

**PEDAGOGICAL PRACTICES IN A HIGHER EDUCATION
CONTEXT: CASE STUDIES IN ENVIRONMENTAL AND SCIENCE
EDUCATION**

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DISSERTATION

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Co-promoter: Associate Professor Y Waghid

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Declaration

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Signature: 

Date: *14 September 2001*

ABSTRACT

My study investigates opportunities that may currently be available to enable the transformation of post-apartheid teacher education. I examine two case studies of my own professional practice. The first case study involves in-service education work that I performed with teachers in a local community, Grassy Park. The second case study represents work I performed with students in a pre-service education programme at the University of Stellenbosch. My study aims to:

- Critically examine the implications of social issues, particularly environmental issues, for pedagogical practices generally and for South African pedagogical work in particular.
- Critically review the changing socio-historical determinants of pedagogical practices in South African teacher education.
- Investigate changing pedagogical practices by describing and reflecting on work done in my own professional contexts as a science/environmental teacher educator at a historically Afrikaner university.

With respect to teacher education, Pendlebury (1998) argues that we are seeing shifts in *public space*, *evaluative space*, *pedagogical space* and *institutional space* from insulated space (hidden from public scrutiny) to a more porous space. In this study I am concerned with pedagogical space that, in Pendlebury's (1998:345) terms determines 'who may learn (or teach), how and what they learn (or teach), when and for how long and where'. I use these categories of Pendlebury (1998:345) together with Turnbull's (1997) perspectives on knowledge production as conceptual tools to frame my analyses of the cases. Although a significant part of my study focuses on classroom practices, I take pedagogy to have a much broader meaning that incorporates in Hernández's (1997:11) terms 'all spaces in which knowledge is produced and identities are formed'.

This research report offers a brief insight into the complexities of change at the micro-level of classroom practices. But, importantly also contextualises these micro-level pedagogical practices within broader socio-historical determinants and provides praxiological comments on post-apartheid education policies. The research also initiates an investigation into the social organisation of trust in post-apartheid South Africa.

ABSTRAK

In hierdie studie ondersoek ek die geleentheid vir die transformasie van onderwyseropleiding in die post-apartheidsera. Ek bespreek twee gevallestudies uit my eie professionele praktyk. Die eerste gevallestudie handel oor die indiensopleiding van onderwysers in Grassy Park, 'n plaaslike gemeenskap. Die tweede gevallestudie handel oor die werk wat ek met studente in 'n voorgraadse onderrigprogram aan die Universiteit van Stellenbosch gedoen het. Die studie het die volgende ten doel:

- 'n Kritiese ondersoek na die uitwerking van sosiale aspekte, met die klem op omgewingsaangeleenthede, op opvoedkundige praktyke in die algemeen en op die Suid-Afrikaanse opvoedkundige praktyk in die besonder.
- 'n Kritiese oorsig oor die sosio-historiese veranderinge wat deel vorm van die opleiding van Suid-Afrikaanse onderwysers.
- 'n Ondersoek na veranderende opvoedkundige praktyke aan die hand van 'n beskrywing van en refleksie op my eie professionele werk as dosent in die wetenskap/omgewingsopvoeding aan 'n historiese Afrikaanse universiteit.

Ten opsigte van onderwyseropleiding beweer Pendlebury (1998) dat verskuiwings in die *publieke ruimte, evaluerende ruimte, pedagogiese ruimte en institusionele ruimte*, plaasvind van 'n afgesonderde ruimte (verberg vir publieke waarneming/evaluatie) na 'n meer deursigtige ruimte. In hierdie studie fokus ek op die pedagogiese ruimte wat, volgens Pendlebury (1998:345), bepaal '*who may learn (or teach), how and what they learn (or teach), when and for how long and where*'. Ek gebruik Pendlebury (1998: 345) se kategorieë saam met Turnbull (1997) se perspektiewe oor kennisproduksie as konseptuele raamwerk vir my analise van die twee gevallestudies. Alhoewel 'n beduidende gedeelte van my studie op klaskamerpraktyke fokus, moet die term *pedagogie(k)* volgens my 'n veel breër betekenis verband gesien word om ook Hernandez (1997:11) se '*all spaces in which knowledge is produced and identities are formed*' intesluit.

Hierdie navorsingsverslag lig die komplekse aard van transformasie op die mikro-vlak van klaskamerpraktyke toe. Van groot belang is ook die kontekstualisering van opvoedkundige praktyke op mikro-vlak binne die breër sosio-historiese veranderlikes en lewer praktykverwante kommentaar op die opvoedkundige beleid van die post-apartheidsera. Die navorsing dien ook as vertrekpunt om sosiale vertroue in die post-apartheids-Suid-Afrika te ondersoek.

This dissertation is dedicated to

My parents: Tommy and Amy. Although they were denied the benefits of education rightfully deserved, they taught me to value it. Their sacrifices made it possible for me to pursue post-secondary studies that served as an important foundation on which this doctoral study was built. I borrow Hargreaves's (1994) words that, "sacrifice is one of the most unfashionable yet underrated human virtues".

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Chapter one

A particular voice, in a specific time

1.1 INTRODUCTION

South Africa is a country of contrasts, diverse both biophysically and culturally, and could be regarded as a world in one country. I have lived in South Africa all my life and as a consequence have experienced first hand some of the harmful effects of apartheid rule as well as some of the pains and challenges associated with the birth of our country's democracy. My professional life, like other aspects of my life, has been indelibly influenced by South Africa's history. In this chapter I attempt to lay bare how my professional life has been shaped by, and embedded in, South Africa's history. This is a necessary component of this dissertation work because it is concerned with representing instances of my own professional life.

All activities we are involved with/in are influenced by their placement in time and space. Pendlebury (1998:333) argues that all social practices 'occur within particular spatio-temporal settings that are partly constitutive of the actions and interactions that take place within them'. She points out that even though these are seemingly obvious 'facts' they are often overlooked. In this study I use these 'facts' as vantage-points for investigating the transformation of pedagogical practices in higher education after apartheid.

My story is shared at a particular time in South Africa's history; a period characterised by rapid change as a consequence of both global forces and the nation's political transformation. The release of Nelson Mandela (from prison) and the unbanning of the liberation movements in 1990, as well as our country's first democratic elections in 1994, signaled dramatic changes to all aspects of South African social life including education. Pendlebury (1998:334) points out that education, which was a primary site of contestation under apartheid, now is a primary site of transformation. She argues that transformation is not only

paramount for education's own sake but also because education is recognised as crucial for transforming other spheres of social life. Since 1994 in particular the Department of National Education (DNE) has released a plethora of policy documents intended to provide frameworks for transforming educational practices and the institutions in which they occur.

In order to meet the demands of a changing society and redress features linked to apartheid's legacies, teacher education, like all other social practices, has had to begin a process of transformation. As a teacher educator, I am particularly interested in identifying opportunities that may currently be available to enable this transformation. In charting the transformation of post-apartheid teacher education, Pendlebury (1998) argues that we are seeing shifts in *public space*, *evaluative space*, *pedagogical space* and *institutional space* from insulated space (hidden from public scrutiny) to a more porous space. In this study I am concerned with pedagogical space that, in Pendlebury's (1998:345) terms determines 'who may learn (or teach), how and what they learn (or teach), when and for how long and where'. In this study I aim to:

- Critically examine the implications of social issues, particularly environmental issues, for pedagogical practices generally and for South African pedagogical work in particular.
- Critically review the changing socio-historical determinants of pedagogical practices in South African teacher education.
- Investigate changing pedagogical practices by describing and reflecting on work done in my own professional contexts as a science/environmental teacher educator at a historically Afrikaner¹ university.

My study charts a journey of inquiry that is linked inextricably to my lived experience. As an entry point to this thesis I reflectively trace how my social and professional development has shaped my interest in pedagogical issues and their particular manifestations in science and environmental education. Although a

significant part of my study focuses on classroom practices, I take pedagogy to have a much broader meaning that incorporates in Hernández's (1997:11) terms 'all spaces in which knowledge is produced and identities are formed'.

1.2 POSITIONING THIS STUDY AUTOBIOGRAPHICALLY

This study is continuous with my past experience as a learner, secondary school biology teacher, and my more recent experience as a teacher educator and postgraduate researcher. I describe these autobiographical influences on my research by briefly examining three interrelated aspects of my life: my years prior to entering professional life, my professional contexts prior to and during the research, and the early theoretical influences on my thinking. As Ballenger (1992:201) writes:

An important part of the research project is examining where a particular research question comes from in one's own life - why it seems important to the teacher-researcher. In many cases, this is a matter of investigating one's own socialisation, a kind of self-reflection that becomes an important part of the investigation.

However, I argue for a need to go beyond mere 'socialisation' and to probe some of the ways in which we actively take up some discourses rather than others. Poststructuralist theory provides useful insights in this regard. Davies and Banks (1992:3) point out that a poststructuralist analysis goes beyond recognising only the constitutive force of discourses, to an acceptance of the possibility of the subject's agency:

Poststructuralist theory argues that the person is not socialised into the social world but interpellated into it. That is, they are not passively shaped by active others, rather they actively take up as their own the discourses through which they are shaped.

In this chapter I show not only how my social and professional life has been shaped by various discourses but also how I have taken up particular discourses through my own agency. I use autobiography to demonstrate that I am not a

¹ By Afrikaner I mean white and Afrikaans speaking. Currently the University of Stellenbosch is still predominantly white and the official medium of instruction at the university is Afrikaans.

‘unitary rational actor’ (Davies & Banks 1992:3) – in other words, my subjectivity is not fixed but constantly in process.

1.2.1 My years prior to entering professional life

Recently, the journal *Environmental Education Research* published a special issue that was concerned with revisiting research on Significant Life Experiences (SLE). In this special issue, guest editor Thomas Tanner (1998:365) argues that this research is based on a simple rationale:

(I)f we find that certain kinds of early experience were important in shaping such adults [committed to environmental quality], perhaps environmental educators can, to the degree feasible, replicate those experiences in the education of the young.

Significant Life Experiences research, as reported by Tanner (1980) and Palmer (1993), claims that childhood experience in the outdoors is the single most important factor in developing personal concern for the environment. According to Chawla (1998:373), Tanner defined outdoor experiences as ‘interaction with natural, rural or other relatively pristine habitats’ and Palmer equated outdoors with natural areas.

My experience has been different from the stereotypical and reductionist views produced by SLE researchers. I am not involved with/in environmental education as a result of significant childhood experiences in ‘outdoors and more or less natural’ environments (Tanner 1998:366). I have lived in an urban environment all my life. With the exception of a three-week school vacation in a rural area and the few drives our family took into the ‘country’ during my childhood, I spent very little time in ‘natural’ environments. Further, as a black² South African, for most of my life I was denied access to many pristine environments; beaches were

² I use the term “black” in the manner consistent with the Black Consciousness usage of the word, that is, as including *Africans*, *Indians* and *Coloureds* (Apartheid categorisations). “Black” in this context developed as an oppositional discourse which both refused to accept the apartheid categorisations and indicated the common oppression of *Africans*, *Indians* and *Coloureds*. I did my schooling in the decade of the 1970s, a period in South African history when discourses of Black Consciousness were taken up by many students. Even though the apartheid categorisations are seemingly being accepted by many in post-apartheid South Africa I am unable to do so.

segregated, and many nature reserves and hiking trails were reserved for those who were classified 'white' under apartheid. I grew up associating natural environments and conservation issues with the world of 'white' South Africans. I certainly did not regard South Africa's beautiful natural environment and its resources as the heritage of all South Africans. I cannot recall ever going on a fieldtrip during my schooling (with the exception of the compulsory visit to the Castle and the South African Museum, a propaganda exercise arranged by the education department).

Most of my school-teachers ('obediently') spent their classroom time transmitting to us what state syllabi and school textbooks prescribed. This seemingly well organised state arrangement was disrupted by events such as the 1976 Soweto uprisings and the 1980 school boycotts that profoundly influenced South African history and education. The 1980 school boycotts were particularly significant for me and contributed greatly to my political awareness. I was raised in a very conservative Christian environment and taught that my religious life should be separated from politics. In 1980 I was in grade 11, during the period of protracted school boycotts. These started in the city of Cape Town, where I did my schooling, and rapidly spread throughout the country (Christie 1985:244). As school students we boycotted 'normal school activities', demanding a single national education department (there were 19 in SA at the time divided on ethnic and racial lines), and for educational resources to be distributed equitably to children. During the four-month boycott I attended alternative awareness programmes organised by the student representative council (SRC) at our school. During this period I became deeply aware of acute disparities in the distribution of both human and material resources between those then classified as 'White', 'Indian', 'Coloured' and 'African'. I also learned that students had the power to change some of the conditions of teaching and learning. Although schools remained segregated following the 1976 and 1980 unrest, the Apartheid State provided more textbooks, repaired school buildings and set up the De Lange Commission (1981) to investigate education in South Africa (Christie 1985:248). It was at this point in my life that I began to understand education to be an important site of struggle and also became aware of the role of human agency in

bringing about change. Although my consciousness about the evils of apartheid was raised during this period, I do not recall that I made any meaningful connections between apartheid policies and state pedagogy. However, there were some students at the time that were able to express their discontent with state schooling articulately and with insight. The words of one student provide an apt illustration:

THEY decide what we are taught. Our history is written according to their ideas. Biology and physics are taught in our schools but which cannot apply to our everyday lives. We are not told that most diseases of the workers stem from the fact that they are undernourished and overworked. We are taught biology, but not biology of liberation, where we can tackle the concept of 'race' to prove that there is no such thing as 'race'. We are taught geography, but not the geography of liberation. We are not taught that 80% of South Africans are dumped on 13% of the land We are taught accountancy merely to calculate the profits of the capitalist (quoted in Maurice 1983, emphasis in original).

One effect of my growing political consciousness was to motivate me to look differently at future career prospects. I became aware of the need for more and better qualified teachers, particularly science teachers in black schools (both my school science teachers were unqualified). In 1980 I decided to pursue a career in education in lieu of my former aspirations to become a civil engineer. My early love for biology and geography, together with my perception of a need for science teachers in disadvantaged schools, formed the basis of my decision to study for a Bachelor of Science degree in biological and earth sciences, and to pursue a career in science teaching.

My studies in botany and geography opened new windows on life for me and provided an initial foundation for my interest in environmental education. These studies enabled me to begin to understand the complexity and significance of human-nature relationships. I was particularly interested in ecology, which formed part of both my botany and geography studies in my third year at university. Ecology involved viewing organisms as part of a broader network of relationships rather than studying living organisms as isolated and abstracted from their natural

environments, as is done in many other areas of science disciplines. My ecological consciousness was further enhanced through weekly fieldtrips (forming part of my ecology studies) into natural environments and sites where human 'progress' was encroaching on ecologically sensitive areas. At this time, even though I saw the negative impact of humans on natural environments, I still viewed human society as somehow separate and detached from nature. I also viewed environmental education as tantamount to studying ecology.

I did my BSc studies in the early to middle 1980s at what was then, arguably, the most radical university in South Africa, the University of the Western Cape (UWC). My formal studies at UWC were often interrupted by student political activities such as public demonstrations, lecture boycotts and mass meetings. In this period my political consciousness developed even further. However, my political consciousness grew in parallel to my ecological consciousness since I had not then developed meaningful connections between them.

In 1986 I studied a higher diploma in education (HDE) course at the University of Cape Town. In the geography method studies that formed part of this course I was introduced to the works of two international geographers, John Fien and John Huckle, which broadened my understanding of environmental education. Reading Huckle (1983) in particular introduced me to three approaches to environmental education: education *about* (emphasis on human ability to control the environment), *in* (using the environment as a medium for education) and *for* (regards environmental well being as its goal) the environment. It was only later that I learned that Arthur Lucas in his 1972 doctoral thesis first developed the idea of these three approaches to environmental education (see Greenall Gough 1993, A.Gough 1999). Further, in the biology method course of my HDE year we listened to several guest speakers who addressed us on different topics. One of these talks on environmental education was particularly useful in challenging me to view the environment more holistically. The speaker, Danie Schreuder, referred to environment as including both natural and cultural. This served as an initial basis for me to later develop an understanding of the complex interrelatedness of

different dimensions (biophysical, social, political and economic) of 'environment' as well as its socially constructed nature.

Another component of the HDE course was a semester module in theory and philosophy of education. The focus of the module was on contesting ideologies in South Africa and how they came to shape educational discourses and practices at the time. The module specifically focused on Afrikaner Nationalism, Liberalism and Social Reconstructionism as ideologies. I found the module useful in several ways. Firstly, it helped me to understand how sets of ideas infuse meaning into peoples' lives as well as social practices such as education. Secondly, it helped me to begin to understand the contradictions in my own life resulting from my social development in a deeply divided South Africa. I remember feeling confused as I personally could identify with aspects of all three ideologies. Thirdly, what I learned served as an initial basis for me to later develop philosophical lenses not only to understand but also to critique nuances and divergences of these ideologies in social practices such as educational research, teacher education and pedagogy. Next I reflect on concerns related to my professional contexts as teacher and teacher educator.

1.2.2 My professional contexts

After completing my Bachelor of Science degree and Higher Diploma in Education I taught biology in a state school for ten years. The school I taught in was administered by one of the nineteen apartheid education departments called the Administration: House of Representatives. The school was located on the border of a lower middle class Cape Town suburb, Grassy Park, and a township, Parkwood. My decision to teach in Grassy Park was a conscious one. Both my parents grew up and did their schooling in Grassy Park. The childhood and adult memories they shared with me, and weekly visits with my grandfather, gave me a vivid picture of the area including the resilience of oppressed people who first settled there for economic opportunities and property ownership in the difficult years of colonial rule and apartheid. My decision to teach in Grassy Park was motivated by a deep desire to serve a community which served my parents well.

I entered the teaching profession with great enthusiasm and an eagerness to share my love for biology. While my enthusiasm to teach biology never waned, I soon realised that my task was not going to be easy. The culture of the school and the education system were major constraining factors. The culture of the school did not encourage co-operative learning or collaborative work among teachers, and there was no school or system based in-service education programmes. The classroom was a private domain where each teacher had to find his or her own way and struggle to survive.

Education department officials and many school principals strictly controlled what was taught in schools. I remember my first inspection by a school inspector (euphemistically referred to at the time as a 'subject advisor'). After he observed my lesson I was reprimanded for two reasons: firstly, work supposedly meant only for higher-grade learners, appeared in the books of standard grade learners and, secondly, I used an overhead projector to explain the life-cycle of *Taenia solium* (tapeworm) instead of drawing the life-cycle on the blackboard. Although I tried to justify what I did educationally in a short discussion with the subject advisor, his visit was followed by a very negative written report. To ensure that all aspects of syllabuses were covered, subject advisors strictly moderated end-of-year examination papers. These control measures made it very difficult to teach anything other than the formal syllabus in very conventional ways. Although I explored opportunities that the immediate school environment provided for biology teaching, they were few and far between. My main resource as a teacher was the school textbook. Adopting a critical perspective *vis-a-vis* the textbook did not work very well either. I pointed out many errors in the textbooks to learners and encouraged them to view textbooks and what I said critically. This was difficult for them, as they had come to believe that textbooks report truth and are not to be questioned.

Reflecting on the situation that I found myself in made me realise that there were limited opportunities to develop professionally within the system. My deep desire to develop both personally and professionally made me pursue two avenues that significantly influenced my interest in environmental education, educational

research and teacher professional development. Firstly, I continued with formal studies and completed my Bachelor of Arts and Bachelor of Education degrees part-time and completed a Master of Education degree in Science Education full-time whilst on study-leave (sabbatical). The second avenue I pursued was to network with other teachers who, despite the systemic constraints, were interested in developing professionally. Some of these networks were the Biology Teachers Forum, which was an initiative of the Naturalist Society (Natsoc), two participatory action research projects reported in the theses of Reddy (1994) and Wagiet (1996) and the Biology and General Science Teachers' Forum which later led to the establishing of the Peninsula Biology Teachers' Association (PBTA).

My collaborative work with teachers occurred in the period post 1990. At this time the state's control of schools slackened in the light of mounting pressure from the organised teaching profession as well as the wider political changes. In the Western Cape Province, many schools banned department officials from visiting them and, with the exception of matriculation examinations, papers and exam marks up to grade 11 were moderated internally by schools. The teacher union movement strengthened and we saw the launch of the largest teachers' union, the South African Democratic Teachers' Union (SADTU) in October 1990, a culmination of a struggle for teacher unity from the middle 1980s (Moll 1991). The changing socio-political milieu provided space for us as teachers to do collaborative curriculum development work in science and environmental education.

The collaborative work that I did with teachers during this period contributed to my professional development in several ways. Critical discussions that I had with colleagues and the literature that we read made me reflect more deeply on my own teaching practice. For the first time I became critical of the biology content which formed part of the state syllabi. My main concern centred on relevance. I started asking questions such as:

- Why had I uncritically taught the details of the life cycle of a pine tree (as an example of a gymnosperm) without pointing out to learners that the pine tree is an alien plant and that pine plantations are responsible for diminishing water resources in certain areas?
- Why had I taught the structure and reproduction of viruses without referring to the HIV which is responsible for causing AIDS?
- Why in South Africa were we required to teach the intricacies of the DNA model to learners who are 'exhausted and struggling to concentrate because of pregnancy, tuberculosis, chronic bilharzia and other parasitic infections such as roundworms and hookworms, and undernutrition because crops will no longer grow on barren land' (Doidge 1996:46)?

Moreover, I questioned why I was force-feeding an unrelenting diet of irrelevant biology content to learners by way of transmission modes of teaching. I thought deeply for the first time about my undemocratic pedagogical practices and how I had acquired them. This caused me to listen to learners more attentively and to consider their critical questions more carefully - questions such as, what was the relevance to their future lives of learning the osmoregulation process in a tiny organism like the Amoeba? I realised that prescribed syllabi were a mechanism of the state aimed at controlling teachers' work. Syllabi were loaded with content to keep teachers and learners busy so that there was very little time to question the social ills of apartheid. I thought about the contradictory roles we may be playing as teachers, protesting on the streets against poor service conditions under apartheid whilst to a large extent contributing to the maintenance of the status quo through our pedagogical practices.

As a network of teachers we used the space provided by the post-1990 period to explore ways of introducing more relevant topics in our biology classrooms. We collaboratively redesigned the syllabi (see Wagiet 1996), but their implementation had limited success because members of the network were individuals from different schools who were required to set uniform examinations in line with work done by their school colleagues. However, I learned a language of critique that

enabled me to understand how teachers in South Africa had been systematically deskilled and that they functioned merely as 'technicians' to implement curricula developed within a Research, Develop, Disseminate and Adopt (RDDA) model of curriculum development. I also, for the first time, started to see other possibilities for developing curricula such as participatory action research. During this period of collaborative work with other teachers I was able to broaden my understanding of environment as not only biophysical, but as a construct with interrelated biophysical, economic, social and political dimensions.

As I reflect on my experiences as a teacher and teacher educator, and my involvement in collaborative work with teachers, it is with a sense of humility that I share some of what I saw was possible. I learned that teachers have power to significantly change the conditions of teaching and learning. Despite many constraints I saw the commitment, creativity, resilience and strength of teachers to change their circumstances and practices. I witnessed teachers spending their weekends and many afternoons involved in organising and conducting in-service education programmes 'for teachers by teachers' because the education department provided no INSET (In-service Education of Teachers) programmes. Through my interaction with other teachers I became involved in curriculum development processes, learned and became interested in participatory research, environmental education, and materials development and teacher professional development. As we entered a democratic dispensation in 1994 it was fitting that as a group of teachers we reversed previous practices and conducted in-service education programmes for subject advisors as well as other teachers as part of the activities of the interim syllabus committee for the natural sciences learning area.

Although my experience may not be that of many other teachers who may continue to function as technicians, curriculum consumers or implementers, as a result of an education system which systematically deskilled them, I am convinced that teachers can and should play a significant role in curriculum development processes. According to De Clercq (1997:140) curriculum research throughout the world has shown the vital importance of building the professional capacity of teachers and involving them as key agents in both the design and implementation

of new curricula. In theory the 'new' South African curriculum (Curriculum 2005) provides greater opportunities for teachers to become curriculum developers/designers. I elaborate on this in chapter 3. In the first case study I describe a partnership between schools and a university aimed at designing curricula collaboratively. In the second case study I describe the role played by pre-service students in curriculum design. In the words of Elliot (1991: 44) my research will present, 'the art of what is possible' in specific pedagogical sites and contexts.

As I mentioned earlier, in 1995 I took a year's sabbatical and registered for a Master's degree in Science Education. I did a course work Master's degree consisting of a structured component and a minor dissertation (half-thesis) in a science education unit at the University of Cape Town. Generally, all universities have an interest in ensuring that students complete their studies in a certain allocated time so that the institution can derive maximum subsidy support from the government. Research programmes are therefore often designed to ensure efficient completion of studies. As a consequence students often follow research approaches used by their study leaders, allowing little space for exploring alternative approaches to educational research. The research done in the science education unit where I studied was located to a large extent within a scientific paradigm. By this I mean that the research mainly involved applying a somewhat stereotypical, textbook version of the scientific method (as is popularly supposed to be used in the natural sciences) to research problems in science education. The research was based mainly on quasi-experimental and survey research designs. At the time, I was not sufficiently aware of alternative research paradigms and accepted this framework for my study. I was, however, uncomfortable with certain aspects of my study such as being distanced from research subjects'. I had experienced the benefits of working closely with research participants in participatory research work through my involvement in the research studies of Reddy (1994) and Wagiet (1996), and through the collaborative work with(in) teacher networks.

