ultimate goal of effective environmental learning in this educational context can be realised.

According to Bernstein ideas (1996), specialist NRM knowledge has to be created first in the production field before it can be relayed to the other fields of pedagogic discourse for conversion into classroom texts and practices (see Section 7.7.2). The creation of the NRM knowledge that is available for recontextualisation and integration into the Grade 10 Life Sciences curriculum was not investigated during this study. Yet it is likely to be a key determinant of the NRM content that is eventually delivered to learners in rural disadvantaged classrooms in the Eastern Cape. It is also important that the major role players involved in the creation of specialist NRM knowledge be identified, their contexts analysed, and the relations between them investigated, especially their impact on the final content and

form of NRM knowledge that is offered in South Africa's classrooms. The potential for rural schools to generate knowledge on the management and sustainable use local natural resources also needs to be explored. Shava (2008) showed that Indigenous Knowledge of NRM processes exists in such communities.

As already discussed in Section 13.8.2, while the study analysed the extent of NRM integration in different fields of pedagogic discourse, it did not investigate the quality of the NRM knowledge that was integrated. Research needs to be conducted on the effect that the recontextualisation process has on the quality of NRM knowledge which is available in each field of pedagogic discourse. Bernstein (1990) notes that the relative autonomy of the PRF from the ORF, and between the various recontextualising sites in the PRF, has an important influence on the direction of the curriculum recontextualising process. This study did not fully investigate the nature of these relations, and could only hint at them during the discussion of the results. Further investigations of these relations is a prerequisite to understanding the trajectory of the curriculum recontextualising process as it occurs in Eastern Cape's rural disadvantaged education sector.

This study analysed the extent of NRM integration in only one subject (Life Sciences) and in only one Grade (Grade 10). To get a broader view of the extent of NRM integration across the entire FET band, it is necessary that the study be repeated to cover all the subjects and Grades in this section of the education system. Furthermore, the findings of this study are based on only four schools. Wider coverage of the province's rural and disadvantaged schools would give a general picture of the status of NRM integration across the entire province's schooling system. The analysis of pre- and post-1994 curriculum documents would also provide information on the effect of post-apartheid curriculum reforms on the status of NRM in the country's education system.

According to Bernstein (1990), the final content of pedagogic discourse, and its transmission are a product of a struggle between the various curriculum recontextualisers that exist in the education system, and their underlying ideologies and interests. This study identified only some of the curriculum recontextualisers operating within the Eastern Cape education system, and did not examine their underlying ideologies and interests. It is important that all the major curriculum recontextualisers operating within Eastern Cape's rural and disadvantaged schooling system be investigated, and their influence on the content and delivery of

pedagogic discourse in the province's rural and disadvantaged classrooms examined. As noted in Section 7.10, Bernstein's concept of *classification* is a very abstract term which needs to be operationalised first before it can be applied to the empirical world. For this study, the concept was operationalised through the use of indicators and scaling grids, which were used to analyse the extent of NRM integration in a given criterion in the item that were analysed (see Section 8.8). Although this was not fully explored during this study, the concept of *classification* can also be used to investigate and describe the relations between the ORF, the PRF and the reproduction field. A similar process involving the operationalisation of *classification* for this research focus would have to be devised, as these relations were only superficially discussed in this study.

This study attempted an innovative approach to the analysis of the extent of curriculum integration which was based on the performance of selected key indicators, and which represented the research findings in form of radar diagrams. More studies need to be conducted to confirm the feasibility of this approach. Further, the study assumed that all the selected indicators contributed equally to the overall extent of NRM integration, and subsequently allocated equal weighting to all of them. In real life contexts this is likely to be far from the truth. Further research needs to be conducted on the relative role of different indicators in determining the overall extent of NRM integration in a given item, and how this can be reflected in the analysis procedure, and in the illustration of the overall extent of integration. More research also needs to be conducted on the design and testing of more simple but robust research tools for use by inexperienced researchers such as teachers in rural disadvantaged education contexts who wish to investigate their own curriculum integration practices. This will go a long way towards reducing the dearth of information on curriculum integration (and other classroom) practices in this section of South Africa's education system.