In 1996 I started part-time teaching in the Faculty of Education at the University of Stellenbosch. I left full-time school teaching at the end of 1996 and continued to lecture part-time at the university, and worked as a researcher in the Environmental Education Programme, University of Stellenbosch (EEPUS), until I was appointed full-time as a lecturer in 1999. During this period I became involved in three research projects which further stimulated my interest in asking critical questions concerning teacher education, environmental education and science education practices. I also became increasingly interested in learning about and doing research that provides alternatives to dominant positivist/-empiricist approaches. I turn now to a discussion on early theoretical influences on my professional life.

1.2.3 My early theoretical influences

I have already discussed some of my theoretical influences in earlier parts of this chapter. I expand on them briefly here. As a schoolteacher I read in professional journals the works of Watson (1990) and Schreuder (1991) among others. These authors drew my attention to the irrelevance of state biology syllabi to the everyday lives of school learners and the needs of a broader South African society. However, they did not address sufficiently the underlying causes of irrelevant aspects of biology that was taught to school learners.

Reading the works of environmental educators such as Robottom (1993) and Fien (1993) enabled me to better understand the underlying causes of environmental as well as educational problems. I found Fien's (1993) linkage of the three approaches to education *about*, *through* and *for* the environment with the three ideological positions of *neo-classical*, *liberal progressive* and *socially critical* respectively, particularly useful. I could easily relate Fien's work to ideological positions taken up by different groups of people in South Africa, namely, Afrikaner nationalists, liberalists and social reconstructionists. As a black South African I found the discourses around environmental education *for* the environment particularly appealing because it critiques *neo-classical* and *liberal progressive* ideologies which are responsible for reproducing dominant values in society. I need to point out, however, that environmental educators such as Gough

(1987) and more recently Jickling and Spork (1998) have critiqued variously the rhetoric around education for the environment. The critiques centre on the anthropocentric nature of the discourse and the potential danger of bias and indoctrination in using environmental education to develop political literacy (see Fien 1993: 43-44). As Gough (1987:50) wrote:

While it has been recognised that environmental education ought not to be merely education *in* or *about* environments, I am not convinced that the popular slogan of 'education *for* the environment' is much of an improvement. Apart from being somewhat patronising and anthropocentric (who are we to say what is 'good for' the environment, and which environment is '*the* environment', anyway?), this slogan maintains the sorts of distinctions that tend to work against a deeply ecological world view - distinctions between subject and object, education and environment, learner and teacher (emphases in original)

In the 1990s in particular, we have witnessed the construction of discourses on sustainability such as education for sustainability (EFS), education for sustainable development (EFSD) and education for a sustainable future (EFSF). These approaches have also been critiqued for similar reasons to those leveled against education *for* the environment. Sauvè (1999:27) argues that the concept of a sustainable future or sustainability is based on an essentially anthropocentric ethic that puts humanity at the centre. She points out that the discourse of education for a sustainable future (sustainability) with its distancing of subject and object as well as human and nature, is bathed in the paradigm of modernity which is inadequate for a reconstructive educational project. Further, Sauvè points out that with its focus on the future, education for sustainability may have a limited appeal to the younger generation, 'whose significant future prospects are limited to short or medium terms' (Sauvè 1999:27). Others have argued against the deterministic tendencies inherent in constructions like 'education for sustainability' and point out that sustainability has been made controversial by interpretations of the concept itself, many of these being anthropocentric (see Schreuder, Le Grange & Reddy 1999:128). These authors argue that anthropocentric approaches to the concept may reinforce and perpetuate modernist views of the earth and natural resources exclusively as human resources and commodities. Influenced by debates

on education and sustainability, in this study I show how a discourse on *science and sustainability* has been taken up in higher education programmes I was involve with/in. This perspective argues for a more holistic view of sustainability, integrating natural systems with social systems that may enable us to draw on examples of sustainable processes in natural systems and thus inform a more sustainable human society.

In my attempts to explore the relationship between science and sustainability I read the works of scientists who were exploring new perspectives within the natural sciences that I thought could contribute to addressing environmental concerns. I found the works of Capra (1994, 1997), Lovelock (1995), Bohm (1994) and Zohar & Marshall (1994) particularly insightful. I also found Ulrich Beck's (1992) notion of *reflexive science* useful in this regard. I discuss these developments in greater detail in chapter 2. I also benefited from Giroux's (1995:x) notion of a *culture of positivism*. He distinguishes between a culture of positivism as an ideological form and positivism as a particular philosophical movement. Giroux's idea of a culture of positivism (obsession with progress, technical control and prediction) helped me to understand how culture as an ideological form has contributed to crises which abound in ecological, educational, economic, political spheres and so on. Modern (dominant) approaches to educational research have also been influenced by the culture of positivism and my study is an attempt to respond by doing research that is postpositivist. It is with this in mind that I turn now to a brief discussion of postpositivist research. I discuss postpositivist inquiry in greater detail in chapter 4.

1.3 CHARTING A POSTPOSITIVIST APPROACH TO RESEARCH

Usher (1996:9) points out that epistemological and ontological assumptions underlying research work are not examined by the majority of educational researchers. Epistemology and ontology are complex philosophical concepts and not easily definable. As Gough (2000a:2) writes, "we can no more provide a precise three-line definition of epistemology than of everyday words like 'love' or 'justice' - these are terms that will always be the subject of exploration, speculation and debate". I do not discuss these constructs in detail but put simply,

epistemology relates to how knowledge is perceived and ontology relates to how reality is viewed. Dominant positivist discourses of research assume a realist ontology and thus do not accept the possibility that both knowledge and reality are socially constructed and, therefore, are perceived differently within disparate discourses. Usher (1996:9) points out that the failure to examine these assumptions has led to research being understood as a 'technology', as simply a set of methods, skills and procedures applied to a defined problem. Although the latter view continues to dominate many educational discourses, viewing research as a 'technology' or 'technical process' has been (and is increasingly being) challenged in both the natural and social sciences (Kuhn 1970, Quine 1970, Lather 1991a, Lather 1992, Howe 1992, Usher 1996). The view of the scientific method as an abstract set of logical rules, 'made in heaven' and universal in their applicability is no longer accepted without question - no method is self-validating but is itself culturally specific, historically located and value-laden (Usher 1996:13-14).

Instead of viewing research as a 'technology', I take it for granted in this study that research is a socially constructed process. By this I mean that research is an embodied process (shaped by personal beliefs, values, interests and lived experience) and an embedded process (occurring within human co-existence and shaped by socio-historical factors). For examining how personal beliefs, values, and interests as well as how socio-historical factors shape educational research (processes) the concept of reflexivity is particularly useful. Usher (1996:38) distinguishes between two forms of reflexivity, *personal reflexivity* and *epistemic or disciplinary reflexivity*.

Personal reflexivity draws attention to the view that the self that researches has an autobiography marked by the significations of gender, sexuality, ethnicity, class, and so on (Usher 1996:38). In chapter 1 of this thesis I foreground how personal values, interests and my lived experience have been brought to bear on this research study. *Epistemic or disciplinary reflexivity* concerns moves away from the researcher to the research act so that the focus switches to the communities within which the research as a practice is located (Usher 1996:37). He points out

the significance of seeing research as located within a community. Following Kuhn (1970) he highlights the effect this has on the way research is organised through a community's disciplinary matrix. In chapter 2 I examine how this study has been shaped by changing trends in, and conceptions of, 'environment' and environmental education as manifested within the broader environmental education community. In chapter 4 I locate this research study within changing orientations to educational research. I point out that this study is being conducted within a period characterised by the 'ferment over what is seen as appropriate within the boundaries of the human sciences' (Lather 1992:89), an era depicted by the contestation of positivism (or the hegemony thereof). This research study therefore will be broadly located within a framework of research endorsed by a community of researchers who choose to refer to their work as postpositivist inquiry.

1.4 REFLECTIVE SUMMARY

In this chapter I have examined how my lived experience and professional work has contributed to shaping my interest in this study. I also discussed briefly some of the early theoretical works that influenced the production of this thesis.

I have shared a story. My story represents a struggle 'to write in such a way that I break the tension between my structuralist training and the desire to affirm the primacy of human experience' (Jansen 1991:194). My narrative serves as an attempt to undermine empiricist assumptions that human experience can only be represented by quantitative indices and pre-defined outcomes. However, I point out that my aim here is not to 'draw endlessly on the details of idiosyncratic experience but to use it as a starting point for further theorising' (Jansen 1991:195), as an entry point for investigating post-apartheid pedagogical practices with reference to the context of my own work. In this first chapter I have portrayed how experiential moments have been significant in shaping my interest in education generally and pedagogical practices, and educational research more specifically. Later in my thesis I will draw on what I have shared in this chapter to help me to be reflexive about what will unfold in the rest of the thesis.

In **Chapter 2** I provide a socio-historical perspective on the relationship between science education and environmental education. I raise some of the historical tensions between these two areas of study and raise arguments for a closer relationship between the two. In **Chapter 3** I provide a historical perspective on teacher education in South Africa and chart possibilities for its transformation. I also introduce Pendlebury's (1998) idea of pedagogical space and Turnbull's (1997) idea of knowledge spaces. I use their ideas to analyse the cases in chapter 6. **Chapter 4** describes my research methodology. In this chapter I articulate the nexus between *headwork*, *fieldwork* and *textwork* (see van Maanen 1995:4) in developing cases and stories related to my professional work. I also raise issues concerned with the discourses of methodology and method, describe how data was produced in the study and consider aspects of research rigour. **Chapter 5** presents a description of the two cases and the discourses and stories embedded within them. In addition to a written narrative account of the cases I use photographs to provide additional insights. In **Chapter 6** the cases are interpreted and analysed and possibilities for further investigation and research are opened up. **Chapter 7** provides a reflexive summary of the study.

The writing style of this thesis has strong narrative and biographical elements. The thesis will not be structured in a traditional way. In lieu of a special chapter on literature reviewed, the entire thesis will provide evidence of the literature that has informed my research. The contribution of this dissertation lies not only in insights articulated with respect to changing pedagogical practices and pedagogical spaces, but importantly, initiates an investigation into the social organisation of trust in post-apartheid South Africa. How trust is negotiated in knowledge spaces is central to knowledge production processes. Because pedagogy is viewed in this study as, 'all spaces in which knowledge is produced' (Hernandez 1997:11), investigating how the social organisation of trust may be changing in post-apartheid South Africa could provide useful insights as to how pedagogical spaces/pedagogical practices are changing.

Chapter 2

A socio-historical perspective on environmental education and its relationship with science (education)

In this chapter I provide my perspective on relationships between science education and environmental education, and how they have evolved over time. Such a perspective is important to this study for two reasons: Firstly, science/environmental education provides the context in which the cases of pedagogical practices are examined. Secondly, my professional development and professional identity have been partly shaped by specific discourses in science education and environmental education that I have actively taken up. I mention this since the meaning of pedagogy in this thesis is not confined to teaching and learning, but also includes the spaces in which knowledge is produced and identities are formed (see 1.1).

2.1 BACKGROUND

In chapter 1 I pointed out that this study is continuous with my past experience as a learner and secondary school biology teacher, and with my more recent experience as a teacher educator and postgraduate student (see 1.2). I begin this chapter by recounting a moment in my journey as educator and researcher. In October 1995 I was invited with three other people to co-author material resources that would serve to support science teachers in the junior secondary school phase (grades 7-9). The authoring team consisted of a US academic working as an education consultant in South Africa, a researcher in the Environmental Education Programme University of Stellenbosch (EEPUS) and two school biology teachers (including me). The project was conceived initially as a partnership between a university, a donor funder, a funding agency, a publisher and a writing (authoring) team. Prior to the first meeting that I was invited to, discussions had taken place between a publisher and the project leader. The aim of the project was to adapt the US *Windows on the Wild* materials for South Africa. Windows on the Wild (WOW) is a project that supports biodiversity education in

North American schools through the use of teacher and learner resource materials. As a project team we envisaged that WOW (SA) would be concerned with the development of a series of teachers' handbooks dealing with *biodiversity* and *sustainability*. *Biodiversity* refers to the variety of plant and animal species, which inhabit our planet. Put simply, sustainability refers to the capacity for something to endure or continue indefinitely. Its meaning within environmental education discourses will be explicated later in this chapter.

The rationale for the project was to enhance the relevance of biology curricula for South African learners. As a project team, we thought that this might be achieved by developing teacher support materials that would serve the needs of junior secondary science teachers and learners. South African school curricula were largely content-based (factual learning) and teachers almost exclusively used textbooks (designed for learners) as resources (see Wagiet & McKenzie 1991/1992). By focusing on biodiversity and sustainability, we hoped that the WOW (SA) materials would introduce environmental education concepts and processes to science teachers so that they could enhance the relevance of their teaching – more relevant for addressing environmental concerns than concepts and processes in state syllabi. At the Environmental Education Programme, University of Stellenbosch (EEPUS), where this project was located, environmental education materials had already been developed for junior primary teachers (We Care Junior Primary) and for senior primary teachers (We Care Senior Primary). The team hoped that developing these materials for junior secondary science teachers would augment the materials that already existed at EEPUS.

During the early developmental stages of the WOW (SA) project, I decided to document the process as part of my PhD studies. Although the focus of my PhD later changed, this moment was significant. As a team we spent a great deal of time critically discussing the overarching theme of the project, sustainability. This included how our understandings of sustainability related to other discourses of sustainability. I also took advantage of the opportunity the project provided to inquire further into the relationships between science education and environmental education as well as how our project articulated with these disciplines.

Furthermore, during the early stages of the project, education policy makers in the 'new' South African government produced several policy proposals, such as the discussion document on a National Qualifications Framework (NQF) (Department of National Education, 1996a), and a Curriculum Framework (Department of National Education 1996b) that provided the basis for the development of Curriculum 2005. Later in this chapter I will discuss the significance of Curriculum 2005 for this study, but before doing so, I will provide a brief introduction to the chapter.

2.2 INTRODUCTION

Personal (dis)positions and research processes are influenced by, and emerge from, broader societal and historical perspectives. Additionally, Kirby and McKenna (1989:16) point out that:

(R)esearch that does not reflect on and analyse the social context from which it springs serves only the status quo and does not enable us to interact with and change society.

In this chapter I show how socio-historical factors have influenced conceptions of 'environment', environmental education and science education. I also describe how changing conceptions of 'environment', environmental education and science education have influenced my research, and explore possibilities for integrating science and environmental education processes within Curriculum 2005.

Di Chiro (1987: 24-25) captures concisely how environments (environmental issues and concepts) are socially constructed:

We define [environment] by use of our own individual and culturally imposed interpretive categories, and it exists as the environment at the moment we name it and imbue it with meaning. Therefore, the environment is not something that has a reality totally outside or separate from our social milieux and ourselves.

The concepts I use in this study have been fashioned by human purpose and action. As Fay (1975) and Taylor (1985) point out, concepts are not ahistorical or apolitical but rather embedded within history. Also, the concepts that I use and

refine in this study are not detached from who I am and the understandings I have developed of them up to this point in my life. I therefore intentionally refer to 'a' perspective because what I share here is my story (my understandings) of how the relationship between science education and environmental education has developed over time both internationally and in South Africa. Obviously, debates on the relationship between science (education) and environmental education started long before I developed my interest in them. I therefore have benefited greatly from reading the works of others to clarify my own understandings of interrelationships between environmental education and science education. Firstly, I orientate this chapter by discussing the concepts *environment*, *environmental crises* and *environmental risks*. In the rest of the chapter I discuss the divide between science and environmental education, environmental education as processes of social change, the development of environmental education in South Africa and possibilities for including environmental concerns in science curricula within a Curriculum 2005 framework.

2.3 ENVIRONMENTS, ENVIRONMENTAL CRISES AND RISKS

At the beginning of the twenty-first century, we are becoming increasingly aware of environmental problems as diverse as global warming, deforestation, desertification, and threats to biodiversity, population-resource imbalances, and pollution. These problems are serious enough to give rise to the speculation that present patterns of human interaction (with each other and the world at large) are unsustainable. Several responses to environmental problems have emerged in recent decades. These include, *inter alia*, concerned persons writing books and journal articles, media coverage, targeted messages and intergovernmental conventions. Many of these responses highlight the important role education could play in creating greater environmental awareness and, more importantly, how education could (and should) contribute to improving environmental qualities.

Since the 1960s in particular we have witnessed a growing awareness of the effects of human exploitation of the environment. Early responses to environmental problems were those of scientists such as Rachel Carson (1962) concerned with environmental problems associated with the use of pesticides,

Ehrlich and Ehrlich (1970) concerned with human population problems and Meadows *et al.* (1974) concerned with issues related to resources. During the 1970s and 1980s the state of the environment deteriorated even further. Sterling (1993) points out that the world lost nearly 200 million hectares of tree cover, deserts expanded by 120 million hectares, thousands of plant and animal species became extinct, and an estimated 480 billion tons of topsoil were lost in the period from 1970 to 1990. This trend has continued in the 1990s as evidenced by a recent United Nations report, GEO-2000, that according to Mucatta (1999) delivered a devastating assessment of the state of our planet.

Robottom (1983:27) points out that science education followed the reaction of scientists of the 1960s and 1970s and took upon itself the responsibility of responding to this increasing consciousness of environmental problems. He argues that since the 1970s we have seen sharp increases in the number of ecology-related courses offered at all levels of formal education. It is in this context that I argue that environmental education has at least some of its roots in science education. In South Africa ecology was first introduced into schools in the 1970s as part of the grade twelve biology syllabus. In the middle 1980s it shifted to grades 8 and 10 and today this approach to environmental education is still dominant in many South African school programmes.

However, early approaches to environmental education have been criticised for having rather limited conceptions of environment, the nature of the crisis and the kinds of actions to be taken (Janse van Rensburg, 1995). In many of the early education responses the concept of 'environment' was perceived to signify 'nature' or, as in the discipline of ecology, its focus was mainly on biophysical surroundings. This narrow interpretation of environment has been challenged (see O' Donoghue & Mc Naught, 1991; Ekins, 1992; O' Donoghue, 1993; Janse van Rensburg, 1995) and today many environmental educators accept that the concept of 'environment' includes interactions between social, economic, political and biophysical dimensions.

Not only has environment been narrowly conceptualised within science disciplines such as ecology, science itself has been implicated in the current global-ecological crisis. In his seminal work of social analysis, *Risk Society: Towards a New Modernity*, Beck (1992) points out that risks (including environmental risks) experienced in the late twentieth century are the consequence of science in conjunction with industry. Beck (1992) identifies a three-stage periodization of social change in western society. He distinguishes between *pre-modernity*, *modernity* and *reflexive modernity*. This view holds that modernity is co-extensive with industrial society and reflexive modernity with risk society. Industrial society and risk society are, however, not distinct social formations as the risks of risk society are seen mainly as a consequence of industry in conjunction with science (Lash & Wynne: Introduction to Beck, 1992). The cultural productions of modernisation include *inter alia*, an obsession with progress, an unquestioning belief in the value of technique, an unquestioning belief in the scientific method, and a belief that individuals are separate from social arrangements (see Capra, 1983; Beck 1992; Zohar & Marshall, 1994; Janse van Rensburg, 1995; Lotz, 1996). Zohar and Marshall (1994:3), for example, relate current socio-ecological crises to mechanistic perceptions of social and political reality. They point out that mechanism stresses the separation of human beings from physical reality and that nature is therefore perceived as wholly 'other' than ourselves, a force to be conquered and used (Zohar & Marshall, 1994). Capra (1994:334) has a similar view and writes:

(t)he major problems of our time - the growing threat of nuclear war, the devastation of our natural environment, our inability to deal with poverty and starvation around the world, to name just the most urgent ones - are all different facets of one single crisis, which is essentially a crisis of perception. It derives from the fact that most of us, and our large institutions, subscribe to the concepts of an outdated worldview, inadequate for dealing with the problems of our overpopulated, globally interconnected world.

Motari (1994:6) argues that the roots of environmental crises lie not only in the modern era but also in the earlier Greek philosophical tradition that constructed the dualisms that have become archetypes for Western thought. However,

scientists such as Capra (1983, 1994, 1997), Zohar and Marshall (1994), Bohm (1994), sociologists such as Beck (1992), and environmental educators such as Sterling (1993) see current environmental problems as being rooted in modernism, which began with the European philosophical and scientific revolution of the seventeenth and eighteenth centuries. The limits of the scientific paradigm in which school science has traditionally operated may be one reason for some environmental educators viewing science education as a limited vehicle for environmental education.

2.3.2 Environmental problems and risks in South Africa

South Africa has unique and complex environmental problems as a result of both modernism and its delinquent cousin apartheid (O'Donoghue 1993:29). Ramphela (1991) has described some of South Africa's environmental problems as follows:

Overcrowded townships, the air heavy with smoke: barren soils, scarred by ravines and bereft of vegetation; people and land under threat from toxic waste dumps, polluted rivers and pesticides. South Africa is suffering from decades of environmental mismanagement, aggravated and institutionalised by apartheid, which forced people to live in rural and urban areas unable to sustain themselves.

The following example may illustrate more clearly how modern life-styles in combination with apartheid policies have contributed to unique environmental problems. Air pollution (and its associated health risks) is an example of an environmental problem that is a consequence of both modern life-styles and poor living conditions. It has been reported that respiratory illnesses resulting from air pollution were seven times higher among African children than among white children. This is because many African households, due to a lack of electricity, use domestic fuels such as coal and wood as a form of energy (Race Relations Survey 1994/1995). Two other major sources of air pollution, reported in a recent South African research study, were industrial pollution and pollution from the use of fossil fuels in vehicles (Race Relations Survey, 1994/1995). The same study reports that those affected badly by the latter sources of air pollution are people who live in black townships often located near industrial areas and mine dumps.

The resolution of environmental problems (with their associated risks) in post-apartheid South Africa must therefore address the root causes of both modern lifestyles and the poor living conditions that are a continuing legacy of apartheid. In the next section I discuss briefly how environmental problems are linked to education.

2.3.3 Environmental education's challenge in South Africa

Environmental education in South Africa needs to be responsive to complex environmental problems and risks. The difficulty of responding to such problems is compounded by crises in education that are consequences of modernism and apartheid. Schreuder (1995) argues that environmental crises are inextricably linked to education crises. He argues that in South Africa the complex interplay between social, environmental and educational dilemmas has reached a crisis, which he attributes to either *poor education* or *miseducation* or a combination of both. In Schreuder's terms *poor education* is the result of a political dispensation in which education resources were inequitably distributed, benefiting a minority of the population and leaving the vast majority of people with little or no access to quality education. *Miseducation* characterises the education of the 'privileged' minority of the South African population, and could be the result of hegemonic influences of modernist economic and political ideologies on education philosophy and practice. These influences are often referred to as typical of a 'dominant positivist social paradigm'. One consequence of miseducation is a life-style characterised by environmental illiteracy, overt consumerism, and lack of environmental sensitivity and over-exploitation of natural resources (Schreuder 1995). Lotz (1996) argues that education systems in which both *poor education* and *miseducation* thrive have pedagogical climates characterised by, *inter alia*, highly structured curricula, rote learning, inappropriate teacher-learner ratios, authoritarianism, teacher dominated pedagogy, poor quality resource materials and a lack of resource materials. Transforming pedagogical characteristics of poor and miseducation present challenges for the South African education system. The WOW project was intended to respond in some way to this challenge.

2.4 THE SCIENCE EDUCATION/ENVIRONMENTAL EDUCATION DIVIDE

Although environmental education has some of its roots in science education certain environmental educators have long argued that science education is a limited vehicle for environmental education. Robottom (1983:27) argues that environmental education is more than teaching about ecology and human/environmental aspects (education about the environment). For him, environmental education could be described as an effort at comprehensive educational reform, challenging several aspects of conventional schooling, including its disciplinary structures, authoritarian teacher-student relationships, classroom-bound locus of operation, avoidance of controversy, and textbook-based didactic patterns of instruction. Moreover, Robottom (1983: 27) argued that science education was a limited vehicle for environmental education in the 1980s because conventional science subjects operated within a scientistic world-view and was therefore counter-productive to environmental education. He argued that the incompatibility of environmental education and science education resided in the perceived relationship between knowledge and values. Drawing on the work of Skolimowski (1975), Robottom (1983) pointed out that historically we could distinguish at least four basic positions regarding the relation of values to knowledge:

- Plato - the fusion of knowledge with values without ascertaining the primacy of one over the other;
- Christianity - the fusion of the two by ascertaining the primacy of values;
- Kant - the separation of the two without censure of either; and
- Empiricism - the separation of values from knowledge while ascertaining the primacy of factual knowledge over values.

The empiricist position has come to dominate the way science is taught and learned in schools and universities. Robottom (1983:29) points out that the positivistic world-view (separating knowledge and values) promulgated in

conventional science education disregards the many qualitative dimensions of environmental issues that involve emotions, beliefs, aspirations, aesthetics, and perhaps most important of all, political factors. In other words, positivistic science education separates knowledge and values³. Furthermore, Lucas (1980:11) raises concerns about the disciplinary chauvinism of science education evident in the literature. He claims that science educators seem to believe that their discipline is the only vehicle for environmental education. He goes on to argue that science educators have failed to draw upon extensive literature from other disciplines that might bear on the aims of, and issues in, environmental education. However, I must point out that at about the same time, others, such as Greenall (1979) and Fensham and May (1979) argued for a closer relationship between environmental education and science education. For them, science education (at least potentially) was distinctly different from that practised in most classrooms (see A. Gough 1999 for details).

More recently, science educators such as A. Gough (1999), Schreuder, Le Grange and Reddy (1999) and Le Grange (1999a) have argued that science education may be an appropriate vehicle for environmental education. This may be possible if science education and environmental education are viewed in different ways. The scientific paradigm that Robottom (1983:27) sees as counter-productive to environmental education has been contested and discredited within the discipline of science itself (see Kuhn, 1970; Bohm, 1994; Zohar & Marshall, 1994; Capra, 1997). Concerning developments in postmodern science, Bohm (1994:343) argues that:

A postmodern science should not separate matter and consciousness and should therefore not separate facts, meaning, and value. Science would then be inseparable from a kind of intrinsic morality, and truth and virtue would not be kept apart as they [are in modern science].

Bohm's (1994) perspective introduces a fifth position regarding the relation of values to knowledge which Skolimowski (1975) and Robottom (1983) do not

³ The dichotomy between knowledge and values exists only within a positivist tradition. Within

recognise. I argue that if science education programmes are informed by developments in postmodern science instead of conventional (modernist) science, then science education will be able to accommodate the qualitative dimensions of environmental issues Robottom (1983) refers to. Beck (1992) argues that in the period of reflexive modernisation, science tends to refute itself as its culture of scientism creates false claims and expectations in society (see Lash & Wynne: Introduction to Beck 1992:2). I do not discuss in detail the differences between postmodernism and reflexive modernisation. Indeed, postmodernism is itself a polysemous concept and I prefer to refer to postmodernisms since the term has multiple and various meanings. Rather than taking the position that Western society is going through a decisive transitional epoch (defined as 'postmodern'), Beck (1992) argues that Western society is faced with a different modernity typified by reflexivity (thus, reflexive modernisation). In the light of Beck's (1992) and Bohm's (1994) positions, I argue that rather than rejecting science we should draw on changing conceptions of science (such as Beck's and Bohm's) to explore how a reflexive science may contribute towards addressing environmental concerns. A reflexive science⁴ concerns the sciences dealing with mistakes, errors and criticism of their practical consequences within science itself. Furthermore, viewing environmental education as a process of social change may help us to liberate environmental education from the ideological constraints of defining and essentialising it as education *in*, *about*, or *for* (or any other preposition) environment.

2.5 ENVIRONMENTAL EDUCATION AS PROCESS

Environmental education emerged as response to environmental problems. Over the years environmental education has been defined in various ways, often as a consequence of intergovernmental conferences, conventions and deliberations. But merely defining and redefining environmental education has not contributed to the

other traditions such a dichotomy is rendered useless.

⁴ Beck's idea of a 'reflexive science' has broader applicability than my usage in the text. His idea has implications for 'sciences' other than conventional science education such as curriculum policy work, academic work and educational inquiry. My dissertation provides an example of the working of both personal and disciplinary reflexivity in educational inquiry.

improvement of environment qualities or the amelioration of environmental problems.

Distinguishing between education *in*, *about* and/or *for* the environment, as first suggested by Lucas in his 1972 doctoral thesis (A. Gough, 1999), has become an established way of thinking about environmental education. According to Fien (1993: 15) education *about* the environment emphasises knowledge about natural systems and processes. Education *in* the environment emphasises learners' experience in the environment as a means of developing their competencies and values clarification capacities. Education *for* the environment has an overtly critical agenda of values education, social change and transformation through action based exploration and involvement in resolving environmental problems. As I pointed out in chapter 1, these three approaches have often been associated with ideological positions, *neo-classical/vocational*, *liberal progressive* and *socially critical theory*, respectively (Fien, 1993). The neo-classical/vocational orientation sees education as preparation for work. According to Fien (1993: 19) it is an education that uncritically accepts existing social structures and hierarchies, and may thus perpetuate elitism, injustice, class and gender inequalities, and privileges economic growth at the expense of environmental degradation. The liberal progressive orientation sees education as preparation for life and values individual excellence and achievement. The socially critical orientation to education contends that education should not merely prepare learners for the world of work, but that education should engage society and social structures directly. A socially critical education develops constructively critical thinking, not just in individuals but also in group processes (Kemmis, Cole & Sugget 1983:9).

Landmark conventions in the past two decades have influenced the emergence of sustainability as a focus for environmental education. The *World Conservation Strategy* (IUCN/UNEP/WWF, 1980) called for the conservation and sustainable use of life-support systems, biodiversity and renewable resources. It was the World Conservation Strategy that first gave 'sustainability' currency and redirected the goals of environmental education to what often is referred to now as 'education for sustainability'. In the 1980s it also became clear that the first world

environmental conference held in Stockholm in 1972 proved inadequate in addressing the needs of the developing world. In order to meet the needs of both conservation and development the term sustainable development was coined by the Brundtland Commission Report. This report reinforced the need for 'education for sustainability'. It was the follow-up document to the World Conservation Strategy, the document *Caring for the Earth: A Strategy for Sustainable Living* (IUCN/UNEP/WWF, 1991) that firmly established education for sustainability as the central international policy goal of environmental education in the 1990s. Tilbury (1995) further states that this new agenda was firmly embraced by delegates to the 1992 Earth Summit in Rio de Janeiro (UNCED, 1992).

Because of the above-mentioned developments, some members of the environmental education community have re-defined environmental education in the 1990s as 'education for sustainability' believing that education should play a role in promoting more sustainable living practices. The focus on sustainability is understandable in the light of a deepening global socio-ecological crisis, which often is ascribed to the apparently unsustainable trajectory of human 'progress' (Schreuder, Le Grange, & Reddy, 1999:127). It is also generally agreed that humans need to change their life-styles to fit the reality that we inhabit a planet with finite resources. However, including sustainability in the new definitions of environmental education, and formulating principles and values for this new approach, may yet again create false expectations of reducing environmental problems and risks. I say this because new definitions of, or approaches to, environmental education will not necessarily contribute to solving environmental problems or improving environmental risk positions.

However, we might have unnecessarily (and uncritically) circumscribed our thinking and actions by adopting frameworks and definitions that specify how environmental education should address environmental problems and risks. Doll (1993:280) views defining in our usual, modernist sense as problematic since definitions tend to limit and close rather than generate and open. Therefore in order to allow for open processes of engagement it may be useful *not* to define environmental education nor find the need to define it. Viewing environmental

education in terms of processes of change towards critically addressing environmental problems and risks might be much more useful. Such processes might enable us to reflexively examine both education and environment as social constructions (Schreuder, Le Grange & Reddy, 1999). I choose therefore to add a qualifier to environmental education and prefer to use the concept environmental education processes, which allows for openness and inclusivity.

2.6 TOWARDS A DIALOGUE BETWEEN SCIENCE EDUCATION AND ENVIRONMENTAL EDUCATION

The relationship between science education and environmental education has a substantive history. As I pointed out earlier in this thesis (section 2.3) contemporary environmental education has its roots in science education. However, the scientific paradigm in which science education has conventionally operated provides limited possibilities for enabling environmental education within the natural sciences area of learning. Some environmental educators see very little space for meaningful dialogue between the two discourses and some suggest that science education and environmental education are in some respects incompatible.

Developments in the natural sciences such as relativity theory, quantum mechanics, chaos (non-linear dynamics) and complexity theories challenge many modernist understandings. If new understandings in the natural sciences can be brought to bear on science education programmes, greater possibilities for dialogue between science education and environmental education may be realised. Also, liberating environmental education from the ideological constraints of education *in, about* or *for* the environment may further enable such a dialogue. Such a postmodern science education and environmental education will have in common the integration of knowledge and values as well as the acceptance of the contextual and emergent nature of knowledge. I will now discuss how these ideas may be enabled in a post-apartheid era. Before doing so I briefly describe the development of environmental education in South Africa.

2.7 ENVIRONMENTAL EDUCATION IN SOUTH AFRICA

Irwin (1990:5) who some regard as one of the 'founders' of environmental education in South Africa states that the environmental education movement was pioneered by non-governmental conservation agencies and state conservation agencies. He points out that organisations such as the Wilderness Leadership School and the Wildlife Society of Southern Africa had by the 1960s recognised the importance of educating people about environmental responsibilities. According to Irwin (1990:5), the Wildlife Society's Umgeni Project, started in Natal in 1973, has played a major and innovative role in the development of environmental education. He ascribes their 'success' to the support and co-operation they received from the Natal Education Department and the Natal Parks Board. The Natal Education Department was the White Education Department of the former Natal Province, today known as Kwazulu-Natal Province. Irwin (1990:5) points out that the co-operation, which occurred in Natal, was not repeated in the other provinces. He notes that in the former Transvaal (now Gauteng) province internally controlled racially exclusive 'outdoor' education programmes such as 'Veld Schools' were set up.

Irwin (1990:5) suggests that environmental education was often more successful at grassroots levels in the 'national states', homelands and 'black' areas of South Africa, perhaps because, as history has shown, degraded environments affect poor and dispossessed people more acutely. According to Irwin the two most successful environmental education programmes in Southern Africa in the 1970s and 1980s are those of the former homeland, Bophuthatswana and the National Environmental Awareness Council (NEAC) in Soweto. In Bophuthatswana there had been close co-operation between the Department of Education, the Bophuthatswana National Parks Board and the teacher training institutions. Irwin says that NEAC, which started in 1974, grew in popularity and effectiveness despite political and social instability. Next I discuss the development of EE in South Africa with respect to formal education.

2.7.1 EE and the formal curriculum in South Africa

Concerning teacher education, Irwin (1990) points out that environmental education programmes were offered at the University of Bophuthatswana and all the colleges of Education since the beginning of the 1980s. Several universities in South Africa also introduced environmental education programmes as part of teacher education curricula. These developments were enabled by proactive individuals in organisations that enjoyed a measure of autonomy from the South African State. However, until 1989, there had been no nationwide, state driven attempt to include environmental education into formal school curricula. The first attempt to include EE in the formal curriculum was the 1989 White Paper on Environmental Education (Mosidi 1997). According to Mosidi (1997), the White Paper's inclusion of the guidelines adopted at the international conferences held in Belgrade (1975) and Tbilisi (1977) was an encouraging shift from narrow interpretations of environmental education held up to this point. Irwin (1990:6) made an even stronger claim when he wrote:

In 1989, after years of resistance from conservatives in some of our education departments, a **'White Paper on Environmental Education'** was tabled in parliament. For this the Department of Environment Affairs and the Council for the Environment deserve much of the credit. Notwithstanding some skepticism and the limited acceptance of this document among sections of our society it is important to note that it unequivocally embraces the 'Tbilisi Principles' and the internationally accepted concept of Environmental Education (emphasis in original).

Irwin's idea of one universal definition of environmental education is highly problematic since it does not account for the ambiguities, nuances and diversity of meanings subsumed by the construct. However, his other claim that the 1989 White Paper unequivocally embraced the 'Tbilisi principles' deserves more careful attention. The 1989 White Paper on Environmental Education excluded the following Tbilisi principles:

- help learners discover the symptoms and real causes of environmental problems;

- emphasise the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills; and
- Focus on current and potential environmental situations while taking into account the historical perspective.

This shows that the 1989 White Paper selectively embraced Tbilisi principles and omitted the more critical principles that would have questioned apartheid policies. According to Clacherty (1994:56) the White Paper was never enacted in parliament and was not broadly inclusive resulting in little implementation in formal education. However, developments post-1990 created greater opportunities for more inclusive processes of involvement in the development of environmental policy.

2.7.2 A changing policy environment

In 1992 the Environmental Education Policy Initiative (EEPI) was started as a more inclusive process developing environmental education policy options for formal education in South Africa. According to Clacherty (1994:59), the formal membership in 1992 consisted of two state departments, three university departments or units, two national NGOs, Congress of South African Students (COSAS) and the National Education Coordinating Committee (NECC). The ANC Education Desk also had informal representation. A significant outcome of this process was the inclusion of environmental education in the most recent Government White Paper (March 1995) on education and training, as one of the key principles for education and training policy in a new South Africa. The principle states:

Environmental education, involving an inter-disciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training system, in order to create environmentally literate and active citizens and ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources (Principle No.20: 22, RSA, 1995).

South Africa's first democratic election in 1994 necessitated imperatives for change and redress. In the period immediately following the elections we have witnessed the emergence of a plethora of new policies, including policies on education and environment. The right of every citizen to a healthy environment is embedded in the Bill of Rights of the new South African constitution. Key policy documents emphasise the importance of using the country's natural resources in a sustainable manner, as well as the need for sustainable development (ANC, 1994; RSA, 1994; RSA, 1997).

Flowing out of the 1995 White Paper on Education and Training were policy processes that had broader implications for the restructuring of the education and training system and school reorganisation. Foremost among these were the establishment of a National Qualifications Framework (NQF) and a new outcomes-based education (OBE) curriculum. In March 1997 the Education Ministry under the title Curriculum 2005⁵ launched the new curriculum. This curriculum is envisaged to replace content-based education with outcomes-based education and teacher-centred pedagogies with more learner-centred pedagogies. Another change is the replacement of the 42 school subjects offered to learners in South African schools by eight areas of learning. The learning areas combine the old subjects, in a sense, ostensibly to promote a more holistic approach. Each learning area has curriculum-linked outcomes (specific outcomes) which learners should attain through learning activities. These learning activities should have a local and contextual focus, and teachers will have to play a much more prominent role in developing learning programmes (coherent collection of learning activities). In addition, all programmes of learning are to be organised by cross-curricular themes (phase organisers) such as *environment*, *entrepreneurship*, *personal development* and so on⁶.

⁵ Curriculum 2005 is post-apartheid's South Africa's new curriculum framework. Because Curriculum 2005 is an outcomes-based framework I use *Curriculum 2005* and South African *OBE* interchangeably.

⁶ Some of the aspects of Curriculum 2005 that I refer to here have been revised or are in a process of revision. However, since they informed this study I choose to use concepts as they were applicable at the time. I reflect on the revision of aspects of Curriculum 2005 in chapter 6.

The shift in 1996 from national education policy development to curriculum development necessitated the need for a curriculum initiative in environmental education. This prompted the establishment of the Environmental Education Curriculum Initiative (EECI), to take the work of the EEPI from policy to curriculum development. Since its establishment in 1996 the EECI has been given opportunities to formally contribute to the new curriculum for South Africa. These included participation in the Department of Education's national workshops, official representation on the national Learning Area Committee (LAC) for Human and Social Sciences, representation at all Co-ordinating Committee meetings, in reference groups for the technical committee and representation on phase committees working on the development of Learning Programmes. Through these various means of participation the EECI has been involved in attempts to ensure the inclusion of environmental concerns in the specific outcomes of the outcomes-based curriculum for South Africa (EECI, 1997).

The inclusion of environmental education as one of the key principles for a new South African education and training system in the most recent White Paper on education and training was encouraging for many environmental practitioners who see the infusion of EE into formal education as necessary and important. However, it is important to raise two concerns related to this policy statement. Firstly, these developments should be understood in terms of the broader education policy agenda of the government post-1994 and secondly, in terms of the gap between policy rhetoric and school-level realities.

Following the 1994 democratic elections a narrowing of the education policy agenda is taking place in South Africa. Chisholm and Fuller (1996:693) argue that there has been a shift in education policy from earlier talk of people's education and robust civil participation to a technocratic discourse emphasising centrally-defined outcomes-based education, learner-teacher ratios and a unified education system. The reasons for the shift in the education policy agenda are many and various and are beyond the scope of this chapter. Suffice it to say that the narrowing of the education policy agenda will make moves to greater equity, participation and redress unlikely (De Clercq, 1997:127). What is more likely to

occur is the favouring of interests of privileged sections of society thus widening the existing gap, benefiting a minority of schools and alienating the majority of teachers and learners (De Clercq, 1997:127; Reddy & Le Grange, 1996:20).

De Clercq (1997:140) argues that the education policy development processes occurring in South Africa are largely excluding grass-roots teachers and reflect the work of technical 'expert' committees. She points out that this is taking place despite the fact that curriculum research throughout the world has shown the vital importance of building teachers' professional capacities and involving teachers centrally as key agents in both the design and implementation of new curricula. Christie (1996:413) further argues that policies are best understood in terms of practices on the ground, in lieu of idealist statements of intention or blueprints for action. Furthermore, Fullan (1991), argues that change does not always result from putting into practice the latest policy but involves the changing of the cultures of classrooms, schools, universities, and so on.

The narrowing of the state's policy agenda post-1994 has unfolded as a centrist curriculum development process in South Africa. The outcomes-based curriculum development process in South Africa reflects strong elements of the Research, Development, Dissemination, and Adoption (RDDA) model. OBE as a system-/model had not been sufficiently debated by the broader education community in South Africa before the Department of Education decided to implement it in all schools. A decision to follow an OBE model was decided centrally by the Department of National Education. All curriculum framework documents were centrally developed with very little input from provinces other than rubber-stamping. The time frames were inflexible allowing few opportunities for meaningful participation. Teachers and provincial representatives were a small elite group (Jansen, 1997) and functioned mainly to inform their constituents concerning decisions already taken at national level.

How did this process affect the inclusion of EE concerns in the new curriculum? The original set of specific outcomes put together for all the different learning areas had EE outcomes in most of the learning areas and one could see the cross-

curricular potential of EE in the new curriculum. A centrally appointed committee of twelve 'experts' called a technical committee unceremoniously removed many of these EE concerns from many of the learning areas (Le Grange & Reddy 1997). Four EE-related critical outcomes were unceremoniously removed from the original list of critical outcomes (generic and cross-curricular) that appeared in earlier curriculum documents. The months of hard work by the EE community to ensure that EE concerns were reflected in all learning areas were effaced within three weeks. The word sustainability was removed from one of the specific outcomes in Human and Social Sciences in the last three days of work of the technical committee. Submissions were made by members of the EE community to re-instate the word sustainability but these were ignored (Le Grange & Reddy 1997). Objections in provincial LAC meetings⁷ to critical outcomes were answered by departmental officials with what had then become a ubiquitous expression in the new curriculum process 'it is cast in stone'. Furthermore, the critical outcomes adopted by SAQA (South African Qualifications Authority) are almost exact replicas of those of Western countries such as USA, New Zealand and Australia and there is nothing that makes them uniquely South African (Le Grange & Reddy 1997).

Very little teacher development took place in the period of curriculum policy making after apartheid. Whilst facilitating provincial EECI workshops it became clear to me that few teachers were familiar with outcomes-based education and very little meaningful INSET (other than one day information sessions) was taking place. Participation in the curriculum process by the vast majority of teachers in the country has been non-existent and clearly teachers are viewed merely as 'technicians' to deliver a curriculum which has been centrally designed by a few 'experts'. The realisation of EE concerns/aims in such a RDDA curriculum process must be seriously questioned as past experience has shown it to be inappropriate for environmental education (Naidoo, Kruger and Brookes 1990, O'Donoghue and Mc Naught 1991, Robottom 1991). However, despite criticisms

⁷ I was a member of the Natural Sciences learning area committee (LAC) and therefore had inside information as to what was taking place in policy making processes at both national and provincial levels.

and critiques of new educational policies in South Africa I have decided to explore what spaces there are within the new curriculum framework for addressing environmental concerns. In particular I explore opportunities that the new framework in the Natural Sciences Learning Area may provide for addressing environmental concerns.

2.8 SCIENCE-BASED ENVIRONMENTAL EDUCATION PROCESSES WITHIN CURRICULUM 2005

Curriculum 2005 distinguishes two levels of outcomes: generic critical outcomes and specific outcomes located within different learning areas. There are eight learning areas, one being the natural sciences.

The natural sciences will further have four organising themes, namely *Planet Earth and Beyond*, *Energy and Change*, *Matter and Materials*, and *Life and Living*. The scope statement for the theme life and living is:

Learners must appreciate the dynamic interdependence between organisms and their respective environments; the forms of the diversity that arises; and how that diversity can be explained as arising out of the interactions of organisms within their environments – which include other organisms. It is important for learners to understand, at an appropriate level, how life processes are sustained and how human activities and other factors affect these processes.

The theme *life and living* provides space for including environmental concerns in science programmes. In addition, as indicated earlier all learning programmes are to be organised by cross-curricular themes (phase organisers). Using environment as an organiser for the natural sciences implies that science processes can be directed towards understanding and addressing environmental problems and risks. In this way science education processes and environmental education processes become conflated, or in other words, we could speak of science-based environmental education processes. Further one of the nine specific outcomes of the natural sciences, for example, states that learners need to demonstrate an

understanding of the changing and contested nature of the natural sciences. The elaboration of this outcome in the draft curriculum framework reads as follows:

Specific outcome 7 aims at developing in the learner an understanding of some essential features of science, its methods and products. Too easily science can be seen as absolute and without change. Learners need to know that science is a human activity, dependent on assumptions, which change over time, and over different social settings. By realising the changing nature of scientific knowledge, both the learner and teacher will be supported in their aim of linking everyday knowledge with scientific interpretations and so create a better understanding of the world.

This outcome might provide a challenge to conventional science as it is often taught in schools and universities, and portrayed in South African textbooks. The outcome might provide space for exploring the new developments in the natural sciences I described earlier, including the postmodern understanding described by Bohm (1994). Another outcome, specific outcome 8 states that learners need to be able to demonstrate knowledge and understanding of ethical issues, bias and inequities related to the natural sciences. The elaboration of this outcome reads as follows:

Specific outcome 8 aims to develop awareness in the learner that science is not value-free and can be mis-used. On the one hand science can create inequities and show bias; on the other hand science can also help to redress such situations. Ethical issues often have a science component to them; learners need to develop the ability to use scientific perspectives among other perspectives to evaluate ethical issues. The outcome reflects a wish to create an awareness of various viewpoints and issues, rather than propagate any specific viewpoint.

If this outcome were to be combined with, for example, the phase organiser environment, the ethics around environmental issues such as sustainability could be made one of the focuses of school science learning programmes. In summary, *Curriculum 2005* might provide the space for enabling the integration of science education processes and environmental education processes.

2.9 THE OPPORTUNITIES CURRICULUM 2005 PROVIDES FOR ADDRESSING ENVIRONMENTAL CONCERNS

Curriculum 2005 softens the boundaries between subjects. The integration of subjects into eight learning areas may enable greater possibilities for addressing environmental issues. In addition environment as phase organiser will direct educational activities/programmes towards addressing environmental concerns and also may enable integration across learning areas – allowing for much broader environmental perspectives.

Because learner activities will be developed towards achieving outcomes instead of being developed from prescribed content there is a pedagogical space for introducing environmental concerns in classrooms. Importantly, learner-centred education should be seen as more than activity-based learning, that is, that educational activities should include issues relevant to learner's lives. Using local environmental issues can be an entry point for introducing learner-centred approaches into classrooms. In addition local environmental issues can serve as the starting point for developing environmental education programmes. Curriculum 2005 also provides opportunities for schools to organise their teaching and learning time more flexibly. The fewer learning areas allows for greater integration of learners' work and by replacing the many school subjects of the 'old' system, which fragmented learning/teaching time into separate lesson periods, allows for greater flexibility in arranging learning/teaching time. Also, because local schools have greater power to develop their own learning programmes (replacing syllabi prescribed by the government) they are able to arrange their learning/teaching time more flexibly. This changing institutional space can thus be used meaningfully in addressing environmental problems within programmes of a particular school or in collaboration with other schools and communities.

Concerning science education, OBE provides space for drawing on new developments in science - postmodern science - that does not separate knowledge (facts) from values. This view of science provides opportunities to accommodate the qualitative dimensions of environmental issues into science education programmes. The phase organiser *environment* allows space for the articulation of

science-based environmental education processes. Phase organisers have since been removed from Curriculum 2005 but I discuss it in this chapter because it informed the curriculum development work that I did with teachers.

2.10 CHAPTER SUMMARY

In this chapter I described my understanding of how the relationship between science education and environmental education has evolved over time. I examine reasons for a historical divide between science education and environmental education and argue for a possible dialogue between the two discourses. I traced the historical development of environmental education in South Africa and explored possibilities for including environmental concerns in science education programmes within developing curriculum frameworks post-1994.

In the next chapter I provide a socio-historical perspective of teacher education in South Africa. Teacher education programmes provided the context for the science/environmental education case studies that I shall report in this thesis. Providing a socio-historical perspective on teacher education in South Africa might usefully inform the interpretation of the case studies.

Chapter 3

A socio-historical perspective on teacher education in South Africa

3.1 INTRODUCTION

In chapter two I discussed how conceptions of environment and environmental education, and how the relationship between environmental education and science (education) have changed over time. In this chapter I provide a socio-historical perspective on teacher education in South Africa. Because teacher education programmes provided the context for the science/environmental education case studies I shall report in chapter 5, chapters two and three together provide important background information for understanding and analysing the case studies.