This study established Grade 10 Life Sciences textbooks as major PRF pedagogic text regarding the teaching and learning of NRM at the four case study schools. Although the study demonstrated that the extent by which NRM was integrated into these textbooks was very strong (see Section 12.3), this was not reflected in the Grade 10 Life Sciences lessons and written texts which were analysed. These results points to a need for further research on the use of textbooks in rural disadvantaged classrooms. More investigations also need to be conducted into the role of district education offices as recontextualising sites.

13.10 RECOMMENDATIONS

The overriding goal of this study was to analyse the extent of NRM integration in the ORF, PRF and reproduction field in a rural disadvantaged education context (see Section 1.6). This analysis acted as a ‘lens’ into the curriculum recontextualisation process in this education sector. The recommendations that I make here concern two processes: those that relate to the integration of NRM into the Grade 10 Life Sciences curriculum; and those that relate to the curriculum recontextualising process, both in a rural disadvantaged context.

The study revealed that the Grade 10 Life Sciences teachers had at their disposal four different ORF pedagogic texts that were issued by the National Department of Education. Although the overall extent of NRM integration was very strong in three of these documents (see Section 12.2.1), between them the three documents showed considerable variation in the extent of NRM integration. The extent of NRM integration was particularly weak in the fourth national ORF text that was analysed, the *National Curriculum Statement Grade 10-12 (General) Life Sciences Subject Assessment Guidelines* (see Section 9.7.3). There is a need for more standardisation of the status of NRM within the nationally produced Grade 10 Life Sciences pedagogic texts. This can be achieved by making more explicit references to NRM, for example, when defining Life Sciences as a subject, in outlining the purposes of studying Life Sciences, and in the glossary. In the case of the *National Curriculum Statement Grade 10-12 (General) Life Sciences Subject Assessment Guidelines*, the extent of NRM integration can be enhanced by making more explicit references to NRM in the stated purpose of assessment and by providing more NRM related practical work examples. I also recommend that the various agents and agencies involved with the production of the ORF texts at national level work more collaboratively together. In Bernstein’s language, the degree of ‘isolation’ between these agents needs to be reduced so that the documents they issue convey a more consistent message about the integration of NRM to the readers and users of these documents. It is important to note that a better understanding of why this ‘isolation’ is not only in terms of the physical needs to be developed, since it also relates to funding, pedagogical ideologies, education backgrounds and individual capacities of the agents involved in the curriculum recontextualisation process.

The study showed that between them the four schools had three types of provincial ORF texts that relate to the teaching and learning of Grade 10 Life Sciences, two of which were about assessment (see Section 9.3). When compared to the national ORF texts, these provincial

ORF texts generally reflected a relatively weaker overall extent of NRM integration. Two recommendations can be made from these findings. The first recommendation relates to the need to broaden the range of Grade 10 Life Sciences provincial ORF texts that are made available to these schools, so as to cover other areas of this curriculum. The National curriculum Statement for Grade 10 Life Sciences is left 20% open for the inclusion of local content (South Africa. DoE, 2003). Agents in the Life Sciences section of the FET schools Curriculum Sub-directorate within the Eastern Cape Department of Education need to grasp this opportunity to create Grade 10 Life Sciences curriculum documents that reflect a focus on the Eastern Cape, including the management of its natural resources (of course within the limits set by the National Department of Education). The second recommendation concerns the need to strengthen the status of NRM within the provincial Grade 10 Life Sciences assessment texts by, for example, including investigations on NRM, or basing more assessment activities on NRM issues and concepts. This has two implications for the recontextualisation process at the provincial department level. The agents in the provincial Department of Education who are responsible for the Grade 10 Life Sciences curriculum need to be given further training in natural resource education, and in the production of the necessary educational materials for its effective implementation in rural disadvantaged classrooms. They also need to work collaboratively in the production of these texts so that a clear and unified message about the integration of NRM is conveyed to the teachers and other key stakeholders.