3.1.1 Pre-service teacher education (PRESET)

As in many other countries, teacher education in South Africa is characterised by both initial/pre-service (PRESET) and in-service (INSET) programmes. According to Siebörger and Kenyon (1994:145) initial teacher education in South Africa has its roots in a system of elementary schooling. Elementary school learners who were thought suitable to become teachers were given the responsibility of teaching younger learners under the guardianship of a teacher. Siebörger and Kenyon (1994:145) point out that secondary education developed later and that for most of the 19th century the system depended on teachers who had received their education overseas. The first colleges of education (referred to initially as teacher training colleges) were established before the turn of the twentieth century to educate mainly primary school teachers. Early in the twentieth century universities established faculties of education (1918 in the case of the University of Stellenbosch) which catered mainly, though not exclusively,

for the preparation of high school teachers. Other institutions that have been involved in pre-service teacher education were technical colleges and technikons. Currently in South Africa all initial teacher education providers form part of the higher education sector. One of the reasons why this research study has a higher education focus is because case study two is concerned with investigating changing pedagogical practices in a pre-service teacher education university course. This brief historical perspective on initial teacher education in South Africa may also provide important background information for interpreting case study one. It is important to note that initial teacher education received by in-service teachers, influences the way(s) in which they view teaching as well as the practices they are involved with/in. Case study one focuses on in-service work with teachers as a community outreach programme of a university (therefore the higher education focus).

Historically, state education departments have administered colleges of education. During the apartheid era nineteen education departments controlled teacher education provided by colleges of education. The funding provided and the status enjoyed by these institutions varied greatly. Those institutions established for whites enjoyed greater status and funding compared to those established for blacks (see Siebörger & Kenyon 1994:145, Hofmeyr & Hall 1995:69-70). Compared to the colleges, the universities enjoyed considerable academic autonomy, with very little overt control by the state. However, Siebörger and Kenyon (1994:145) note that the state did determine norms for the recognition of teachers' qualifications. But, on the whole teacher education was largely hidden from public scrutiny during apartheid.

In 1994 a National Teacher Education Audit was conducted for the first time in South Africa's history. According to this Audit, during the apartheid era there was no inclusive national policy framework for teacher education, although there were national criteria provided for a common input model for curricula. In their synthesis report on the National Teacher Education Audit, Hofmeyr and Hall (1995:60) point out that this situation is changing. They write:

As a result of the legacy of apartheid, the multiplicity of providers and the lack of a national policy framework for teacher supply, utilisation and development, the field is very fragmented. The National Criteria for teacher education did provide a common input model for curricula, which focused on the content to be covered in teacher education courses. The new COTEP norms and standards, which are in line with the National Qualifications Framework, will be implemented in 1996. These focus on teacher competencies as outputs and so will require a radical shift in the design of courses. The transition to a democratic South Africa has encouraged a number of institutions to review their curricula and they are experimenting with new approaches appropriate to the changing context.

This does not necessarily mean that all teachers/teacher educators did not experiment with new approaches to their work during apartheid. As I pointed out in chapter one, for example, the networks of teachers with which I was involved made efforts to improve their own practices. The point is that there might now exist enabling policy frameworks and 'new' spaces to do transformative work.

The Teacher Education Audit also reported that dominant approaches to teacher education in South Africa have to date been authoritarian and teacher-centred. As Hofmeyr and Hall (1995:60) write:

The dominant approach to teacher education has been authoritarian and teacher-centred as a result of the historical influences of Christian National Education and Fundamental Pedagogics. This is becoming more eclectic especially in the universities, but in many institutions lecturers and students are so steeped in the dominant approach that they find it difficult to change.

In chapter five I describe my attempts to subvert dominant approaches in my professional work. Again I point out that attempts to subvert dominant approaches to teaching (teacher education) were not new for me, but rather, that a national climate of change provided greater opportunities for doing 'radical' work. I discuss Christian National Education and Fundamental Pedagogics in greater detail in section 3.2. but will turn now to a brief description of some historical influences on in-service teacher education (INSET) in South Africa.

3.1.2 In-service teacher education (INSET)

INSET encompasses all forms of continuing education and training of serving teachers. As Thompson (1982:4-5) summarises:

[INSET covers] the whole range of activities by which serving teachers and other categories of educationalists (within formal school systems) may extend and develop their personal education, professional competence and general understanding of the role which they and the schools are expected to play in their changing societies. INSET further includes the means whereby a teacher's personal needs and aspirations may be met, as well as those of the system in which he or she serves.

According to the National Teacher Education Audit Report there are two main types of INSET provided in South Africa: INSET for further qualification and INSET focused on school competence (Hofmeyr & Hall 1995:61). The latter is not normally accredited. INSET for state colleges and universities have historically provided further qualifications. Currently there are additional providers such as private colleges (distance), non-governmental organisations (distance) and Technikons (contact and distance). According to Hofmeyr and Hall (1995:62) the second type of INSET, which is more directly related to school competence, usually involves curriculum-related courses or management training, without formal accreditation. The National Teacher Education Audit acknowledges the following providers of this type of INSET as Departments of Education (contact), NGOs (contact and distance) and private colleges. In this study I explore another space for INSET provision, namely, university-school partnerships.

In order to understand INSET provision in South Africa, and the case study I report on INSET in a local community (see chapter 5), a brief historical perspective may be useful. During the apartheid era glaring disparities characterised the separate and unequal systems of education in South Africa. This critically influenced the need for INSET. Hofmeyr and Hall (1995:61) note that since the mid-1970s INSET provision burgeoned as non-governmental organisations (NGOs) responded to the need to improve black education in particular. From about the same time the state also made some effort to attempt to

address the problem of un/underqualified black teachers through INSET programmes, albeit to a lesser extent. Despite these efforts, Hofmeyr (1991) reported in her doctoral research that there were few coherent INSET policies in South Africa. She pointed out that despite the great faith in INSET, public and private policies for INSET were inadequate or non-existent. According to Hofmeyr and Jaff (1992:182), interviewees in Hofmeyr's (1991) research believed that an absence of policy was one reason for INSET provision often being seen to be ineffective.

Some contextual factors that have had implications for INSET provision in South Africa may also inform the reader's interpretation of the cases I describe in chapter 5. I will refer here to just three contextual factors. Firstly, Hofmeyr and Pavlich (1987) point out that black teachers in their initial teacher education have been strongly influenced by Afrikaner philosophies of Christian National Education (CNE) and its offspring, Fundamental Pedagogics (FP). They argue that these philosophical influences have reinforced an authoritarian culture in classrooms. In the description of the case studies (chapter 5), I point out that some of these practices remain entrenched in South African education. Secondly, Hofmeyr and Jaff (1992:173) argue that socio-economic factors and the ongoing political turmoil that characterised South African education since 1976 have systematically weakened the morale of black teachers. Hofmeyr and Pavlich (1987) note that the strict control exercised over teachers by education departments did little to bolster teachers' already battered morale. Thirdly, black teachers historically have been caught between pressures of school learners and community leaders on the one hand, and the departments and political pressures on the other. Hofmeyr and Jaff (1992) point out that this involved a struggle for survival within a system in which they did not believe and which had no credibility in their communities. Hartshorne (1987) asserts that in the 1980s teachers became more politicised as they were drawn into the education struggle. As I pointed out in chapter 1, in October 1990 we witnessed strong moves towards teacher unity with the establishment of the South African Democratic Teachers Union (SADTU). However, teacher associations historically have been fragmented by apartheid education. In the next section I discuss some theoretical influences on teacher education in South Africa.

3.2 THE INFLUENCE OF THEORETICAL DISCOURSES

South African teacher education practices have been influenced by two main theoretical discourses, which Van den Berg (1994:37) calls the 'diabolical influence of Fundamental Pedagogics' and the 'pervasiveness of positivistic modes of thought'. Although these two theoretical influences have been inextricably linked to each other, I will discuss them separately here.

3.2.1 Fundamental Pedagogics and Christian National Education

I confine my discussion of Fundamental Pedagogics to a brief historical perspective and to a few features pertinent to this study. I begin this section by commenting briefly on Christian National Education, which was an aspect of the apartheid (ruling) ideology. Thereafter I briefly examine Fundamental Pedagogics as a philosophy of education. I argue that although Fundamental Pedagogics was a more recent doctrine than Christian National Education it played a significant role in reproducing apartheid ideology.

Enslin (1984:139-140) argues that although the Christian National Education Policy of 1948 purported to be policy for white Afrikaans-speaking children, it also had far reaching consequences for the education of all children in South Africa. I argue that it also had far reaching consequences for teacher education, a practice at the nexus of school and higher education. Enslin (1984:140) points out that according to CNE policy, education for blacks should have the following features: be in the mother tongue; not be funded at the expense of white education; by implication, not prepare blacks for equal participation in economic and social life; preserve the 'cultural identity' of the black community (although it will nonetheless consist in leading 'the native' to acceptance of Christian and National principles); must of necessity be organised and administered by whites. Enslin (1984:140) elaborates on the latter feature:

The final point reflects a significant paternalistic element in the policy. This is particularly evident in articles 14 and 15, entitled 'Coloured Teaching and Education' and 'African (Bantu) Teaching and Education' respectively. Black education is the responsibility of

‘white South Africa’, or more specifically of ‘the Boer nation as the senior white trustee of the native’, who is in a state of ‘cultural infancy’. A ‘subordinate part of the vocation and task of the Afrikaner’, is to ‘Christianise the non-white races of our fatherland’. It is the ‘sacred obligation’ of the Afrikaner to base black education on Christian National principles. Thus, revealingly, ‘We believe that only when the coloured man has been Christianised can he and will he be secure against his own heathen and all kinds of foreign ideologies which promise him sham happiness, but in the long run will make him unsatisfied and unhappy’.

Enslin (1984:140) asserts that CNE policy is ‘explicitly statements of beliefs (‘We believe’ appears frequently) which purport to constitute the life- and world-view of the *Afrikanervolk*’. It is clear that the CNE policy, as an expression of aspects of the ruling ideology, was intended to justify a separate and inferior education system for blacks. Enslin (1984:141) notes that since 1948 CNE has been the obvious candidate for critical scrutiny by educational theorists. It is in this context that the responses of Fundamental Pedagogics are particularly significant.

Although Fundamental Pedagogics did not aim to replace CNE, it became the centre of attention in certain academic circles in South Africa. Fundamental pedagogics can be traced historically to C J Langeveld’s publication *Beknopte Theoretische Pedagogiek* in the Netherlands in 1944. The first publication in South Africa was C K Oberholzer’s *Inleiding in die Prinsipiële Opvoedkunde*, published in 1954. In the 1960s, 1970s and 1980s Fundamental Pedagogics was a powerful doctrine in Afrikaans-medium universities. It was also powerful in black colleges of education and in education faculties of historically black universities that were dominated by Afrikaner lecturers. Fundamental Pedagogicians argued that the ‘scientific method’ was the only authentic method of studying education. For them, in particular, the scientific method that was appropriate for studying education was the phenomenological method (see, Landman & Gous 1969, Viljoen and Pienaar 1971, Gunter 1974). Enslin (1984:141-142) points out that it was believed that through this method the Fundamental Pedagogician would learn to know the phenomenon of education by undertaking ‘radical reflection’ on the educational situation. She states that the pedagogician describes the essence of the

educational situation in terms of pedagogic categories, and the corresponding criteria derived from them. Advocates of Fundamental Pedagogics such as Landman and Gous (1969) and Gunter (1974) have argued that practising Pedagogics as science frees it from metaphysics, dogmatics and ideology. In their textbook entitled *Fundamental Pedagogics*, Viljoen and Pienaar (1971) distinguish three stages in scientific research:

- the *pre-scientific* (pre-reflective) life-world in which the original phenomena reveal themselves, and which rouse the wonderment of the scientist;
- the *scientific reflection* on the phenomenon and the universal, verifiable logically systemised body of knowledge offered by such reflection; and
- the *post-scientific* meaningful implementation of this body of knowledge.

According to Enslin (1984:142) the distinctions made by Viljoen and Pienaar are significant because during the scientific stage values are excluded whereas in the pre-scientific and post-scientific stages values or life-views play a prominent role. During the scientific phase the pedagogician brackets extrinsic aims and beliefs. Enslin (1990:82) states that the political therefore becomes forbidden speech, as it has no legitimate place in the realm of science. The problem of Fundamental Pedagogics is that in the scientific stage no room is made for critically examining the question of values in the pre-scientific and post-scientific stages, such as CNE policy in the South African case. Instead of being 'universally valid' knowledge about education, free from 'metaphysics', 'dogmatics' and 'ideology' Fundamental Pedagogics has played a role in reproducing the ruling ideology by legitimating CNE policy. In fact some Fundamental Pedagogicians such as Viljoen and Pienaar (1971) and De Vries (1986) explicitly made links between Fundamental Pedagogics and Christianity, claiming that Christianity is the only doctrine on which education can safely be founded (for details see Viljoen & Pienaar 1971, De Vries 1986, Enslin 1990). As De Vries (1986:211) writes:

The Christian educator acknowledges that the child is conceived and born in sin and consequently is inclined to evil. He also knows that the child cannot be educated without authority, but

acknowledges that God is the absolute authority and that all human authority is therefore only delegated authority.

The links made between Pedagogy and Christianity under the “philosophy of Fundamental Pedagogics” provided the justification for authoritarian educational practices in South Africa in the apartheid era. As Enslin (1990:87) writes:

Central to the content of the educational doctrine endorsed by Fundamental Pedagogics, as distinct from but complementing its methodology, is the claim that education is, universally, the leading of the helpless dependent child to adulthood by the adult pedagogue. Out of this claim emerges the justification for authoritarian practices.

Fundamental Pedagogics also provided limited possibilities for transforming education in South Africa. As Enslin (1990:78) notes:

Fundamental Pedagogics is the dominant theoretical discourse in South African teacher education. It provides little illumination of the present social and educational order, of possible alternatives to that order or how teachers might contribute to transformation. By excluding the political as a legitimate dimension of theoretical discourse, Fundamental Pedagogics offers neither a language of critique nor a language of possibility.

During apartheid rule certain voices were marginalised by dominant educational discourses because of their failure to bracket the political. Among those who could not speak were ‘teachers not initiated into Fundamental Pedagogics; parents; students; academics who partook of other discourses; trade unions; the oppositional churches, and the private sector’ (Enslin 1990:88). However, particularly since the so-called 1976 Soweto uprisings we have witnessed these marginalised voices strengthening in resistance to the disabling rules of Fundamental Pedagogics. One discourse constructed in opposition to the debilitating discourse of Fundamental Pedagogics was ‘People’s Education for People’s Power’. Levin (1991:117) points out that the slogan ‘People’s Education for People’s Power’ represents a strategic shift in the education struggle in SA, involving a departure from the education boycott as a tactic of struggle in favour of a longer-term strategy of reconstruction through the development of alternative

education. People's education was an attempt co-ordinated by the then National Education Crisis Committee (NECC), advocating that parents, teachers, students and other community members (the people) should be involved in the government of education. Mkatshwa (1985:14) has noted that People's education emphasised the links between education, politics and social transformation. However, in the late 1980s People's Education plunged into crisis due to state repression as well as a lack of clarity over what, precisely, it meant (see Levin 1991, Walker 1991, Johnson 1991, Gultig & Hart 1991 for more detail).

Also marginalised by dominant discourses on education during apartheid were a minority of teachers in South Africa, which included a small percentage of black teachers who were educated at universities and colleges that provided alternative, critical discourses. They were according to Enslin (1990:88) mainly the so-called open English-language universities and the University of the Western Cape. Although these universities may to some extent have contributed to reproducing the ruling ideology, through a more eclectic theoretical discourse including liberal and Marxist perspectives, critique and criticism of the dominant ideology and Fundamental education was not only permitted but also encouraged. Enslin (1990:88-89) points out that both the liberal and Marxist perspectives treat the political as central to critically understanding education and its future possibilities in South Africa. My educational studies at the English-medium University of Cape Town and my experiences at the University of the Western Cape (see chapter 1) gave me opportunities to take up alternative discourses to the majority of South African teachers and most of my students and colleagues at the University of Stellenbosch. This has significant implications for how the cases are constructed in chapter 5.

3.2.2 Positivist modes of thought

It is beyond the scope of this thesis to discuss comprehensively all issues related to the influence of positivist modes of thought on teacher education practices in South Africa. I raise only a few concerns. However, before raising these concerns, I will discuss what I mean by positivism. Positivism is not a monolithic entity and

it might be preferable to speak of positivisms rather than positivism. As Giroux (1995:9) writes:

The term 'positivism' has gone through so many changes since it was first used by Saint-Simon and Comte that it is virtually impossible to narrow its meaning to a specific school of thought or a well-defined perspective. Thus, any discussion of positivism will be necessarily broad and devoid of clear-cut boundaries. However, we can speak of the culture of positivism as the legacy of positivistic thought, a legacy that includes those convictions, attitudes, techniques, and concepts that still exercise a powerful and pervasive influence on modern thought.

Giroux (1995:9) distinguishes between a culture of positivism as an ideological form (a form of cultural hegemony) and positivism as a specific philosophical movement. Positivism has several features. Connole, Smith and Wiseman (1993: 48) summarise these features by noting that positivism is marked by:

- A 'realist' rather than a relativist approach to the nature of reality, that is, reality exists independently of our knowledge of it. The role of individual interpretation and therefore, the fallibility of observation are recognised by some theorists taking an empiricist perspective.
- A view of knowledge as impersonal and objective. This leads to an attempt to distance the researcher from the objects of inquiry, and an attempt to preserve objectivity.
- A philosophical determinism, that is, a view that human behaviour is determined by external events. This leads to an emphasis on prediction and control in empiricist science, and the search for generalisation and a search for a theory of human action.

Giroux (1995:11) argues that the separation of values from knowledge and methodic inquiry is central to a culture of positivism. He points out that such an assumption undermines the development of a critical historical consciousness and engagement in political action. The inextricable link between a culture of

positivism and Fundamental Pedagogics is evident here. In the scientific stage that Fundamental pedagogicians Viljoen and Pienaar (1971) identify (see 3.2.1), values and the political are exorcised from knowledge about education. A second problematic feature of a culture of positivism is that it cannot reflect on its own presuppositions, or to provide a model for critical reflection in general. As a consequence it tends to support the status quo uncritically and reject history as a medium for political action. In South Africa this feature has contributed to the (re)production of the ideology of Christian National Education (on a macro-level) and authoritarian classroom practices (on a micro-level). The separation of object and subject and other related polarities has influenced teaching practices. Doll (1993:63) points out that the linear cause-effect relationship of positivist understandings of teaching has resulted in teaching being didactic, and directing rather than aiding and stimulating, or challenging natural, self-organising processes. Also Van den Berg (1994:38) points out that in South Africa teacher educators and teachers have largely accepted positivist frameworks uncritically. He argues that instead of viewing knowledge as a complex web of interrelationships, '[South African teachers/teacher educators] teach it as if it is easily parceled up into "facts" that can be structured and taught sequentially'. What is taught is therefore not often relevant to the complex realities and complexity of life. As Van den Berg (1994:39) writes:

We fail to see that by using our mental constructions to bring order to the huge complexities of reality, we also lose perspective on the whole and teach a distorted understanding of reality. And so we teach...as if knowledge can be divided into components or relatively discrete components, that the knowledge can be communicated from one person to another by using conventional media of communication, and that this knowledge exists outside and apart from people and simply has to be collected, like fallen fruit under a tree.

I have argued elsewhere (Le Grange 1999b:306) that such approaches assume that knowledge and curriculum content can be reduced to subject-matters, objectives and so on. McKernan (1993:347) says that this trivialises knowledge by reducing it to objective, disconnected facts. Teacher education programmes at many colleges of education and universities have constructed their curriculum within

such positivist frameworks. At the University of Stellenbosch, for example, teacher education programmes are arranged around a number of different subject didactics courses, which are discipline based. The significance of this will be elaborated in chapters five and six. In the next section I discuss transformation processes that are occurring in higher education generally and teacher education particularly as a background to examining changing pedagogical practices.

3.3 TRANSFORMATION PROCESSES

As I mentioned in chapter 1 socio-political and socio-economic change in South Africa in the 1990s produced imperatives for the transformation of all education sectors. A recently published White Paper, *A Programme for the Transformation of Higher Education*, emphasises the importance of equity, redress and a need for a single co-ordinated higher education system that will enable life-long learning (Department of National Education 1997a). The progressive implementation of the new national curriculum for General Education and Training, Curriculum 2005, is also influencing teacher education programmes (Department of National Education 1997b). Central curriculum concerns include the introduction of outcomes-based education and learner-centred education. Challenges for teacher education in South Africa includes new norms and standards for teacher education gazetted in 1995, and the transformation of institutional space, especially that of the colleges of education (Pendlebury 1998:338).

South Africa's greatest challenge in a 'new' era is to reconstruct all spheres of public life so as to enable a flourishing democracy. With this in mind I now briefly discuss some concerns related to the transformation of higher education, and the transformation of teacher education.

3.3.1 The transformation of higher education in South Africa

The imperative to transform higher education in South Africa is neatly captured in the introduction to the recently published Education White Paper 3, *A Programme for the Transformation of Higher Education*:

South Africa's transition from apartheid and minority rule to democracy requires that all existing practices, institutions and values are viewed anew and rethought in terms of their fitness for a new era.... In South Africa today, the challenge is to redress past inequalities and to transform the higher education system to serve a new social order, to meet pressing national needs, and to respond to new realities and opportunities. It must lay the foundations for the development of a learning society which can stimulate, direct and mobilise the creative and intellectual energies of all people towards meeting the challenge of reconstruction and development (Department of National Education 1997a: 7).

The same White Paper summarises the requirements for transformation of higher education in South Africa as follows: *increased and broadened participation, responsiveness to societal interests and needs and cooperation and partnerships in governance* (Department of National Education 1997a: 10). These requirements include to 'increase access for black, women, disabled and mature students', and to develop 'new curricula and flexible models of learning and teaching, including modes of delivery' (Department of National Education 1997a: 10). Increased and broadened participation also means a need to change the demographics of staff at white dominated institutions.

In order to be responsive to the needs of South African society it may be important for universities to shift from traditional roles of research and teaching. Gibbons (1998:60) points out that transformation of the higher education sector globally is evidenced by the emergence of a distributed knowledge production system. He writes:

The main change, as far as universities are concerned, is that knowledge production and dissemination - research and teaching - are no longer self-contained, quasi-monopolistic activities, carried out in relative institutional isolation. Today universities are only one amongst the many actors involved in the production of knowledge, and this is bound to govern, to some extent, the future relationships that universities will seek to establish. Equally, teaching must take account of the fact that more and more knowledge may not find its way into textbooks as conventionally defined and that disseminating knowledge, at the leading edge, may take place in the context of the research itself.

In this regard we are witnessing greater emphasis being placed (alongside teaching and research) on what is referred to as community service by universities. Waghid (1999:113) argues that community service includes, among other things, universities 'running hospitals that help people, legal services, services to schools, conducting programmes of continuing education to meet the needs of working adults, and other community activities such as those which address the plight of the homeless and street children'. Importantly, Waghid (1999:113) points out that engagement on the part of universities in community service does not imply a uni-directional extension of universities but rather a two-way sharing of expertise with members of society.

The massification of higher education has influenced the way in which knowledge is produced in contemporary society. Many university graduates find themselves placed in organisations outside universities that also are involved in processes of knowledge production. In South Africa these include, for example, non-governmental organisations (NGOs), the private sector, and government departments. In such a distributed knowledge system, the need for partnerships between different players has become necessary. However, South Africa also has development needs. The majority of South Africans have not had access to higher education to enable them to develop research expertise. There may thus be a need for partnerships between universities and historically disadvantaged members of South African society that enhance the capacities of such individuals or groups in ways that benefit both universities and local communities.

At the University of Stellenbosch community service is seen as an important function in a changing South Africa. This has been mentioned in the academic planning framework document as well as the institutional plan of the university (for the period 1999 to 2001). In her speech at the graduation ceremony of 9 March 2000 the Chancellor (Prof Elize Botha) emphasised the University of Stellenbosch's important responsibility to provide community service to all members of South African society. She pointed out that a key position has been created at the university for the co-ordination of community service, so that it receives the same priority as teaching and research. This is not the place here to

explore all of the ramifications of this policy initiative, but I wish to point out that although community service, teaching and research often are viewed as separate entities, the three are inextricably linked (see Waghid 1999, Waghid & Cilliers 2000 for further discussion).

The brief background that I have sketched on the transformation of higher education in South Africa is pertinent to the case studies I describe in chapter 5. In case study 1 I document pedagogical practices in in-service work I did with teachers in a local community in order to gain insights into possibilities for school-university partnerships as a way of integrating teaching, research and community service. Also as is the case with all other faculties, the Faculty of Education in which I work is challenged with issues of transformation. As a consequence the faculty has been involved in the redevelopment of its programmes in order to be responsive to changing societal and policy processes. Against this background, in case study 2 I document my work with pre-service students to gain insights into changing pedagogical practices in a science method course.

In my research I look at the role of a higher education institution in teacher education. However, what occurs in the school sector impacts on teacher education practices in higher education institutions. In the next section I discuss some of the challenges for transformation of teacher education more specifically, and include issues pertinent to the school sector such as the introduction of Curriculum 2005.

3.3.2 The transformation of teacher education in South Africa.

The challenge for teacher education in South Africa is a need to move from the old (ways of thinking and doing) to the new. Pendlebury (1998:334) argues that under apartheid, teacher education was largely hidden from public scrutiny. In 1994, in an effort to transform teacher education the Department of Education commissioned a National Teacher Education Audit, providing us with the first and only critical database on the state of teacher education in South Africa. Several publications on the Audit's findings have been produced (see, for example,

Department of National Education 1995, Edupol 1996, Joint Education Trust 1996, Hofmeyr & Hall 1995).

In the published findings of the Audit an extensive map of the old is provided. As Pendlebury (1998: 335) elaborates:

A disturbing map, it shows how deeply apartheid divided and undermined teacher preparation. The inherited system is replete with racial and ethnic divisions. Hard boundaries run across many facets of teacher education - separating academic from professional knowledge, teachers' education from teachers' work, 'facts' from their related concepts and from conceptual webs in which they have currency and meaning and fragmenting the college [university] day into small compartments of time, each filled with content to be 'stamped' on to student teachers before they move on to the next compartment.

Although apartheid was responsible for gross inequities and other conditions, which brought on poor education practices, it is instructive to compare criticisms of South African teacher education with those of other countries. Pendlebury (1998:337) points out, for example, that each of the major flaws raised by the National Commission on Teaching and America's Future (1996) were also mentioned in the findings of South Africa's Teacher Education Audit. These flaws included inadequate time, fragmentation, uninspired teaching methods, and traditional views of schooling and so on. I argue that these criticisms raised by both the American and South African audits are linked to the pervasiveness of what Giroux refers to as a culture of positivism. I discussed Giroux's notion of a culture of positivism in 3.2.1 of this chapter (see Giroux 1979, 1995 for greater detail). Next I look at some policy recommendations made in the synthesis report of the National Teacher Education Audit. I focus only on those pertinent to this study and what I mention therefore represents my selected priorities.

Firstly, it is recommended that inappropriate philosophies of education have to be replaced. As Hofmeyr and Hall (1995:91) write:

Authoritarian, teacher-centred, single-theory approaches to teacher education such as Fundamental Pedagogics must be replaced by learner-oriented philosophies and theories of education which are consonant with the values, goals and principles of education reconstruction and a democratic society. These must be incorporated in new teacher education curricula, and as a priority, teacher educators must be assisted by staff development in such theories and philosophies.

Secondly, it is suggested that teacher education curricula be restructured. Hofmeyr and Hall (1995:91) point out that research suggests that new teacher education curricular should include:

- the latest advances in knowledge in all subject areas;
- in-depth development of subject knowledge to at least first year university level; and
- courses on contemporary societal issues in the South African and global context.

Thirdly, it is recommended that a range of methodologies should be used in teacher education. Hofmeyr and Hall (1995:92) point out that:

‘Talk and chalk’ text-based, examination-driven, rote-learning methods dominate at present and must be changed to more active, co-operative, learner-centred approaches.

Fourthly, and particularly pertinent to this study, is the recommendation that environmental education should be part of all programmes. This recommendation is also emphasised in other policy documents such as the 1995 White Paper on Education and Training as well as in the Norm and Standards for Teacher Education discussion documents. Finally, I briefly discuss concerns raised in the Norms and Standards document for educators (Department of National Education, 1998) that are pertinent to this study.

In the dying days of legal apartheid the Committee on Teacher Education Policy (COTEP) was charged with the following tasks: to conduct a situational analysis

of all South African teacher education institutions; to develop a national qualifications framework for teachers; and to propose national governance structures for teachers. COTEP's first task resulted in the National Teacher Education Audit and the second resulted in the Norms and Standards for Teacher Education, gazetted as national policy in September 1995 (see Pendlebury 1998:338). In 1997 the Department of Education appointed a technical committee to revise the Norms and Standards. In the draft revised Norms and Standards (Department of National Education 1997c, 1998) greater emphasis is placed on ends rather than means although institutions are granted more discretion on how to attain these ends. Teacher education programmes will be evaluated in terms of whether students can fulfil the following proposed roles: teacher as mediator of learning, teacher as curriculum and materials designer, teacher as leader and manager, teacher as scholar, researcher and lifelong learner, teacher as pastor and care giver, teacher as learning area specialist, teacher as citizen and community developer (Department of National Education, 1998). These roles are to be demonstrated through applied competence as defined below:

Applied competence is the overarching term for three interconnected kinds of competence: practical, foundational and reflexive competence. Practical competence is our demonstrated ability to perform a set of tasks. Foundational competence is our demonstrated understanding of what others and we are doing and why. Reflexive competence is our demonstrated ability to integrate or connect our performances with our understanding so that we learn from our actions and are able to adapt to changes and unforeseen circumstances (Department of National Education 1997c: 58).

Another important challenge for teacher education programmes concerns what, and how, aspects of Curriculum 2005 are to be included in teacher education. The imminent (at the time of the study) implementation of Curriculum 2005 may require teacher education institutions to reconsider aspects of their programmes. In chapter five I describe how I included aspects of Curriculum 2005 in a pre-service education programme and also in an in-service education programme.

So far in this chapter I have provided an historical overview of teacher education in South Africa. As I already discussed such a perspective sheds light on interpretation of the case studies I describe in chapter five. In the next section I develop conceptual tools for analysing the case studies. I develop these conceptual tools so that knowledge produced in the case studies can be framed meaningfully and coherently. I see this as being pertinent to this academic exercise given the idiosyncratic nature of case studies, and the complexity of the social realities they are embedded within.

CONCEPTUAL FRAMES FOR ANALYSIS

In order to analyse the complex social realities conveyed in the case studies, I use Pendlebury's (1998) idea of pedagogical space and Turnbull's (1997) notion of knowledge spaces to frame my interpretation. I introduce the ideas of the two authors and expand on them in chapter six.

3.4.1 Pendlebury's notion of pedagogical space

Pendlebury (1998) states that 'teaching and teacher education, like other social practices, occur within particular spatio-temporal settings that are partly constitutive of the actions and interactions that take place within them'. She uses these obvious but often overlooked facts as a vantage point for charting the transformation of teacher education in South Africa. Pendlebury assesses change in three spaces - *public space*, *evaluative space* and *pedagogical space*. She argues that the main direction of change is from insulated space and interrupted time to porous space and concentrated time. It is Pendlebury's notion of *pedagogical space* that will serve as the focus of my further deliberations.

Pendlebury (1998:343) defines *pedagogy* as 'the relation between curriculum, teaching and learning'. She argues that *pedagogical space* is 'defined by, among other things, the curriculum, modes of transmission, rules of access and combination, the sites in which teaching and learning occur and by who counts as a teacher or a learner'. Further, she points out that 'a specification of *pedagogical space* will indicate *who* may learn (or teach), *how* and *what* they learn (or teach), *when* and *for how long* and *where*'. I use these notions to conceptually frame my

description of interactions with students during the pre-service science method course at the University of Stellenbosch and the in-service work with teachers in Grassy Park. As a next level of analysis I shall focus on processes of knowledge production using the work of Turnbull (1997) to frame my interpretation.

3.4.2 Turnbull's idea of knowledge spaces

Turnbull (1997) argues that generally views on knowledge have focused on the knowledge itself that he refers to as a representationalist perspective, rather than on the processes involved in producing the knowledge, that is, that scientific knowledge is a social activity. For Turnbull (1997:553) knowledge is both performative and representational.

Turnbull (1999:551) argues that all knowledge traditions are spatial in that they link people, sites and skills. Turnbull (1997:553) suggests that from such a spatialised perspective, universality, objectivity, rationality and so on cease to be unique characteristics of 'technoscientific knowledge':

(R)ather these traits are effects of collective work of the knowledge producers in a given space. To move knowledge from the local site and moment of its production and application to other places and times, knowledge producers deploy a variety of social strategies and technical devices for creating the equivalencies and connections between heterogeneous and isolated knowledges. The standardisation and homogenisation required for knowledge to be accumulated and rendered truthlike is achieved through social methods of organising the production, transmission and utilisation of knowledge. An essential component is the social organisation of trust.

Following Shapin (1994), Turnbull (1997:553) points out that the basis of knowledge is not empirical verification, as the orthodox view would have it, but trust. He uses diverse examples such as the building of gothic cathedrals in medieval Europe, the Polynesian colonisation of the Pacific, the development of modern cartography as well as rice farming in Indonesia to demonstrate 'how particular knowledge spaces can be constructed from differing social, moral and technical components in a variety of cultural and historical contexts'. The

important contribution Turnbull makes is the fact that all knowledge systems have localness in common and that the difference between different knowledge traditions is based on different kinds of work involved in creating assemblages from a collection of practices, instrumentation, theories and people:

Some traditions move it and assemble it through art, ceremony and ritual; [Western] science does it through forming disciplinary societies, building instruments, standardisation techniques and writing articles. In both cases, it is a process of knowledge assembly through making connections and negotiating equivalencies between the heterogeneous components while simultaneously establishing a social order of trust and authority resulting in a knowledge space.

I use Turnbull's (1997) framework to analyse the case studies in terms of how they might be illuminating with respect to the social organisation of trust in post-apartheid South Africa.

3.5 INTRODUCING THE CASE STUDIES

3.5.1 Case study 1

I mentioned in chapter 2 that, in 1996 the Environmental Education Curriculum Initiative (EECI) was established to take the work of the EEPI from policy to curriculum development (Le Grange & Reddy 1997). Since its establishment in 1996 the EECI has been proactive in efforts to support EE in the proposed South African curriculum (EECI 1997). Key EECI activities centre around four projects: *learning programme development, materials development, and research and teacher education*.

The aim of the *research* project of the EECI was to support environmental education curriculum research within the framework of an envisaged new outcomes-based curriculum (Curriculum 2005) for South Africa. This project was made possible through a partnership formed between the EECI and the Human Sciences Research Council (HSRC). In 1997 the HSRC and the EECI invited proposals for research projects within the broader framework of the collaborative

project which was entitled *A facilitative programme for Environmental Education Curriculum Development*. One of the seven projects selected as part the broader collaborative project of the HSRC/EECI was a project facilitated by the Environmental Education Programme, University of Stellenbosch (EEPUS). The project undertaken at EEPUS was part of an outreach initiative intended to develop sustainable partnerships in EE between the university and schools. Through a participatory curriculum development process, as EEPUS-based researchers, a colleague and I initiated a learning programme development process with teachers in a local community, Grassy Park. The aim of our project (case study 1 of this research) was to introduce in-service teachers to outcomes-based education and environmental education.

3.5.2 Case Study 2

Case study 2 was one of six professional development case studies forming part of Activity Two of the South Africa/Australia Institutional Links project entitled *Educating for Socio-Ecological Change: Capacity-building in Environmental Education*. The project was funded by AusAID (Australian Agency for International Development) and administered by IDP Education Australia. The structure of the project as a whole was quite complex, involving a total of eight tertiary institutions in two countries (South Africa and Australia). The project was structured into four 'Activities': Activity One was concerned with curriculum development; Activity Two was concerned with professional development; Activity Three was concerned with evaluating existing environmental education curricula in South Africa and Australia; and Activity Four was concerned with the development of a methodology text to support post-graduate research in tertiary educational settings. The overall focus of the project was the professional development of new and existing staff in South African higher education institutions. Specifically, Activity Two sought to enhance research and professional capacity by working collaboratively with colleagues in a process of workplace-based participatory research aimed at the development of authentic case studies of changing environmental practice (Lotz & Robottom 1998:20). The case study I will report in chapter 5 is concerned with pedagogical issues that

emerged during the progress of a pre-service teacher education programme at the University of Stellenbosch.

In Activity two we examined developing case studies of changing practice as processes of professional development in two distinct ways: firstly as a moment in professional self-development, as participants reflected critically on the meaning and significance of their theories, policies, organisational arrangements and teaching practices; secondly the emerging case studies themselves were seen as possibly forming the basis for useful professional development interactions with other environmental educators outside of the project (Lotz & Robottom 1998:20). The former distinction will be the focus of this study.

Rather than following a single defined process of professional development or adopting a single set of existing environmental educational materials, we sought to work flexibly within a set of principles. These principles were that professional development should be:

- **contextual**: that professional development respects and relates closely the particular workplaces and workplace issues of participants;
- **responsive**: that the issues explored in the professional development processes are those of interest and concern to participants themselves;
- **emergent**: that the professional knowledge that carries most weight in discussions about how to improve professional practice is that which emerges from the case study work lying at the centre of the professional self-development process;
- **participatory**: that participants are involved directly and as equitably as possible in all dimensions of the professional development process (for example: identifying issues to be addressed; collection and analysis of case study data; development and dissemination of materials and reports);
- **critical**: that the processes of professional development look beyond the surface layers of activity at the levels of policy, organisation and practice to

identify and appraise the values, assumptions and interests that inform and justify this activity;

- **praxiological:** that processes of professional development proceed through and are mediated by *praxis* -- the conscious and continuous interplay between theoretical and practical considerations.

(Le Grange, Lotz, Makou, Neluvhalani, Reddy & Robottom 2000)

3.6 CHAPTER SUMMARY

In this chapter I have provided a socio-historical perspective of teacher education in South Africa. The historical perspective on INSET and PRESET serve as important background information for case study 1 and case 2 respectively. Theories that have influenced South African education practices generally and teacher education more specifically, such as the theoretical influences of Fundamental Pedagogics and positivist modes of thought are pertinent to both case studies. Further, bearing in mind the idiosyncratic nature of case studies, the complexities of social reality, and the differing contexts of the two case studies, in this chapter I introduced two sets of ideas for analysing the case studies. I briefly introduce Pendlebury's (1998) idea of pedagogical space and Turnbull's (1997) notion of knowledge spaces. In the final part of this chapter I introduced the two case studies that will be examined in the thesis. Case study 1 formed part of a broader national project aimed at researching possibilities for introducing environmental education into formal education within a 'new' curriculum framework. Case study 2 was developed in collaboration with colleagues in Activity Two of the South African/Australian Institutional Links programme. In chapter 4 I will discuss the methodological framework and procedural methods of both case studies and in chapter 5 I describe the case studies.

Chapter 4

Research methodology

4.1 INTRODUCTION

When I began this study I knew very little about research methodologies and methods. I knew even less about the distinction between the terms *research methodology* and *research method*. A combination of reading research, talking to other researchers and participating in a research methodology course at Rhodes University in 1997 helped me begin to develop philosophical lenses to understand and accept a wider array of research methodologies. Moreover, I started to learn the importance of using research methodologies and methods appropriately for particular research foci as well as for addressing different research questions.

I contend that knowledge and acceptance of different research methodologies assists us to critically read the research work of others, to theoretically locate our own research work, and to use methods appropriately. However, Cantrell (1993:84) notes that learning about methodologies informed by different research traditions (positivism, interpretive, critical science and post critical science), is not intended for us as researchers to ‘cement our own philosophical entrenchments’ or to parochially make our research fit a particular theoretical orientation. Instead, she argues, an understanding of research traditions provides ‘philosophical goggles which enlighten our view and, in turn, lead to an acceptance of the array of methodologies’ along with the appropriateness of method.

4.2 RESEARCH METHODOLOGY AND METHOD

In research conversations the terms *methodology* and *method* often are used interchangeably. However, as Sandra Harding (1987) points out, distinguishing between *method* and *methodology* is necessary. For her method refers to techniques for gathering empirical evidence (the way of proceeding) whereas methodology is the theory of knowledge and the interpretive framework guiding a particular research project (Harding 1987:2). Fien (1992:2) states that methodology is the philosophical framework that guides the research activity, for

Van Manen (1975:27) it is the general orientation to life, the view of knowledge whereas Robottom and Hart (1993:594) consider methodology in terms of ideology. Although the literature manifests nuances of meaning, methodology generally should be viewed not merely in technical terms of method but concerned rather with theories behind method. As Burgess (1984:2) states, 'methodology involves the consideration of research design, data [production], data analysis, and theorising together with the social, ethical and political concerns of the social researcher'.

Educational research literature in the 1980s was replete with debates over the paradigms 'quantitative' and 'qualitative'. However, this distinction (albeit not dead) may no longer be useful for naming in Lather's (1991b:9) terms the 'unprecedented cross-disciplinary fertilisation of ideas' which characterise inquiry in the social sciences. For her, qualitative is the other of quantitative and therefore a discourse at the level of method and not paradigm or methodology. Others such as Gough (1993:176) and Le Grange (2000:194) have argued that etymologically the distinction between qualitative and quantitative is appropriate only at the level of data. It is in the light of the above that I prefer to distinguish between positivist research and postpositivist (interpretive, critical and postcritical) inquiry instead of quantitative and qualitative.

Lather (1991b) asserts that postpositivist inquiry represents contemporary intellectual work in a time characterised by disturbances to formerly secure foundations of knowledge and understanding, including contestation of positivist perspectives on knowing and understanding reality. Since the mid-1980s in particular, we have seen an explosion of alternative ideas and practices in social inquiry: ethnography, phenomenology, hermeneutics, as well as, feminist, critical, and narrative inquiry are just some of these relatively new frames of reference for examining social reality. Phenomenology and hermeneutics have long histories in continental European philosophy (dating back to the 19th century) – its application to educational inquiry is, however, relatively new. In addition, according to Lather (cited in Goodman 1992:118), in the 1990s there has been a proliferation of 'post' frameworks such as post-modernism, post-critical, post-structural, post-

paradigmatic and so on. My intention is not to pursue these alternative ideas and practices in great detail but to point out that some understanding of them might enlarge our repertoire of inquiry.

Conceptual frameworks help us to understand our own research work, to better understand the work of others, and to learn about educational research in more meaningful ways. But these frameworks should be viewed as dynamic and ever changing and should not be used to parochially locate our work. In his seminal work, *The Structure of Scientific Revolutions* (1970), Kuhn contributed significantly to our understanding of science, research and scientific methods, by focusing on science as a social practice that is historically embedded rather than transcendental.

Kuhn (1970) introduced the concept of 'paradigm'. Paradigms are frameworks that serve as maps or guides for scientific/research communities, determining important problems and issues for its members to address, and determining acceptable theories and methods to solve identified problems/issues. When a paradigm becomes settled and dominant within a scientific/research community, Kuhn refers to the research carried out as 'normal science'. According to Kuhn (1970) 'normal science' is interrupted from time to time by occasional breaks and discontinuities, which he called 'scientific revolutions'. A paradigm shift occurs when dominant paradigms are questioned and a community of scientists accepts new paradigms. Paradigm shifts therefore represent new ways of viewing the world and new ways of doing science. Kuhn's concept of paradigm informs Table 1 (adapted from Lather 1991b, who in turn draws on Habermas, 1972) and which represents four paradigms of social inquiry in an era characterised by the weakening of the hegemony of positivism. I contend that these paradigms are much more useful in characterising contemporary educational research than categories such as quantitative and qualitative. However, these paradigms do not represent a linear progression and replacement of one by another, because their interrelationships are complex, recursive and messy. These paradigms are not equally appropriate in all particular contexts of inquiry, but are conflicting and contested.

Table 1: Paradigms of Postpositivist inquiry - adapted from Lather (1991b) and Habermas (1972)

Predict	Understand	Emancipate	Deconstruct
Positivism	Interpretive Naturalistic Constructivist Phenomenological Hermeneutic Symbolic interaction Microethnography Macroethnography	Critical Neo-Marxist Feminist Race-specific Praxis-oriented Freirean Participatory	Post-structural Postmodern Post-paradigmatic

According to Connole (1993:26) there are two positions that one may take *vis-à-vis* the different research traditions/paradigms outlined above, namely, to view them as ‘competing paradigms or as complementary frameworks’. My preference is for the latter position. Personally I find it difficult to position myself ideologically, epistemologically, ontologically or axiologically within any of these research traditions. Rather I argue for methodological appropriateness in determining quality in educational research. By this I mean that research methodologies should be informed by research foci or questions rather than vice versa. As Patton (1990: 38-39) writes:

Rather than believing that one must choose to align with one paradigm or the other, I advocate a paradigm of choices. A paradigm of choices rejects methodological orthodoxy in favor of methodological appropriateness as the primary criterion for judging methodological quality. The issue is whether one has made sensible methods decisions given the purpose of the inquiry, the questions being investigated, and the resources available. The paradigm of choices recognizes that different methods are appropriate for different situations.

In this research study I will seek primarily to understand, describe and interpret my own and others’ experiences and the meanings they give to phenomena they

encounter. Thus, for the purposes of this study, I choose to work chiefly within an interpretive frame.

4.3 INTERPRETIVE RESEARCH

Interpretive inquiry is concerned with understanding daily occurrences as well as the meanings people give to phenomena. Their meanings are understood as multiple, constructed through human interaction, holistic and divergent. In this study I document, describe and interpret changing pedagogical practices in the context of my own professional work. I examine two cases *in situ*: a learning programme development process with in-service teachers and a learning programme development process with pre-service teachers.

Appropriate choices of research methods are as important as methodological appropriateness. Cantrell (1993:87) argues that methodology guides choices concerning methods. Although interpretive research studies do not rely exclusively on methods that produce qualitative data, they are the methods most typically used (Patton 1990, Cantrell 1993). Qualitative data production methods are not monolithic and include, for example, ethnography, interview studies, case study, action research, participatory research, discourse analysis, life history and so on. For the purposes of this study, case study is the most appropriate research method for producing data.

4.3.1 Case study method

Case study research is not a new method. According to Merriam (1988:xi) historically, significant 'cases' have long been part of disciplines such as medicine and law, and have contributed to the development of other fields ranging from anthropology to political science. She points out that in the late 1960s and early 1970s the merits of case study research were first recognised in education. Since then, case studies in education have offered useful insights into educational practice and have contributed to the development of educational policy.

Merriam (1988:1) points out that although case study is a familiar term to most people, there is little agreement on what constitutes case study research.

Stenhouse (1988:49), for example, suggests that even though quantitative indices are used (generally descriptively), case study research should be viewed as a response to research done within the psychostatistical paradigm. He writes:

Case study may be seen as a response to the need for a return to close natural observation, or as a reaction against the positivist epistemology implied in the psychostatistical paradigm. Case study methods are often described as naturalistic, qualitative, descriptive, responsive, interpretative, hermeneutic, or idiographic by way of contrast to the abstracted, quantitative, nomothetic approach of psychostatistical methods that strip observation to indices.

In social science literature most case studies are descriptive accounts of complex situations rather than quantitative measures. Stake (1978:7), however, notes that case studies in institutional research and vocational counseling often are highly quantitative. This is not the place to visit all the debates concerning what constitutes case studies but, rather, I will identify some key features of interpretive case studies (the orientation of my research) and provide a characterisation of case study that will inform my research study.

Merriam (1988:11-13) identifies four features of the interpretive case study: *particularistic*, *descriptive*, *heuristic*, and *inductive*. *Particularistic* means that the case study focuses on a particular situation, event, programme, or phenomenon. *Descriptive* means that the final case study report is a rich, 'thick' description of the phenomenon under study. As full a description as possible is given of the incident or entity being investigated. *Heuristic* means that the case study illuminates and extends the reader's understanding of the phenomenon under study. *Inductive* means that the case study relies on inductive reasoning: data are grounded in the context itself.

The definition of case study, which informs this research study, is:

Case study is the examination of an instance in action. The study of particular incidents and events, and the selective collection of information on biography, personality, intentions and values, allows the case study worker to capture and portray those elements of a situation that give it meaning. In educational evaluation and

research the case study worker may attempt to study and portray the impact in a school of a particular innovation, the experience of a curriculum development project team, the development of an idea through a number of social organisations, the influence of a social and professional network, or a day in the life of a teacher, administrator or pupil. These very different studies have in common some commitment to the study and portrayal of the idiosyncratic and the particular as legitimate in themselves (Walker 1980:33).

Previously I indicated that I examine two cases of changing pedagogical practices in a higher education context. These cases represent instances in my own praxis. The detailed, descriptive accounts of the cases are provided in chapter 5.

Case study reports may be presented in different ways. In this study each case study will take the form of narratives. Although case study reporting has traditionally not been regarded as storytelling, Stake (1995:127) argues that we are increasingly hearing references being made to the writing of case study research as telling stories. However, the case studies will not simply be storytelling, but will broadly incorporate the following three elements, which Stake (1995:127) identifies as:

- A chronological or biographical development of the case;
- A researcher's view of coming to know the case; and
- Description one by one of several major components of the case.

Two broad conceptions of case study can be distinguished, that is:

- The case as one instance of a constellation of such instances, for example, a case study of school curriculum. According to Adelman, Jenkins and Kemmis (1976:141) such a bounded system is selected as an instance drawn from a class.
- The case as a singularity – it is not a case of something. Adelman, Jenkins and Kemmis (1976:141) describe this understanding of the case as a bounded system in which the boundaries have common sense obviousness, e.g. an individual teacher, a single school, or perhaps an innovatory programme.

The conceptions of case study mentioned above raise an issue concerning the tension between generalisations made from case studies and the uniqueness of case studies. Adelman, Jenkins and Kemmis (1976:141) argue that three different kinds of generalisations can be made from case study:

- The first generalisation is that made from the instance studied to the class it purports to represent (e.g. a study of OBE practices in one school may tell us about OBE practices in other schools);
- The second kind of generalisation is made from the case-bound features of the instance to a number of different classes. For example, studying OBE classroom practices may generate insights beyond the initial aim of the study about diverse matters such as policy-making, school leadership and management and the working of the local press; and
- A third type of generalisation is generalisations about the case itself. This type of generalisation would often be generated in the second conception of case study I mentioned above.