The study showed that between them the four schools had available two different Grade 10 Life Sciences textbooks as the only PRF pedagogic texts for the teaching and learning of NRM within the Grade 10 Life Sciences curriculum (see Section 10.2.1). This means that either the recontextualising process involving the teaching of NRM within the Grade 10 Life Sciences curriculum is dominated by textbook publishers, or rural disadvantaged schools are unaware of or lack the funds to access other sources of PRF pedagogic texts that relate to the teaching of NRM. It is recommended that more NRM-related PRF texts be made available to rural disadvantaged schools to counteract the domination of textbook publishers as the sole recontextualisers in this field. Such texts could include for example fact sheets, work sheets, pamphlets, posters etc. produced by NGOs, other state agencies such as Department of Water Affairs and Forestry, the Eastern Cape Parks Board, and university departments of education. Many of these educational resources are freely available, or are sold to schools at greatly subsidised rates, those produced by Share-Net being a case in point (see Section 6.8). I

further recommend that the King William's District Education Office, under which the four case study schools fall, take charge of the responsibility of soliciting and distributing these resources to these schools, rather than dealing with only those that are issued by the national and provincial education departments, as is currently the case. Teachers also need to be provided with more training in the production of their own NRM related pedagogic texts for use in class.

Another finding that emerged from the analysis of the two textbooks was the disparity between them in terms of the extent to which they integrated NRM (see Section 10.4). While the extent of NRM integration in Textbook A was comparable to that in most of the national ORF texts, that in Textbook B was considerably weaker. This finding points to a certain degree of inconsistency in the recontextualising process between the ORF and the textbook publishers regarding the status of NRM within the Grade 10 Life Sciences curriculum. To remove this disparity in the recontextualisation of NRM, the ORF needs to provide more guidance to the textbook publishers about the teaching and learning of NRM within the Grade 10 Life Sciences curriculum. As has been mentioned above, this may occur through further strengthening of the status of NRM in the ORF texts, or through special guidelines and training sessions for the various textbook publishers in the country, in which NRM education is promoted. This would also help to narrow the considerable differences that currently exist in the NRM content and its presentation between Textbook A and B. It is also recommended that in addition to the list of prescribed school textbooks that is issued by the provincial Department of Education, the Grade 10 Life Sciences teachers at the four the four schools be provided with more practical guidance in the selection of suitable Grade 10 Life Sciences textbooks.

The study revealed the very weak extent of NRM integration in the teacher professional programmes that are run by the district education office (see Section 10.4.2). To build up the capacity of this office as an NRM recontextualising site, it is recommended that the curriculum support staff at this office receive specialist training in natural resource education, especially in the production of educational materials. Better still would be the appointment of a curriculum specialist at this site to oversee environmental learning programmes within the Life Sciences curriculum. The GET band has an environmental education co-ordinator who is stationed at the provincial education offices. It is important that a similar position be created

for the FET band to drive environmental education/natural resource education programmes from a provincial level.

The analysis of the extent of NRM at school level revealed very little integration of NRM at all four schools that were involved in the study (see Section 11.5.1). The importance of integrating NRM into out of class school activities, practices and documents should not be underestimated, as it can serve as an entry point of NRM into the school and eventually into the classroom, besides contributing to the quality of the learning experience offered by a school. Based on these findings it is recommended that an advisory committee or an environmental education committee as suggested in Eco-Schools be established at each school to drive the NRM agenda. This committee could for, example, be tasked with the responsibilities of raising awareness about NRM among the schools' key stakeholders, raising funds for NRM-related activities, organising and running of environmental competitions, and forging links with external organisations and NGOs that are concerned with environmental learning and environmental conservation.