However, Adelman, Jenkins and Kemmis (1976:141-142) argue that as a case study progresses the boundaries of the system become increasingly permeable. For example, in this research both of the cases might only be understood and interpreted within broader contextual factors such as the history of teacher education in South Africa, changing education policies in SA after 1994, the history of the University of Stellenbosch, and so on. As Adelman, Jenkins and Kemmis (1976:142) summarise, 'each case turns out to be profoundly embedded in its real world situation'. It is in the light of this that Adelman, Jenkin and Kemmis (1976:142) argue that the two conceptions of case study (as a *constellation of instances* and as a *singularity*) refer more to purposes than to two distinct approaches in case study. They point out that in both contexts the case study worker must treat the boundaries of the system and the issues as problematic and to define the innate organisation of the case, i.e. its uniqueness.

In this research I do not treat the two ‘conceptions’ of case study as distinct and attempt to represent both the uniqueness of the two cases and the generalisations produced from them. Producing generalisations are usually associated with positivist research. However, concepts such as generalisations have different meanings within different research traditions. I use the term generalisation in the way Adelman, Jenkins and Kemmis (1976:141) use it (see earlier discussion) Next I turn to a discussion on research design.

4.3.2 Research design

Research design refers to a plan that guides the research activity/process. For positivist researchers such plans are treated as blueprints whereas within other traditions they are viewed as flexible guides. Interpretive research studies are characterised by emergent design and researcher flexibility. Cantrell (1993: 88) argues that plans, research questions, theories, data collection strategies, and analysis all evolve from the start of the research process as the researcher learns more about the people, places, events and processes which are the focus of the study. This view is supported by Lincoln and Guba (1985: 225) who argue that the “design of naturalistic (interpretive) inquiry cannot be given in advance; it must emerge, develop, unfold”. Therefore, instead of prescribing a research design in advance, I describe and justify the design decisions I made as part of the unfolding story of each case study.

Concerning research foci and questions, this study reflects a struggle to delineate them in the first place and to specify how they changed as the study evolved. Determining a focus for the research study was particularly difficult for me. As a neophyte researcher attempting post-positivist research for the first time meant navigating uncharted waters. Further, the unpredictability and contingency of inquiry in ‘real world’ settings mean that stating predetermined research foci and/or questions are pointless. Patton (1990: 166) points out that, ‘there is no rule of thumb that tells a researcher how to focus a study. The extent to which a research question is broad or narrow depends on purpose, the resources available, and the interests of those involved’.

I used convenient cases related to my own professional work and the natural growth of the Windows on the Wild (SA) project. Time constraints impacted on the study, as I was able to interact with participants in each case over a one-year period.

4.4 DATA PRODUCTION

I choose to use the term data production instead of the commonly used term data collection. We do not collect data as if it is 'out there' but rather construct data through human will and intention. As N. Gough (1999:264) emphasises:

(W)e *produce* data by our own acts of will and intent. While this does not preclude treating data with at least some of the moral connotations of the "gathering" metaphor - that is "with all the love and care with which we gather the fruits of the earth," - data most assuredly *are not* "fruits" of anything but our own invention. Many fruits of the earth are not our own creation and are produced as effects of causes that do not include human agency, but this is *never* true of "data," which are always already fashioned by human purpose and action.

Harding (1987:3) points out that when doing field work there are essentially three ways in which we produce data; by listening to and/or questioning informants, by observing behaviours and by examining historical records and traces. In line with the interpretive orientation of this research and the case study method used, I draw on a variety of different data sources, namely semi-structured interviews, questionnaires, the keeping of a research journal, the collection of documents, photographs, workshops and workshop data, observation, informal discussions, focus group discussions and field notes. As Adelman, Jenkins and Kemmis (1976:141) note:

Case study methodology is eclectic, although techniques and procedures in common use include observation (participant and non-participant), interview (conducted with varying degrees of structure), audio-visual recording, fieldnote-taking, document collection, and the negotiation of products (e.g. discussing the accuracy of an account with those observed).

I now discuss in greater detail the techniques used in producing the data for the two case studies.

4.4.1 Observation and field notes

Cantrell (1993:93) argues that the purpose of observation is to give the researcher direct, first-hand experiences of the phenomena under study. Observation is often inextricably linked to participation and therefore appropriately referred to as participant observation. Participant observation represents a continuum ranging from 'pure' participant to the 'pure' observer (Guba & Lincoln 1981). As both of these positions are difficult to achieve, the researcher simultaneously takes on both. It is the context of the setting and/or the purpose of the study that will determine the degree of observation and participation. In both cases of this research I was a participant and an observer. This made 'pure' observation difficult, as opportunities to do nothing other than observe were few. I found it very difficult to distance myself to observe when I was fully engrossed in activities with participants and in many cases facilitating those activities.

Another important aspect pertaining to observation is how observations are recorded. Cantrell (1993:93) argues that for observation, the data appear in the form of field notes. According to Bogdan & Biklen (1982:74) field notes represent a written account of what the researcher hears, sees, experiences, and thinks.

4.4.2 Keeping a research journal

Although it was difficult, I kept a research journal, documenting as many of the activities and experiences, which were integral to the cases being studied. Elliot (1991:77 cited in Lotz 1996:92) recommends that a journal '...should contain personal accounts of observations, feelings, reactions, interpretations, reflections, hunches, hypotheses, and explanations. Accounts should not merely report the "bald facts" of the situation, but convey a feeling of what it is like to be there participating in it'. Meloy (1994:60) has argued that a journal links many different levels of experience - one is simultaneously involved with/in and can provide a place where the research focus and the role of the researcher meet methodological and analytical concerns. She further points out that it can also be, 'a place to make

explicit questions and concerns for later answering and organising; a journal can hold your heart’.

4.4.3 Informal discussions

Informal discussions proved to be a useful site of data production. In both cases, information shared in informal discussions provided insights into what participants were thinking when they were relaxed and not pressured by the formality of an interview. In the first case, teachers were reluctant to be interviewed but shared a great deal in one-to-one conversations with me or in informal group discussions before commencing formal workshop activities. Informal discussions with these in-service teachers provided me with insights into the difficult circumstances in which they were teaching, and the excitement generated by the new ideas they were implementing in their classrooms. When working with the pre-service teachers, I often had brief conversations with individual student teachers at the end of the class period and these provided valuable feedback and often corroborated what I had observed or clarified what they had written in their journals.

It is important that we do not underestimate the significance of ‘informal’ data sources. Drawing on her own research experience, Janse van Rensburg (1995: 55) argues that the use of informal sources of data has been one of the best ways to learn about environmental education in the southern African region.

4.4.4 Semi-structured interviews

The interview is an important source of data production in interpretive studies. The purpose of the interview is to provide descriptive data in the interviewee’s own words and to access that which is unobservable (Cantrell 1993:96). Semi-structured interviews provide opportunities for responding to both predetermined questions and free responses.

I used semi-structured interviews at various stages throughout the research study when requiring in-depth information not provided by other sources. Measor (1985:57, cited in Fien 1992:10) points out that interviews provide better quality data if there is a relationship of trust between the interviewer and the interviewee.

She recommends that relationships of trust should be developed with interviewees through empathy, sensitivity to context, appearance management and the development of shared interests. Throughout the research study I attempted to develop good relationships with research participants. This helped me to conduct interviews in circumstances where interviewees felt comfortable. I do, however, recall discussing with the group of in-service teachers at one point the possibility of interviewing them. The negative non-verbal messages, for example, facial expressions I received made me realise that it was not the appropriate time to conduct interviews and that it may be insensitive to conduct interviews at all. Upon reflection, I instead asked the teachers to complete a questionnaire, which they were very willing to do.

I audio taped the interviews and transcribed them into print form. The typed transcripts were returned to interviewees for validation and supplementary comment if desired. Despite their convenience, reducing audio data to print might result in aspects being lost such as the confidence, mood, and so on of the interviewee.

4.4.5 Focus group discussions

Focus groups discussions are organised to explore a specific set of issues such as people's views and experiences of a particular concern. During such discussions the group is 'focused' in the sense that they are involved in some kind of collective activity such as viewing a film, examining a single education message or debating a particular set of questions (Kitzinger 1994:103). Wood (1992: 2824) points out that whilst conducting focus group discussions the setting should be comfortable, neutral and non-threatening. He further suggests that a moderator (facilitator) who should ensure that all participants are involved in discussions should conduct focus group discussions. The duration of focus group discussions is normally 1.5 to 2 hours (Kitzinger 1994, Wood 1992). In this study I used focus group discussions with the pre-service students to reflect on our interactions. The focus group discussion was done in normal classroom time as a classroom activity. This provided a 'natural' setting and allowed the discussion to proceed in a relaxed

atmosphere. I used photographs as a way of focusing our discussion (see chapter 5 for detail).

4.4.6 Questionnaires

In this research study questionnaires provided an additional source of data when it was not appropriate to conduct interviews. At the first meeting that a co-researcher and I had with the in-service teachers we requested teachers to complete a questionnaire so that we could be provided with some biographical details as well as information with regard to in-service education programmes they attended on outcomes-based education. The latter was important in helping us with the planning of our programme with the teachers. As we did not know the teachers at this point in the process, conducting interviews would not have been appropriate, as relationships of trust had not yet developed sufficiently. As I already pointed out (in my discussion on interviews) even midway through the programme the use of questionnaires remained appropriate when teachers were reluctant to be interviewed. Although, not generally recommended for interpretive studies I found the data produced from questionnaires appropriate for the particular context in which I was working. With the pre-service teachers I used course evaluation questionnaires as a useful source of data for triangulation with data generated through other techniques. The questions, which formed part of the questionnaires, were open-ended and conducive to interpretive analysis.

4.4.7 Documentation

Documentation provides additional information to that which may be accessible through observation and interviewing. It further helps to clarify other data. According to Cantrell (1993:97) documentation refers to 'paper' data and includes, *inter alia*, records, files, internal and external communications, agendas, policy documents, forms, reports, news articles, journals, textbooks, published speeches, lists, and so on. Throughout the research study I collected documents that were pertinent to the research focus. Policy documents on South African education and environment, as well as documents relevant to the development of environmental education internationally, provided rich sources of data for constructing the broader socio-historical context of the study and for interpreting

the individual case studies within a macro-context. Drafts of writing materials, project proposals, research reports and minutes of meetings were extremely useful in the construction of data. The construction of both case studies benefited from the written core module on science and sustainability, research reports and newspaper articles. The science and sustainability core module was the first booklet developed as part of the WOW (SA) project that I referred to in 2.1. The latter helped to sketch the context in which teachers were working, and a new curriculum was being implemented. In the construction of case study 2 student journals, student assignments, and illustrative learning programmes developed by students were valuable data sources.

4.4.8 Photographs

Photographs are commonly used for illustration and for publicity purposes in the promotion of books, projects, exhibits, and so on (Walker 1993:73). The potential of using photographs in educational research has in the main, not been sufficiently explored. Walker (1993:73) points out that photographs are rarely used to provide complex information, to stimulate discussion, or to play a part in encouraging participation or self-reflection. Walker (1993:73) further notes that:

We are tuned to see photographs as illustration and we neglect the power of the photograph to engage thought, extend the imagination and to undermine the implicit authority of the written word.

Walker's latter point deserves particular consideration. When we produce research reports they inevitably are articulated with words and numbers. One consequence of the exclusive use of numbers and words is that effectively those that are less well educated, less articulate and less numerate are discriminated against (Walker 1993:84). Also in multilingual societies such as South Africa if research reports are not produced in the vernacular of readers they are alienated from the text. Photographs may enable some degree of engagement by such audiences in educational research. Photographs can also make it possible for research to develop some degree of reflexivity about the use of language and statistics.

In this study I use photographs as one way of producing data. The use of photographs was intended to triangulate data from other data producing sources. Walker (1993:82), however, points out that photographs have a more important role to play than in the process of producing data. For him the concern is not about 'photographs as records' so much as about the ways in which they are interpreted. In chapter 6 I discuss this concern in greater detail.

Throughout the study I took photographs to capture some of the important moments in action. Taking photographs was not always easy because I was involved in all phases of the project as a full participant. Some valuable moments may therefore not have been captured because I was deeply engrossed with the project activities. A concern I often had when photographing was the possibility that I might perhaps be reducing participants to objects of an exercise important to me. Therefore, I requested the permission of participants and attempted to be sensitive and unobtrusive. Not all participants were happy to be photographed and, upon reflection, I think that photographing might be an imposition not always consistent with building relationships of trust between researchers and participants. I discuss this further in chapter six. With the pre-service group photographing was fun and was enjoyed by the students. This made it possible for me to use photographs for purposes of recollection, reflection and collective meaning-making with the students.

4.4.9 Workshops and workshop data

Workshops are intended for participants to be actively involved and to interact with others when learning. Lotz (1996:92) argues that the use of workshops gained impetus as an INSET (in-service training) strategy in South Africa mainly due to the growth of the non-governmental organisations (NGOs) that have mainly been responsible for INSET provision to historically disadvantaged teachers as a result of unequal or inadequate INSET provision by the apartheid government.

McNaught and Raubenheimer (1991:47 cited in Lotz 1996:93) recommend that workshops should be contextual and not isolated from the actual teaching

conditions. Further, Hope and Timmel (1986:6) note the importance of building trust, openness and honesty in workshop sessions. Workshops were particularly significant in the work I did with the in-service teachers. The workshops were held in the setting where teachers worked and provided opportunities for teachers to learn to work with each other (and ourselves) as well as for building relationships of trust. A great deal of the programme with the pre-service teachers also involved workshopping of ideas as part of normal classroom activities. Oral reports on activities and what teachers recorded on the 'ubiquitous' newsprint sheets provided further useful data.

4.4.10 Data production for case study 1

Data production took place in 1997 and 1998 when a colleague and I conducted research aimed at investigating possibilities for collaborative curriculum development with teachers in a local community. The research project entitled *Introducing teachers to OBE and EE using materials and case studies*, was part of a collaborative project, coordinated and funded by the Human Sciences Research Council (HSRC). This made it possible for us to benefit from feedback, on the progress of our research by participants in the broader research project at colloquia organised by the HSRC. Also, because our research was part of a broader research project we had to work within certain constraints such as time, as well as maintain the focus of the broader project on OBE and participatory research. This influenced the data production process and consequently the data produced. I wrote earlier in this section, data was produced through the use of a variety of techniques including workshops, questionnaires, informal discussions, semi-structured interviews, photographs and my personal journal.

4.4.11 Data production for case study 2

The data production was done in collaboration with Activity Two participants of the South Africa/Australia Institutional Links project described above (see section 3.5.2). Our starting point in Activity Two was to identify environmental and environmental education issues related to our own professional practices. I chose to focus on changes in pedagogical practices related to my own professional work. The first step in the process was for each of us to take photographs representing

issues closely related to our work and workplaces. For a period of two months I observed and listened to students during our interactions in a science method course I was facilitating. I photographed many of the interactions that occurred between members of the class. I brought the photographs to the first workshop of Activity Two and shared them with the other participants. During this workshop session each of us clarified the focus of our case studies through a process of critical engagement with other participants. The other participants provided feedback on the photographs, enabling us to identify the 'gaps' or shortcomings in the pictorial records of our individual cases. The photographs served as the basis for initial individual and collaborative reflection on our practices. We returned to our work places so that we could take additional photographs to fill the 'gaps' that were identified at the first meeting. At the next meeting we individually wrote captions for the photographs and shared them with other participants for critical discussion. Following this, each participant began to develop individual case study commentaries from the photographs in preparation for presentation at the next meeting. Draft case study commentaries and captioned photographs were circulated among at least two other participants who provided critical feedback both orally and in the form of annotations on the text. Feedback was also provided in a plenary session. This enabled all participants to engage in discussions and various issues about each participant's practice were raised. The captioned photographs and case study commentaries were the products of a process of ongoing collaborative critical reflection. Critical reflection was evident in our work in different ways. First, in Hirst's (1998:394) words, our practices 'constituted patterns of activity engaged in individually or collectively which have been socially developed or constructed'. Secondly, individually and collectively, we scrutinised photographs, commentaries, and interview data by engaging in what Peters (1998:224) describes as 'the pursuit of various differentiated forms of inquiry...instantiating...respect for facts and evidence, precision, clarity, consistency and the general determination to get to the bottom of things'. As a final step in the process, the case study commentaries and photographs of different project participants were collated into a material resource as one way of disseminating the research. Although photographs were the primary source of data in this case study, I also used student journal entries, interviews, fieldnotes and

personal communications I had with students to triangulate data produced by the pictorial records. This was done through identifying common themes and patterns produced by different data sources. Data that did not fit into these patterns and themes were also identified.

4.5 DATA ANALYSIS

Bogdan and Biklen (1982:154) note that, 'analysis involves working with data, organising it, breaking it down, synthesising it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others'. As Patton (1990:372) writes, data analysis in interpretive research study takes on a particular orientation:

...there are no absolute rules except to do the very best with your full intellect to fairly represent the data and communicate what the data reveals given the purpose of the study.... This does not mean that there are no guidelines to assist in analysing data. But guidelines and procedural suggestions are not rules.... Because qualitative [interpretive] inquiry depends, at every stage, on the skills, training, insights, and capabilities of the researcher, qualitative analysis ultimately depends on the analytical intellect and style of the analyst. The human factor is the great strength and the fundamental weakness of qualitative inquiry and analysis.

Cantrell (1993:98) argues that the human inquirer serves as instrument for both data 'collection' and data analysis. These two processes are intertwined as data analysis begins with data 'collection'. Cantrell (1993:98) distinguishes between two phases of data analysis: analysis during data collection and analysis after data collection. But I suggest that Cantrell's distinction between data collection and data analysis might be problematic because the two processes are interwoven and do not necessarily follow each other linearly. Also, as I have noted above the term data collection is problematic and I prefer to use the term data production.

Cantrell (1993:98) argues that although there are no rules of thumb for data analysis in interpretive studies several approaches to analysis exist in practice and are supported by the field. She mentions that the most typical and widely used method is the development of a coding through content analysis. This involves

identifying categories or themes based upon patterns and ideas that emerge from the data. The researcher reads through the data looking for primary patterns (e.g., words, phrases, behaviours, thoughts, and events) which repeat and stand out (Cantrell 1993:98).

This approach to analysis is underpinned by positivist assumptions. Firstly, reducing data (representing human actions and interactions) to its small components, such as words, phrases, behaviours, and events is little different from reducing data to numerals. Secondly, using only information that emerges as a part of a pattern or trend ignores what is not part of the pattern/trend (empirical anomalies). In this thesis I intend as far as possible to present the two cases as holistic accounts of human actions and experiences including the uniqueness and idiosyncrasies of individual or group narratives. I acknowledge, however, that my attempts to describe events cannot be done free of human agency and will inevitably involve the selection of particular events or instances in preference to others. I use the description of the cases in chapter 5 as the first level of analysis. Analysis of the cases in terms of Pendlebury's (1998) notion of pedagogical space provides a second level, and analysis of the cases in terms of Turnbull's (1997) idea of 'knowledge spaces' offers a third level of analysis. The second and third levels of analysis are performed in chapter six of this thesis.

4.6 RIGOUR AND TRUSTWORTHINESS OF THE FINDINGS

Rigour and trustworthiness provide the basis for assessing the credibility of research studies. It is important, however, that we wear the appropriate lenses when we assess the worth of post-positivist research studies. Wearing positivist lenses to assess the worth of an interpretive study leads to inappropriate questions concerning, for example, sample size, generalisability and objectivity (Cantrell 1993:100). Positivists typically speak of validity, reliability and objectivity when judging the worth of a study. Based on very different assumptions of reality (ontology) and knowledge (epistemology) the positivistic concepts do not transfer directly to interpretive inquiry. Some authors (working within different traditions), however, retain the concepts of validity, reliability and objectivity but propose different means for assessing their merit (Taylor 1985, Lather 1986, Patton 1990,

Maxwell 1992, Smaling 1993). In this research four key criteria will be applied, namely, *triangulation*, *member checking* (strategies of an empirical nature) *reflexivity* and the *pursuit of truth in narrative* through *thick description* (non-empirical strategies) of the research account.

4.6.1 Triangulation

Triangulation is an important strategy for enhancing the quality of research, particularly credibility (Krefting 1991:219). According to Knaft and Breitmayer (1989) triangulation is based on the notion of convergence of multiple perspectives for mutual confirmation of data to ensure that all aspects of a phenomenon have been investigated. It involves cross-checking data and interpretations by drawing upon different data sources, methods, and perspectives. Different forms of triangulation occur, namely, triangulation of data techniques, triangulation of theories and triangulation of investigators. Although not used exclusively, triangulation of data techniques was pertinent to this study in so far as I drew on a variety of research techniques (e.g. participant observation, semi-structured interviews, documents, and so on) to construct the two case stories.

4.6.2 Member checking (face validity)

According to Krefting (1991:219) the ability of informants to recognise their experiences in research findings is central to the credibility of interpretive research. Member checking involves continually testing with informants the researcher's data, interpretations and conclusions (Lincoln and Guba 1985). Member checking ensures that the researcher has accurately translated the informants' actions, viewpoints and experiences. Further, it decreases the chances of misrepresentation. In this study wherever possible I gave research participants opportunities to read and check versions of the case texts as they were being constructed. This was difficult given the relatively short time I had to work with participants. In the case of the in-service teachers, the circumstances in which they were working and their unfamiliarity with research processes made any meaningful member-checking dubious. Mostly, teachers did not even have the time to read preparatory material given to them prior to workshops. In the case of the pre-service teachers, I gave a

sample of them a draft case study report to read, and used the feedback they provided as a basis for conducting semi-structured interviews with them.

4.6.3 Reflexivity

Reflexivity refers to the assessment of the influence of the investigator's own background, perceptions, and interests on the research process (Ruby 1980). Krefting (1991:218) argues that reflexivity includes the effect of the researcher's personal history on the research study. This perspective is in contrast to the claimed neutrality and even invisibility during the fieldwork experience, which often characterises positivist research studies (Krefting 1991:218). Agar (1986) notes that the researcher's background dictates the framework from which the research account is constructed. This background is made up of all of the resources available to make sense out of the experience and is often reflected in the multiple roles that the researcher plays while engaged in the research (Krefting 1991:218). In the first chapter of this dissertation, in particular, I described how my personal history and experience as a teacher came to shape my interest in this research. Further, I point out that throughout the research process I maintained multiple roles of author, teacher, INSET facilitator and researcher.

4.6.4 Truth in narrative

Van Manen (1990:19) argues that the aim in narrative research is to construct an 'animating, evocative description of human actions, intentions, behaviours and experiences as we meet them in the life world.' Barone (1992:21) asserts that 'accessibility, compellingness and moral persuasiveness will serve as criteria for judging the professional worth of educational stories'. Interpretive research study aims for descriptions that 'exact fullness and completeness of method and detail' (Van Manen 1990). Therefore, reliability, validity and generalizability (the hallmarks of epistemic respectability in positivist research) or a particular understanding of them is less relevant to interpretive research. O'Dea (1994:162) points out that positivist notions of epistemic respectability are not pertinent to interpretive research which openly endorses subjectivity, seeking to give the researcher who has long been silenced in the research relationship the time and space to tell his or her story so that it gains authority and validity.

According to O'Dea (1994:170) educational stories should, however, be more than accessible, compelling and morally persuasive, and must offer more than animating, evocative descriptions of educational settings. She points out that essentially the narrative researcher must delineate the truths of what has transpired in educational settings, to take up a position in the world of their meanings and to strive to articulate faithfully and precisely the realities of those settings (O'Dea 1994:169). Compellingness, evocative descriptions, animating and so on are not ends in themselves but instead means to the end of rendering faithfully and precisely the 'realities' of educational practice (O'Dea 1994: 170).

In constructing this research account I use (although not exclusively) narrative as a textual convention. I particularly use it in my biographical account in chapter 1 and in describing the realities of the human actions and experiences with respect to the two case studies in chapter 5.

4.7 ETHICAL ISSUES IN THE RESEARCH

Interpretive research describes accounts of human actions, intentions and experiences as we meet them in real-life contexts, rather than as objects of research. It is in this context that ethical considerations are not only important but also paramount. Cassell and Jacobs (1987: 1) note that 'much of our lives (including research processes) proceeds undramatically, and often decisions are imperceptible, so that only with hindsight are we aware that our course of action had consequences that we had not foreseen and now regret'. To improve ethical adequacy we therefore need to consider all decisions that we make (not only the outstanding and scandalous one), and to reflect not only on the conduct of others but also upon our own actions.

In this study I consider ethical challenges in relation to principles of *informed consent*, *confidentiality and anonymity*, *relationships* (between researcher and researched) and the *dissemination of data*. I consider each of these principles briefly below.

Burgess (1989:64) argues that all codes of ethics and statements of ethical principles place the principle of informed consent at the centre of research activity that may be deemed ethical. The principle of informed consent can be summarised as follows:

The voluntary consent of the human subject is absolutely essential. This means that the person involved should have legal capacity to give consent; should be so situated as to exercise free power of choice, without the intervention of any element of force, fraud, deceit, duress, overreaching or any other ulterior form of constraint or coercion; and should have sufficient knowledge and comprehension of the elements of the subject matter involved as to enable him [sic] to make an understanding and enlightened decision (Nuremberg Code 1949, reprinted in Reiser *et al.*, 1977:272-273).

In this study I have endeavoured to ensure that the voluntary consent of all research subjects has been sought. However, I also reflect on whether informed consent was achieved authentically in certain circumstances given the power relations evident in some situations.

Concerning confidentiality and anonymity I assured research subjects that their wishes would be followed in this regard. In case study 2 in particular it was important for me to check with research subjects on what I could include from their journals in the thesis. I did not consider initially when it was appropriate to use photographs. I mention this because a degree of anonymity can be provided by not using names in captions but photographs in principle enable research subjects to be identified.

Relationships between researcher and research subjects are at the heart of interpretive research study. Punch (1986) points out that the development of relationships in interpretive research is vital because it is 'subtly intertwined with both the outcome of the project and the nature of the data'. In this study I endeavoured to develop sound relationships with research subjects but also considered particular challenges that emerged in this regard.

Finally, I made every effort to disseminate data to the research subjects to ensure ethical adequacy. In some cases this was not possible, as some of the informants had left the country to work or live elsewhere.

4.8 CHAPTER SUMMARY

In this chapter I described the methodological orientations (methods, tools included) of my research. I described the study as being postpositivist and chiefly interpretive in nature. The method used in this research is case study. In this chapter I briefly described what case study method entails. I emphasised key features of interpretive case study and used Walker's (1980) definition to expand upon how case study is understood and used in this research study. In line with the eclectic nature of case study method I described the various ways in which data were produced in each case. In both cases the data production process formed part of broader research projects and consequently benefited from experiences and insights of other researchers. However, data production also was constrained by time as they formed part of funded projects. I also discussed in this chapter various means that I used to establish the trustworthiness of what I reported, as well as important ethical considerations that I took into account.

In the next chapter I describe the two cases as instances in action. The accounts of the cases will mainly take the form of written narrative descriptions, but importantly will also include photographs of physical features and key moments/events in each study. Through describing the case studies I shall illuminate instances of changing pedagogical practices in the context of two teacher education programmes.

Chapter 5

Case Studies

In this chapter I document two case studies of my own professional practice. Case study 1 represents my work with in-service teachers in a historically disadvantaged community, Grassy Park from October 1997 to August 1998. Case study 2 represents my work with pre-service teachers at the University of Stellenbosch from February 1998 to October 1998. I discussed in chapter 4 that case studies represent the selective collection of information and a portrayal of the idiosyncratic and the particular as legitimate in themselves. In this chapter I describe in words, and represent by means of photographs, particular instances of my work as a teacher educator. In chapter 6 I analyse, interpret and discuss the case studies.

Figure 1: Venues for the programmes



PHOTOGRAPH A



PHOTOGRAPH B

The Faculty of Education Building in which I work is represented in photograph A. It is a modern building with modern facilities and equipment such as data projectors, overhead projectors and so on. The building in photograph B is that of a local church hall in the Grassy Park area. We used this church hall for our in-service programme with teachers because there are few facilities suitable for such work in the area. Photograph B captures me carrying an overhead projector from my car because the facility did not have one. The photographs show the differing milieus of the university and the local community.

CASE STUDY 1: IN-SERVICE PROGRAMME WITH GRASSY PARK TEACHERS

5.1 INTRODUCTION

This case study involves in-service work I did as a university-based lecturer/researcher with teachers in a local community, Grassy Park. As I noted in chapter 3, towards the end of 1997 a colleague and I received a research grant from the Human Sciences Research Council to conduct research in environmental education that would be participatory in its orientation, and have as its focus outcomes-based education. Both my colleague and I decided to work with schools in Grassy Park because we have family and professional histories in the

area. In chapter one I shared some of my childhood memories of the area, and noted that I was a secondary school teacher in Grassy Park for ten years.

I begin my description of the case by briefly sketching its geographical, historical, cultural and educational features.

5.2 THE SETTING

Grassy Park is a suburb situated approximately 25 km south of central Cape Town and about 6km north of the False Bay coast. It is a low-lying area with two badly degraded rivers meandering through it eventually flowing into what some regard as one of the most eutrophic lakes in the area, called Zeekoevlei. People settled in the area more than one hundred years ago to seek economic opportunities and property ownership. In its early years the settlement was racially mixed but was declared a 'coloured' area under the 1966 Group Areas Act. Since the 1960s the area has been home to historically disadvantaged communities. According to Reddy (2000:24), when people first settled in the area it was a bare piece of veld that was covered with grass, beautiful heath, proteas and other fynbos species. The area was given its name because of its extensive grass cover. Missionaries of the English church settled in the area in the early part of the twentieth century and established the first school in 1912. The school was known initially as the All Saints Mission School Zeekoevlei (Reddy 2000:25) but, was later named the English Church School or EC Primary School. As the population increased over time more church schools (such as a Catholic School and Dutch Reformed Church School) as well as state schools were built. Today, there are five secondary schools and approximately twenty primary schools in the greater Grassy Park area. The former House of Representatives (one of the 19 Education Departments of the Apartheid State) administered most of these schools during the apartheid era.

After South Africa's first democratic elections in 1994 apartheid education departments amalgamated within provinces and currently schools in Grassy Park are administered by the Western Cape Education Department (WCED). The condition of school buildings in the area varies from a few that are reasonably well maintained to others that are vandalised and dilapidated. Most of the secondary

school teachers in the area obtained their teacher qualifications from universities whereas most of the primary teachers obtained their pre-service qualifications from colleges of education. Average class sizes range from 40 to 60 children.

PHASE 1

5.3 NEGOTIATING ACCESS TO THE SETTING

5.3.1 Visits to school principals

During the months of October and November 1997 my colleague and I visited schools in the Grassy Park/Lotus River area. Our knowledge of the area and the schools informed our decision to visit schools personally. We explained the nature of and the reasons for the project to the principals to whom we also gave a formal letter of introduction from our institution, which provided further information about the project. The information included the aim of the project, the intended duration of the project, the nature of the process (a series of participatory workshops) and the teachers we intended working with (intermediate and senior phase teachers). We visited twenty schools within a two-week period. Principals usually welcomed us affably and we spent a great deal of time talking to them about changes in education. Our visits to schools made us aware of the conditions in schools and of their educational milieus.

Our visits to schools coincided with crises in education making headlines in the daily newspapers. Cutbacks in education were threatening the jobs of thousands of teachers in the Western Cape Province. As a move towards equity in education the Department of National Education introduced uniform learner-educator ratios for schools in all provinces. This benefited most provinces but affected the Western Cape and two other provinces negatively since it meant fewer teachers and larger classes.

Figure 2 Newspaper headlines

**Teachers angry as talks
fail to head off axings**

**Principals get
hard lesson
in how to
sack teachers**

Schools battling with poor resources will be hardest hit by teacher cut-backs

At the time of its establishment the WCED had the lowest learner-educator ratio and the highest per capita funding level of the nine provinces in South Africa. During the period we visited schools the Western Cape Education Department (WCED) sent a circular to all schools stating that thousands of teachers were to be retrenched. Our visits to schools thus made us aware of some of the pressing issues facing teachers. Some of the principals expressed personal feelings of disappointment and resentment towards the WCED - feelings that the education department had let them down. The views of four principals are quoted below.

- 'The teachers came to school this past weekend to paint the school building. They have attended many in-service courses to develop professionally. Does the department know the teachers? Do they know their commitment to teaching? How can a teacher continue to attend in-service programmes when they not sure they are going to have a job next year? If teachers have to be retrenched, how does one decide who it must be' (Principal 1)?
- 'Teaching is not what it used to be. I am not always motivated to come to school, but I have to be positive so that I can motivate the teachers who

already have a low morale. Former white schools are not affected as much as we are. I went to a principals' meeting the other day and a principal of a former model C school⁸ (senior high school) said that they had set aside R450 000 to employ extra teachers in 1998' (Principal 2).

- 'The total annual budget of this school is R37 000. We don't even get that amount by way of school fees. The school (former model C) that my son attends have set aside R400 000 of their budget for employing extra teachers in 1998' (Principal 3).
- 'Teaching is not that noble profession it was when we first entered it' (Principal 4).

However, despite the pessimistic atmosphere in the province at the time, principals were open to new curriculum initiatives and welcomed changes to the curriculum. Most principals believed that their school communities would support the programme. Many of them criticised the WCED's lack of support. For example, two of the principals said.

- 'All the in-service programmes, which we conduct at our school, were through our own initiative. Nobody (including the education department) has approached the school to provide in-service support. The two of you are the first'.
- 'The education department provides us with no support. We welcome any assistance no matter how radical it may be. Thank you for thinking about us'.

The responses of the principals in Grassy Park highlight some of the complexities and difficulties experienced by historically disadvantaged communities in post-apartheid South Africa. Their responses to the introduction of uniform learner-educator ratios are particularly interesting. As mentioned earlier, the House of Representatives previously administered schools in the Grassy Park area. This department was established during the apartheid era to administer education for *Coloureds*. *Coloureds* and *Indians* were oppressed along with *Africans* but not the

⁸ Model C schools came into being in the late 1980s when the outgoing National Party semi-privatised white state schools. School properties and their maintenance were handed over to local governing bodies and the state continued to pay teachers salaries.

same extent.⁹ For example, *Coloureds* enjoyed a more favourable learner-educator ratio than *Africans*. Thus, uniform national learner-educator ratios implied fewer teachers and larger class sizes in *Coloured* schools. This meant that *Coloured* schools, perceived to be historically disadvantaged (in comparison to *Whites*) could be worse off in post-apartheid South Africa.

The effects of the uniform national learner-educator ratio policy were difficult for teachers in these schools to accept since they had anticipated improved conditions in a post-apartheid dispensation. They were also aware that former model C schools had financial resources to employ teachers additional to staff establishments, in so-called governing body posts. This raises the question of whether uniform national learner-educator ratios contribute to equality. As long as great resource disparities continue to exist between schools, uniform national teacher-educator ratios will contribute little to achieving equality. *Coloureds* find it difficult to accept that they were advantaged relative to *Africans* during apartheid rule and, therefore, that the introduction of uniform learner-educator ratios may benefit the majority African population. The tendency is to look at how they were disadvantaged in terms of *Whites* and not how they were advantaged with respect to *Africans*. What was also interesting at the time was that teachers, particularly those who were members of SADTU, expressed their discontent towards the WCED (National Party controlled) rather than towards the Department National Education (ANC controlled), although SADTU was itself party to the policy decisions made concerning learner-educator ratios¹⁰.

⁹ Although the use of the apartheid 'race' categorisations are unavoidable, I use them reluctantly. I clarify my position on this in my second footnote of this thesis.

¹⁰ SADTU is affiliated to the Congress of South African Trade Unions (COSATU). COSATU is in a tripartite alliance with the South African Communist Party (SACP) and the African National Congress (ANC).

Figure 3: Teachers protesting



PHOTOGRAPH C

Photograph C – teachers protesting against teacher cutbacks introduced by the Western Cape Education Department (WCED). The Afrikaans expression “ons is gatvol” is a display of anger, which means being “fed up”.

A second step in negotiating access to schools was to meet with the teachers. The decision to start our workshops at 13h00 (during official school-time) was decided through a process of negotiation. Some principals felt that teachers would be too tired to attend in-service programmes after school hours, given their increased workloads as a result of rationalisation. Some schools closed early on the workshops days so that teachers could attend the sessions and so that their classes were not left unattended. Most of these schools sent letters to parents to inform them about the early closure of the schools. This was a departure from past practices. Schools in this area had not previously closed early for in-service work, unless this was sanctioned by the WCED. This perhaps indicates that school communities (principals, teachers and parents) are taking greater control of their schools and not necessarily seeking departmental permission for matters of this kind. This could be a result of greater democracy and moves towards community participation, allowing schools more autonomy and power through the governing

bodies. The Schools Act of 1996 states that school governing bodies are to take on the role of determining school curricula on condition that it meets the requirements of the South African Qualifications Authority (SAQA). In this context the Schools Act provides an enabling framework for school-based curriculum development and in-service education programmes.

The venue for the first meeting was a local church hall that was centrally located for most of the schools in the project.

Figure 4: Venue of first meeting with teachers



PHOTOGRAPH D

Photograph D represents the specific section of the Church Hall we worked in. Standing outside the hall are homeless people waiting for a meal provided for them by the local church. We shared the facility with the homeless people who enjoyed a meal downstairs whilst we conducted our in-service programme upstairs. In local communities facilities such as these often are used as multi-purpose venues.

What follows is a description of the first meeting with teachers that served as the second phase of negotiation.

5.3.2 A first meeting with teachers

The meeting was held in the Good Shepherd Church Hall and attended by 43 teachers from 12 schools. The purpose of this meeting was to introduce the project to teachers. We provided teachers with a provisional plan of the project so that it could serve as an entry point for discussion and negotiation. The plan included the following key features:

- Introducing teachers to the NQF and Curriculum 2005
- The changing role of the teacher – teacher as curriculum designer
- Environmental education and Curriculum 2005
- Developing learning programmes for the intermediate and senior phases
- Introducing the *We Care* and *Windows on the Wild* resource materials
- Using activities from support materials to develop learning programmes
- Summative evaluation of the project (see appendix A for more detail).

We explained the proposed aims and the duration of the project and that we intended this professional development process to be participatory. During discussion time, teachers raised a number of issues. Firstly, they enquired about the availability of materials that may result from the process. Secondly, one teacher raised a concern that the data generated from the process would be used for our Ph.D. studies and that teachers would therefore be exploited for our gain. A third concern was with the impact of the pervasive pessimism accompanying rationalisation and the impact it would have on the programme. We responded to these concerns firstly by assuring teachers that they would receive free copies of any materials produced from our collective work. Secondly, we acknowledged that, as stated in the letter sent to schools, we intended to research aspects of the programme for our Ph.D. studies, but emphasised also that we would continually negotiate with teachers how our collective work could be mutually beneficial to all participants. Thirdly, we assured teachers that we were sensitive to the impact of rationalisation on their work demands and that we would negotiate with them suitable dates for workshops. One principal who attended the workshop suggested that we seek permission from the WCED to close schools earlier on the days that the workshops were conducted. We put this proposal to teachers, the majority of whom felt strongly that we should not seek such permission, which they perceived

as doing little to support them with curriculum changes and to which they were negatively disposed because of teacher cutbacks. The possibility of providing certificates of participation to teachers at the end of the process was also discussed. The meeting ended with the majority of teachers agreeing to participate in the programme.

In the first meeting teachers were openly critical of the WCED and its role in providing in-service support. They questioned our roles as researchers and wanted to ensure that they were not being exploited. However, they were willing to work with us and on the whole were eager to engage with curriculum change issues despite very difficult circumstances existing at the time. Many of those who decided to work with us took a significant professional development step in that for the first time they were participating in a programme not officially sanctioned by the WCED.

The first meeting raised some ethical concerns for me. I wrote in my journal:

Today I thought afresh about ethical considerations when doing research. I'm glad we were up front with teachers concerning our intention to research the programme as part of our Ph.D. studies. My commitment to a professional development process that builds everybody's capacity was sincere. Yet I am concerned about who really stands to benefit from this programme. Afterall I would get the Ph.D. qualification and would benefit from the recognition I would get as an academic for the research I was involved with/in. If teachers are going to benefit from the process then it is necessary for us to listen carefully to their requests and to create opportunities for them to say what they would like to gain from the research (Journal entry of 26 November 1997).

We asked teachers to complete a questionnaire requesting biographical details concerning OBE in-service programmes they attended and their general views of OBE and Curriculum 2005 (see appendix B). Of the 43 people present 23 completed the questionnaire from which the following is summarised:

Biographical details of teachers

- Twenty-two obtained their professional qualifications through colleges of education and one had a university qualification.
- Thirteen of the teachers had less than 10 years teaching experience and ten teachers had more than ten years teaching experience.
- The teachers had 278 years of teaching experience between them. Thirteen of the teachers had attended OBE in-service programmes ranging from one to five hours.
- Ten of the teachers had attended no OBE in-service programmes.

Teachers views of outcomes-based education and Curriculum 2005

- 'I don't know enough to form solid opinions'.
- 'I am still in the dark'.
- 'I need more information'.
- 'It's a mystery and I am looking for someone to solve it'.
- 'All that I know is that learners must acquire certain pre-planned skills'.
- 'It sounds good on paper but how do you manage this with 58 learners in your class'?
- 'It should be implemented gradually. Not everything in the old system was negative'.
- 'It is a sophisticated system that will take a while before it will be effectively and successfully used in schools'.
- 'It is long overdue'.

This information provided us with an initial understanding of teachers' knowledge of OBE and Curriculum 2005 and was used as a point of departure for the workshops that followed in phase 2. For example, since some teachers needed more information on OBE and Curriculum 2005, we spent the entire first workshop attempting to address this need. The workshop comprised a lecture presentation followed by a group activity on the key features of OBE and Curriculum 2005.

Not all of the schools we visited participated in the programme. One of the school principals refused to give us a hearing because we did not have written permission from the education department to conduct research. Teachers from another school

refused to join the programme because of their negative experiences with a researcher who had undertaken action research in the area prior to our visits. In the latter instance, teachers felt that they had been used merely to further the ambitions of the researcher.

The day after the first meeting with teachers I visited the school I had taught at for ten years. I spoke to two teachers who had attended the workshop and asked them for their impressions of it. They said that they thought the programme was good but that they would not participate in it. I asked for their reasons and one teacher who had also asked the question about our Ph.D. studies in the first meeting said that he had a difficulty with me producing data from the programme for use in my Ph.D. study. I asked whether we could talk about it for a short while and he agreed to do so. The other teacher present did not comment at all, but I gathered that they had made a joint decision not to participate in the programme since the first teacher spoke on behalf of both of them. The second teacher was in a temporary post and thus his position at the school was not secure. Concurring with his colleague (who was also the acting head of department) might thus be interpreted as enlightened self-interest in terms of his future prospects at the school.

I suggested to the teacher who thought that we would be exploiting teachers for our personal gain that it would have been more exploitative if we had not informed them of our intentions and gone ahead with documenting the process for our studies. I challenged him to join the programme and to negotiate with us what teachers could gain from the programme so that it was mutually beneficial to researchers and teachers but he simply reiterated their decision not to join the programme. I asked him how he thought we could conduct educational research without involving people but he had no answer. I realised that I was unlikely to convince him to join the programme and asked his permission to include his views in my thesis, a request to which he consented. Later that day I spoke to the principal of the school who suggested that professional jealousy might have motivated his colleagues not to participate.

This incident prompted me to think again about ethical issues that should be considered when doing research. I wrote in my journal:

The dialogue with my former colleagues was useful. It made me think again about what my real intentions were for doing the in-service work with teachers. Would I have been as enthusiastic to do the work if there were no personal or professional gain? My interest in doing the in-service work with teachers is certainly influenced by my interest in completing my Ph.D. studies – something I cannot deny. However, I have strong feelings that this process should be mutually beneficial to teachers and that it is up to the teachers and us to ensure that it is. I respect the decision of colleagues not to participate in the programme. Chris and I felt strongly that teachers should participate in the programme on a voluntary basis. Reflecting on the instance made me even more aware that we need to ensure that teachers' voices are not stifled in the process of our engagement with them (Journal entry, 27 November 1997).

I turn now to phase two of the project that involved a participatory curriculum development process with teachers.

PHASE 2

5.4 A PARTICIPATORY CURRICULUM DEVELOPMENT PROCESS

The programme entailed a series of the in-service workshops conducted with teachers over a period of nine months. The aim of the programme was to introduce teachers to OBE and EE using various material resources we had developed at EEPUS.

As university-based researchers our decision to collaborate with the Grassy Park teachers in a workshop programme was informed by our view that these workshops would provide opportunities for all of us to 'learn by doing' in developing curriculum. We agreed that we would produce data from observing and listening to participants, from analysing materials produced in the workshops, and from our own reflections on what transpired during the workshops. The workshops were held on Wednesdays between 13h00 and 15h00.

Figure 5: Teachers using their laps to record information



PHOTOGRAPH E



PHOTOGRAPH F

Photograph E - On days when our in-service activities did not coincide with the lunch-time meals for the homeless people, teachers were able to use tables for group-work activities and to record information on newsprint sheets. On other days when a meal was being provided for homeless people teachers had to use their laps or the floor to record information on the newsprint sheets (see photograph F).

Each of the workshop sessions was preceded by opportunities for informal interactions during which refreshments were served. As facilitators, based on our understanding of what we thought was required for the programme, we developed agendas for the workshops. What we initially planned was based on the proposal developed to secure funding for the research. However, the programme was open to negotiation among participants. We structured the workshops so that a balance could be achieved between presentation of information and opportunities for interaction. This approach to structuring of workshops is endorsed in the literature (see McNaught & Raubenheimer 1991:47, Lotz 1996:93).

In the first workshop we spent quite some time on presenting information. We believed that this was necessary to orientate teachers to the proposed programme and also to provide them with an overview of policy developments at the national level at the time. As the programme developed and as participants became more familiar with one another the workshop sessions became more interactive. Increasingly teachers from different schools worked in small interactive groups and the presentation of information shifted in two significant ways: firstly, presentations to the larger group were done by individuals from the smaller groups rather than by us as facilitators; secondly these presentations (report backs) flowed from ideas generated by the teachers in small group discussions rather than from the predetermined ideas we presented. As facilitators we continued to play a role in introducing workshop sessions and drawing thoughts together at the end of workshop sessions. What follows is a brief description of what occurred during the workshops.

5.4.1 Workshop 1 (3 December 1997)

Before the workshop commenced teachers enjoyed some refreshments and chatted in small groups.

We reported back on two issues mentioned in the first meeting:

1. Availability of materials: teachers were told that the materials produced from this process would be available to all participants at no cost.

2. All teachers who attended the full duration of the programme will receive a certificate of participation endorsed by the University of Stellenbosch.

The workshop focused on introducing the teachers to OBE and Curriculum 2005. Before introducing the NQF and OBE we asked teachers to discuss in groups why they thought there might be a need for a new curriculum. We asked members of each group to provide just single words that would typify reasons for a new curriculum. These words were recorded on an overhead transparency and are listed below.

Terms to describe reasons for a new curriculum.

Lack of resources, new needs, new learners, critical thinking, challenge, relevant, change, self-esteem, confidence, large classes, different approach, past - teacher-centred, motivation, creativity, uniformity, economy

We then presented our interpretation of key policy documents produced by the Department of National Education, including the NQF and Curriculum 2005 and their relationship with one another. We explained what outcomes-based education was expected to achieve, the difference between content-based and outcomes-based curriculum, and provided brief characterisations of key terms in policy documents such as outcomes, specific outcomes, critical outcomes, learning areas, learning programmes and so on. At the end of the session we did an activity in which the teachers matched these concepts with definitions. We asked teachers for feedback on the activity. Three teachers said that they had done a similar activity previously but on this occasion had matched more concepts correctly and felt they had a clearer understanding of some of the concepts. This activity seemed to be a good 'ice-breaker' but the atmosphere at the workshop generally remained a little tense, possibly because teachers did not know each other and us very well.

Figure 6 : An illustration of surveillance



PHOTOGRAPH G

Our intention was for the in-service work that we did with teachers to be participatory, and that we would break down hierarchical power relations between teachers and us. However, in photograph I (as university based researcher) am closely observing the work of teachers instead of participating with them in the group activity, providing evidence of a hierarchical power relationship – what Foucault refers to as surveillance.

5.4.2 Workshop 2 (28 January 1998)

This was the first workshop for the new year, 1998. In this workshop we revisited the idea of a school curriculum. Participants discussed in five groups the following two questions:

- 1) Where do our present school curricula come from?
- 2) What role do teachers presently play in school curriculum processes?

The responses varied and are represented in Table 2 below:

Table 2: Results of workshop 2

<i>Groups</i>	<i>Questions</i>	<i>Results</i>
1	Q1	Partly from the department and partly from teachers.
	Q2	Teachers compile their own resources: use textbooks.
2	Q1	From the National education department. There is a top down emphasis.
	Q2	There is a limited involvement of teachers. Teachers often feel a sense of restriction and that the curriculum has been "forced" onto you. This leaves us with limited possibilities to explore. Teachers make no input into the development of the curriculum. Teachers work in such a way that they almost "mechanically" produce learners. Teachers, however, seem to feel safe and complacent in this situation.
3	Q1	The department, school, textbooks, teachers.
	Q2	Teachers decide what is relevant for the standard or class. Teacher in this way becomes more sensitive to the needs of the learners. More flexible.
4	Q1	Prescribed by the department for all subjects in the form of syllabi. Schemes of work used at schools are then taken directly from the syllabi.
	Q2	The present curriculum/syllabus is very teacher centred. Teachers merely try to cover the prescribed curricula in order to prepare learners for the examination. Very syllabus bound: prescribed curricula are the recipe for that standard. Teachers merely follow the recipe for a flop-proof pass rate.
5	Q1	Western Cape Education Department (WCED) and the old institutions such as the House of representatives and the Coloured affairs department. The Government, especially the advantaged sectors of the population.
	Q2	Teachers are the main source of information and play a dominant role in classrooms. The curriculum is teacher centred. Learners just accept information from teachers unquestioningly. No community involvement in schools whatsoever.
6	Q1	The previous apartheid regime set up the curricula. In most cases it was done by people with no connection to education.
	Q2	Teachers merely serve to implement the curriculum. Teachers' just pass on information, they "go with the flow". They have to do teaching and testing. The learners have a very passive role

After some debate around these questions, two more questions emerged and were discussed in groups.

1) What will the future role of teachers be?

2) What support will teachers need in order to fulfill this role?