The analysis of the extent of NRM integration in the reproduction field produced interesting findings. The dissemination of various ORF documents to the four case study schools appears to be effective as all four teachers admitted to having these documents in their possession. That the majority of the Grade 10 Life Sciences lessons and pedagogic texts that were analysed either lacked or contained very little NRM content, reflects either unwillingness or inability on the part of the teachers to engage with the NRM discourse. A key finding about the recontextualisation process at reproduction level was the lack of data to evaluate key criteria of NRM integration at this level, mainly due to insufficient work being covered in class (see Section 11.7). Based on these findings I recommend that teachers be given more support when working with the PRF and ORF documents. This may be in the form of simplified and shortened versions of these documents to make them more accessible to teachers. The support can also be in the form of practical demonstration of how to work with these documents in rural and disadvantaged settings to produce Life Sciences lessons with a focus on NRM. Again in-service training needs to be provided to the teachers to improve their knowledge of NRM and their skills in its transmission to learners in an under-resourced education context. This could mean extending the bursary scheme which funds postgraduate studies for teachers to include studies in environmental education, although it is not a specific subject area under the new curriculum framework. The teachers also need to form closer ties

with NGOs that promote environmental education and environmental conservation, and to participate in programmes that promote NRM through the school curriculum, such as Eco-Schools, Greening of Schools, and Abalimi Bezekhaya (see Section 6.8). Another related recommendation is that classroom practices of the Grade 10 Life Sciences teachers at these four schools need to be regularly monitored both from inside (for example, by the heads of subject departments and school principals), and outside (for example, by subject advisors). In other words, the relative autonomy enjoyed by the four case study schools from direct control by the ORF and PRF needs to be reduced. This will help alleviate the highly '*classified*' nature of the space under which the teachers are currently working, which will contribute to ensuring that not only do these teachers produce the right quantity and quality of pedagogic texts, but also that these texts integrate NRM as is required by official Grade 10 Life Sciences policy.

Regarding the trajectory of the curriculum recontextualisation process, the study findings pointed to the existence of strong/very strong boundaries between the three fields of pedagogic discourse, and within the fields (at least as far as the recontextualisation of the NRM discourse was concerned) (see Chapter 12). The variations between the extent of NRM integration in the texts and practices by agents/agencies in the different fields of pedagogic discourse, and within a given field are evidence of this. The extent to which the official NRM policy is realised in a given recontextualising site depends on the degree of autonomy it enjoys from the ORF. Hence it is important that research be conducted into how the boundaries between the various recontextualising sites are socially constructed and maintained, and the ideologies that underpin them.

13.11 CONCLUSIONS

The aim of this chapter was to stitch together the main findings of the previous chapters, and to use them as a platform from which to make recommendations towards effective implementation of natural resource education in a rural disadvantaged education context.

The chapter outlined five different contributions that this study has made to rural education in South Africa from the perspective of environmental education and that of sociology of curriculum. They relate to: insight into the NRM integration practices at the four case study schools; better understanding of the curriculum recontextualising process in Eastern Cape's rural disadvantaged education sector; application of Bernstein's ideas to Eastern Cape's rural

under-resourced education sector; and the use of indicator frameworks to analyse curriculum integration from a sociology of education perspective.

The chapter also provided an overview of the major theoretical, methodological and contextual limitations of the study and how they were addressed. It exposed major knowledge gaps which need to be researched. They include insufficient knowledge regarding the creation of NRM discourse; the nature of the 'space' between the ORF and other recontextualising sites, and the quality of recontextualised NRM knowledge. The chapter ended with an outline of recommendations based on the findings of the study. These mostly address the need for further strengthening of the status of NRM discourse in the Grade 10 Life Sciences curriculum at the ORF level (by including more explicit reference to NRM), and the provision of training in environmental education/NRM and educational materials development for recontextualising agents in the PRF (especially at the district education office level), and for teachers and other recontextualising agents that operate at the reproduction field level.

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