Yet again the responses of the different groups varied. The group responses to the questions are represented in Table 3 below

Table 3: Teacher responses to emergent questions

<i>Groups</i>	<i>Questions</i>	<i>Results</i>
1	Q1	Facilitator, mediator, assists learners, researcher who finds and guides learners to resources.
	Q2	Teachers will require the support of parents, the community, and school governing body. In addition a well-resourced school should support teachers. Teacher's centres that are conveniently located should conduct ongoing workshops that form part of an INSET programme and the support of principals is a crucial element for success.
2	Q1	Teachers will have to update themselves at all times and will have to fulfill various roles such as: researcher, facilitator, be equipped to handle learners with special needs, make or be given time for teacher development activities.
	Q2	Teacher aids to use in class. A teacher support system will have to be in place to help teachers. Parents should be involved in learning activities. Community should make input into the school programme. Principals should support new innovations which teachers attempt.
3	Q1	Teachers have to be facilitators who promote learning. They have to observe and guide learning. Allow for and encourage critical thinking. Assist and encourage learners. Encourage creativity and promote independent thinking.
	Q2	Parents and local communities should actively support teachers and teaching programmes. Constant guidance and regular workshops. INSET programmes should be uniform so as not to create confusion amongst teachers.
4	Q1	Teachers will have to be more flexible and learner centred. Teachers will act as facilitators who guide learners. Teachers will have say in the compilation of the content that will be taught. That teachers will not be syllabus bound.
	Q2	Teacher has to research along with learners especially related to project work. Resource centres from which material resources can be obtained. Parent involvement. Community support. Grade meetings in areas so that ideas can be shared.
5	Q1	Teacher should be a facilitator, mediator, and researcher. Pupils

	Q2	<p>should be more actively involved in classroom activities. Should involve communities. Develop skills of pupils. Should be responsible for syllabi.</p> <p>Parental support for school activities. Resource materials should be made available to teachers. In-service training programmes to assist teachers and prepare them for new changes. Incentives: teachers should be given incentives to attend workshops and INSET programmes</p>
6	Q1	Teachers should be facilitators of learning. Should be more encouraging towards pupils. Will have to be highly skilled. More flexible in their approaches. Open minded evaluators
	Q2	Support from: parents, colleagues, pupils (learners), community, other schools. Government should offer financial support as well learning aids and resources.

The information presented above shows that generally teachers believed that teacher-centred pedagogies continued to dominate classroom practice and that learners passively received information prescribed by state syllabi or textbooks. They also desired a shift from teacher-centred to more learner-centred pedagogies. This was evident, in part from their references to roles of teachers as facilitators or mediators. Three of the four groups mentioned that teachers should take on roles as researchers. In a sense teachers were speaking the ‘right’ language – they were echoing what was stated in policy documents. Furthermore, the majority of these teachers want local communities, including parents and learners, to be more involved in curriculum decision making.

We concluded workshop 2 with a brief discussion of the changing role of teachers in an OBE system. We emphasised the possibilities for teacher involvement in curriculum design and development and pointed out that the new curriculum framework (Curriculum 2005) expected teachers to design learning programmes. We shared with teachers our hope that OBE learning programmes would be developed in these workshops.

5.4.3 Workshop 3 (11 February 1998)

In this workshop we introduced environmental education and started to work on frameworks for the development of learning programmes. We thought that as ‘outsiders’ we needed to be sensitive to the teachers’ current circumstances and so we asked them to share their feelings about the situation in schools in the Western Cape. This was done briefly before starting with the ‘official’ business of the workshop. Nobody said anything. There could be many reasons for this. Relationships of trust still needed to be developed between the teachers and us. The group was fairly large and after only three workshops people may not have known each other well enough. Also, teachers appeared not be used to sharing in big groups like the one we had. We thought that we would not push the issue too hard and continued the workshop as planned.

As we (facilitators/researchers) reflected on the previous workshop we realised that we might have spoken too much and needed to get teachers more actively involved. We therefore asked teachers to discuss in groups what they understood by the concept environment, and what they saw as the major environmental problems globally, nationally, regionally and locally. This exercise worked very well for several reasons. Firstly, all the teachers seemed to be actively involved in their groups and there was a buzzing noise as teachers shared their perspectives with one another. Secondly, it appeared as if everybody wanted an opportunity to share his or her views. Thirdly, after each group reported back similar trends emerged. Some of the issues in the Grassy Park area teachers identified included vagrancy, drug abuse, and pollution of vleis and canals (rivers).

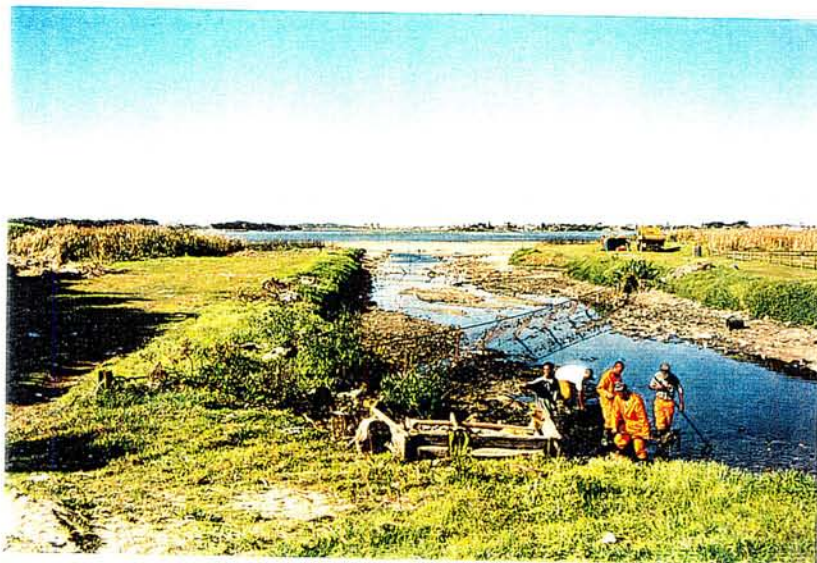
Figure 7: Environmental issues in the Grassy Park area



PHOTOGRAPH H



PHOTOGRAPH I



PHOTOGRAPH J



PHOTOGRAPH K



PHOTOGRAPH L



PHOTOGRAPH M

Photographs H, I, J and K depict some of the environmental issues in the Grassy Park area. Photograph L shows two teachers depicting what for them makes the earth a living (habitable) planet. This is one of the activities in the science and sustainability core module we used during our in-service programme. What is evident here is that what teachers sketched (expressed in “universal terms”) contrasted the issues in their local community. Photograph M shows teachers working in the staff room of one of the schools. Again the contrast between the curriculum activities done in a “classroom” setting and the local environmental issues are evident.

We had a brief discussion and based on what the groups shared we concluded that environment is not only natural but also included the political, economic and social aspects. We then attempted to start working on our mini-learning programmes using *environment* as a phase organiser. It was hot, the ideas complicated and teachers asked whether they would not be able to take the work back to the school and work with other colleagues. It was agreed that we do this.

We then asked the whole group how the programme was going so far. Again there was silence. In small groups teachers were very active but silent in large group discussions. Was perceived hierarchical power relations, given that we were university-based researchers, the problem? What could we do about this? What could we do differently? How could we establish what really was happening? Possibly the group was too large and teachers from different schools did not know each other well enough yet. In addition we may still have been perceived as outsiders. As we reflected on this, the idea of asking teachers to keep a journal to personally reflect on the process emerged. We asked teachers in the next workshop whether they would keep journals. They agreed but the heavy workloads of teachers did not make it possible for them to keep journals.

5.4.4 Workshop 4: (25 February 1998)

The workshop started with a recap of the aims of the project for the benefit of participants who joined the programme late. The aims of the project and the activities that preceded this workshop were explained. An important point emphasised during this discussion was that the process was an open one, adaptable and responsive to change. It was also pointed out that the facilitators were participants in the programme, learning with the process as well. In conclusion the aim of the project was summarised as: combining principles of OBE as set out in Curriculum 2005, with local environmental issues and using capital materials to develop learning programmes (see appendix C). When we called for comments from teachers, these were not forthcoming. Most felt that they understood what was planned and pledged their continued support.

A short report back session followed during which teachers were asked how they managed the learning programme outline exercise from the previous workshop. One teacher indicated 'we did not know where to start'. Another mentioned that he discussed it with his colleagues but that they were not keen to participate. He added that generally his colleagues were poorly disposed to the introduction of the new curriculum and that they were very critical of the WCED in general. He indicated also that the same people were reluctant to attend initiatives of this kind organised by non-governmental organisations. Some teachers also mentioned that they found it difficult to develop a programme without clear instructions or examples to work from.

Groups of teachers from some of the schools, however, made attempts to develop a programme on the proforma provided by my colleague and I. The proforma we used was developed by some members of the Environmental Education Curriculum Initiative (EECI). Two schools attempted this exercise on their own, one of them with the assistance of a worker from an INSET provider currently working with the school. These programmes were not discussed because the teachers in the workshop, particularly those who did not develop learning programmes requested that we try to develop a simple programme together.

One participant suggested that we should now move from 'theory' into a 'practical' exercise of developing the learning programmes. Some said that we were 'moving too slowly' and that we should get down to the 'nitty gritty' of developing learning programmes. Some group members advocated a 'learn as we go' approach. Some suggested that our process should now be more 'hands on'. I assume that by 'hands on' the teachers' meant applying concepts to the exercise of developing learning programmes.

As facilitators we felt that we needed to establish the meanings participants had made of OBE and environmental education concepts at this stage in the process. We suggested that teachers develop concept maps in their groups using concepts related to Curriculum 2005 and OBE discussed in previous workshops. This

exercise revealed a lack of understanding amongst all but one group. This clearly cast some doubt on the way in which concepts were introduced to teachers in the preceding workshops. The central aim of the development of workshops was to familiarise teachers with the concepts of OBE, EE and the new curriculum. After reflecting on what occurred in the workshop we realised that our approach may not have been a useful one. Perhaps we should have started with a practical activity and introduce the concepts through a more hands on approach. We decided to revisit the terms on an ongoing basis as we develop activities for the learning programmes. At this point in the process we split the group into two. Chris worked with the intermediate phase (grades 4-6) teachers and I worked with the senior phase teachers (grades 7-9). I now describe what transpired during this third phase of the project.

PHASE 3

5.4.5 Workshops 5-9 (March to July 1998)

The aim of the workshops with the senior phase teachers was to introduce sustainability as a focus for science education learning programmes. The workshop manual (core booklet) developed at the University of Stellenbosch introduced teachers to ideas for linking science and sustainability in classrooms. Activities from the core booklet were discussed and trialed with teachers (see appendix D). Local environmental issues identified by the teachers in the earlier joint workshops as well as the ideas around science and sustainability in the core booklet provided the content for OBE learning programmes teachers were to develop.

There were ten senior phase teachers who participated in the workshops. However, attendance at the workshops ranged from 3 to 7 individuals. It was difficult to keep the momentum going as different teachers attended consecutive workshops, which meant repeating some of work done in the previous workshops. This was frustrating for those who had attended previous workshops.

There were good reasons for teachers not attending workshops. One teacher, who was the only member of her school participating in the project, could not find anyone to supervise her classes (no person-power because of teacher cut-backs)

and therefore could not attend most of workshops. Another teacher, who was on the redeployment list of the WCED, was transferred to a school in another area, making it difficult for her to attend the workshops. Commitments to sport activities and other INSET and staff development programmes also prevented some teachers from attending workshops.

However, working with teachers in smaller groups enabled us to get to know each other better and trust improved between participants, leading to more open communication and dialogue. Often workshop time was used to discuss problems teachers raised about the difficult conditions in which they were teaching. The circumstances under which some of the teachers taught were difficult. One teacher related how he found it difficult to teach science and mathematics to learners when he knew many of them were hungry, had no shoes to wear and so on. Given time constraints, as facilitator, I was uncertain as to how much of this type of discussion I should 'allow' and when to intervene so that we could focus on the explicit purposes of the project. I knew that many of the complex social problems impacting on the education of learners would not be solved by our programme but sensed the need for teachers to talk about them. Through first hand experience, I also realised afresh how out of touch policies and my own ideals about what teachers can or should do may be from the everyday realities experienced by the teachers I was working with.

We worked through the content and activities of the science and sustainability core module. My idea was for teachers to read through the module on their own (between workshop sessions) and that as a group we would discuss them critically and adapt or develop new activities for inclusion in the learning programmes. This did not work out in the way I envisaged it might. Generally, teachers did not read the materials because they either did not have the time or were not used to engaging in activities of this kind. I sensed that teachers expected me as the university researcher ('expert') to teach them the content of the module and expected me to give a lot more direction than I thought I should. As our interactions continued I realised that teachers lacked science content knowledge to engage meaningfully with the information in the science and sustainability core

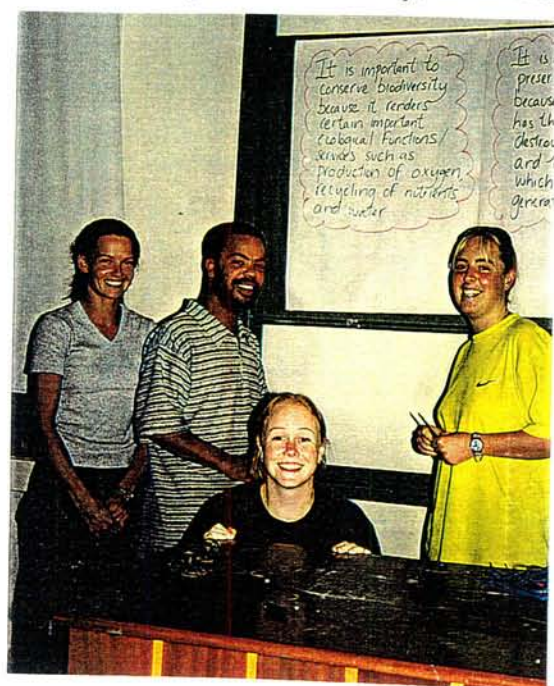
module. None of the teachers had degrees in science and the science they learned in the colleges of education, where they did their initial teacher education, was of a standard not much higher than that offered in secondary schools. Also, some of the teachers did not have science as a major subject in their college teacher's diplomas. I therefore had to spend a great deal of time explaining certain concepts in the science and sustainability module to teachers. I also sensed that the pedagogical expectations of the teachers were that I would teach (and they would learn), rather than the more collaborative process that I had in mind. It was at this time that I asked teachers if I could interview them. I could see that they were reticent about me interviewing them and I asked whether they would agree to complete a questionnaire instead, which they were willing to do (see appendix E for an example of a completed questionnaire). I also made use of informal discussions to gather information as trust between us developed.

After we had talked through the activities of the science and sustainability core booklet, using the learning programme we started to plan and write learning programmes which was intended for teachers to use in their classrooms. Due to time-constraints we decided that teachers would work in school groups on the development of learning programmes. We also decided that draft programmes, activities and developing ideas would be brought to the workshops for discussion and critical reflection. Teachers, however, appeared to have very little time to work on their programmes due to their commitments to daily teaching practice. They also struggled with OBE concepts and the ideas around science and sustainability were new to them. Furthermore, it was difficult to trial activities in classrooms as teachers had already planned their year's work and had to do work that was in line with those of their colleagues.

However, one story is particularly noteworthy. As the programme progressed it became more difficult for some of the teachers to attend the workshop sessions due to their involvement in sport coaching and other extra-mural activities. We decided to attempt running the workshops on Saturday mornings instead of having them on school days.

At the second Saturday workshop session only the two teachers from Sid G Rule primary school attended. I asked if they intended implementing the learning programmes that they had developed (see appendix F for an example of a learning programme developed by one of the teachers) and they said that they had already started. They spontaneously (and with some excitement) shared what was happening in their classes, including their struggles with doing group work because their learners were not used to it and as teachers they had difficulties with classroom control. They reported surprise that learners had developed critical thinking skills as a consequence of engaging with issues related to sustainability and biodiversity. One teacher said that on one occasion he had reprimanded some students for throwing away the crusts of their sandwiches because he felt that they were wasting food. In response one learner said that he was not wasting it because the birds would come and eat the crusts, and that it would be recycled in nature anyway. The same teacher said that learners in one of his classes asked him why he came to school by car because it contributed to air pollution. They suggested that he use a bicycle instead. The other teacher said that students were for the first time talking in class about television programmes they had seen concerning environment and conservation such as 50/50. He believed that the work he was doing on biodiversity and sustainability was stimulating them to watch television programmes on environment and conservation. One teacher also said that learners were making posters on environment and environmentally related issues, which they were going to use to make the public in Grassy Park aware of environmental issues in their area. They planned to stand with their posters along the fence of the school one morning.

Figure 8: Two versions of the poster of activity, *biodiversity the spice of life*



PHOTOGRAPH N



PHOTOGRAPH O

Photographs N and O represent two versions of a poster related to the activity, “biodiversity the spice of life”, forming part of the science and sustainability core module. The poster in photograph O is a reversion of the poster in photograph N. Feedback from pre-service students on the activity was that the words on the posters were too many and complicated. This activity involves learners identifying one of seven reasons why biodiversity should be protected. The feedback from the pre-service students enabled us to alter the posters for use in future workshops. In this instance, reflections on work done in a pre-service programme informed work done with in-service teachers.

A summary of the key insights that were generated by the senior phase process is listed below.

Key insights from the senior phase process

- Some teachers could not recall having thought of the earth as a planet with limited resources.
- Sustainability provided a new way of looking at science for these teachers.
- Teachers learned new things about their local environment. Some of them remarked that they heard for the first time the names of the rivers flowing through the area.
- Teachers struggled to make meaning of OBE concepts but engaging with OBE ideas and concepts made them not only think about but, actively improve their practice.
- During the programme one teacher introduced group activities in all her classes for the first time in twenty-five years. She shared this with great excitement and enthusiasm. She pointed out that she was surprised to see how many learners enjoyed the group work activities.
- Some teachers adapted their planned programmes to include some aspects of biodiversity
- Two teachers from the same school not only designed a new learning programme for their grade 7 classes but also implemented the programme at their school immediately.
- Time remains a constraint when doing research and in-service work with teachers because teachers are not also available to attend research activities or in-service workshops.
- Working with teachers in small groups encouraged active participation and the building of relationships of trust.

In the next section of this chapter I describe case study two which concerns the work I did with pre-service teachers.

CASE STUDY 2: PRE-SERVICE COURSE AT UNIVERSITY OF STELLENBOSCH

5.5 THE CONTEXT

The University of Stellenbosch is one of the oldest and largest universities in South Africa. It was established when its forerunner Victoria College became a university with the promulgation of the South African University Act of 1918. The

University of Stellenbosch is located in the centre of South Africa's oldest town Stellenbosch, which is nestled in the mouth of the valley of the Jonkershoek Mountains. Traditionally it has been an Afrikaner university but its monocultural identity has been challenged by imperatives for change in post-apartheid South Africa.

I teach in the Faculty of Education and work as a researcher in the Environmental Education Programme, University of Stellenbosch (EEPUS). Since its establishment in 1992, EEPUS has been involved with course development aimed at integrating environmental education into diploma and degree courses in the faculty. Currently environmental education modules form part of both undergraduate and post-graduate programmes and environmental education is regarded as one of the growth points of the faculty.

As in most modernist institutions many of the lecture venues in the faculty are characterised by an arrangement of desks with a podium and chalkboard in the front of the room that reflects traditional hierarchical power relations. Such arrangements reinforce the role of the lecturer as the authority and information dispenser separated from passive learners (Slattery 1995). In South African education generally and in Afrikaner institutions more particularly this arrangement traditionally has been reinforced by the ideology of Christian National Education and the philosophy of Fundamental Pedagogics (Ashley 1989, Le Grange 1999a). To legitimate the ideologies of Christian National Education in South Africa, the educational 'science' of Fundamental Pedagogics was used (Rhodes University 1998). Fundamental Pedagogics was used by the apartheid government to rationalise structures and characteristics of educational processes in which passive learners were schooled to adulthood by teachers serving as authority figures and role models (Ashley 1989, also see chapter 3 for a more comprehensive discussion).

Political and socio-economic change in South Africa in the 1990s was accompanied by imperatives for transformation of all education sectors. I noted in chapter 3 that a recently published White Paper, *A Programme for the*

Transformation of Higher Education, emphasises the importance of equity, redress and a need for a single co-ordinated higher education system that will enable life-long learning. The phasing in of a new national curriculum for General Education and Training, Curriculum 2005 is influencing the programmes of teacher education institutions (Department of National Education 1998). Key aspects of the new curriculum that are pertinent to environmental education are: outcomes-based education, learner-centred education as well as the defining of 'environment' as a phase organiser. This requires teacher education providers to consider possibilities of including environmental education processes into both pre- and in-service teacher education programmes (Lotz & Robottom 1998). Currently, the University of Stellenbosch is in the process of re-orienting and re-shaping all existing programmes to include environmental education programmes with this changing policy environment in mind. According to Sauve (1999:12) changes in pedagogical practices are necessary to ensure that education can help to bring about social change. She argues that this may be more important than focussing on particular discourses within environmental education such as education for sustainable development (ESD), education for a sustainable future (ESF), and education for sustainability (EFS) and so on.

One of the courses I teach in the faculty is a general science method course for pre-service teachers. This course aims to prepare pre-service teachers for school science teaching at grade levels 8 and 9. Curriculum policy developments in South Africa influenced my decision to actively involve the science method students in the design and development of OBE learning programmes. The content focus of the course is *science and sustainability*. I pointed out in chapter 2 that we were busy at EEPUS with a curriculum materials development project focused on *science and sustainability*. We started with the project at EEPUS during 1996 at the same time that new national curriculum policy frameworks were being developed. The national curriculum policies provided greater enabling possibilities for including environmental concerns in school science curricula. The work at EEPUS and the new curriculum policy frameworks was serendipitous for my research purposes. Since the materials developed at EEPUS also aimed to support science teachers of grades 7 to 9 I decided to use some of the activities in these

materials in the course I was teaching. I thought that this would work to the mutual benefit of both the method course and the curriculum materials development project.

With its focus on science and sustainability the WOW (SA) core module provided a useful resource for the course. I thought that making sustainability and the new curriculum key areas of concentration might enable the course to be responsive to emerging curriculum and environmental policy processes, as well as providing an opportunity to extend my research. News that the Department of National Education intended to pilot learning programmes for Grade 7 in 1998, aimed at implementation in schools in 1999, gave further impetus to what I had planned. Introducing pre-service students (who were going to start their teaching in 1999) to the new curriculum and collaboratively working with them on learning programme development was therefore particularly pertinent at the time. I now describe the programme with students.

5.6 THE PROGRAMME

My first meeting with the nine students who had registered for the course was pleasant. Six of the students were white and Afrikaans speaking. One student was white and English speaking and two of the students were black (so-called coloured). The student group comprised seven women and two men. From the outset the students were friendly and open. At the same time I provided students with an outline of the course for the year. I told them that I hoped to study our interactions during the course closely as part of my doctoral research. More importantly, I asked for their consent to document our actions, experiences and interactions, which they agreed to provide. I asked students to keep a journal to record their reflections on their experiences during the course. I also suggested that we should address each other using our first names. I thought that this might be one small way to break down hierarchical power relations and to promote open dialogue and conversation. I have done this with all of the classes I have taught at the university since 1996. However, I did not anticipate the impact this would have on students. Three months into the course one student wrote in her journal:

When you walked into the classroom the first day and you said that we should call you on your first name, I immediately developed a respect for you that I never had for any lecturer in my 3 years of B.Sc. studies. To be honest I was scared of the other lecturers. It was because I never had the freedom to say anything *in* their classes. In your class it is a totally different story (student journal entry, 16 May 1998, translated from Afrikaans).

Another student shared his struggle with addressing me on my first name. He wrote:

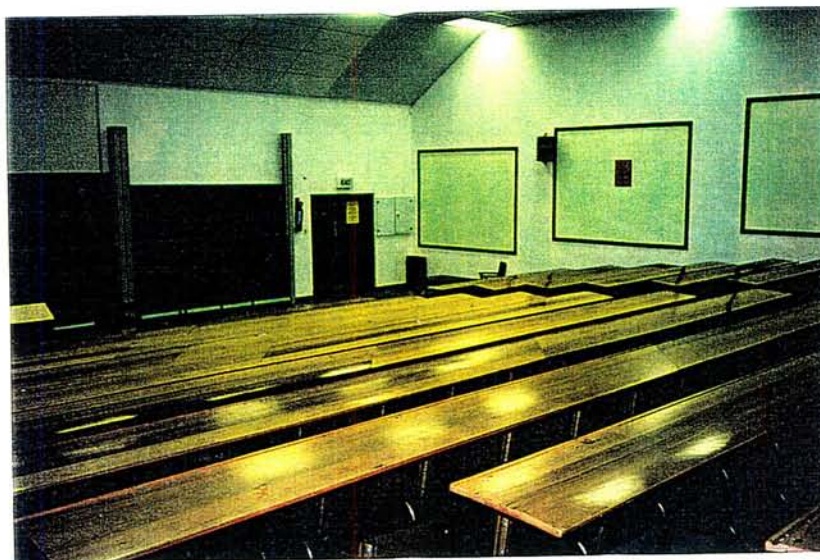
The informal class situations make me feel very easy. I am, however, a little reluctant to call my lecturer on his first name. It must be the result of the respect and discipline enforced by educators in the past. Not that I think there won't be any respect (student journal entry, 02 March 1998, translated from Afrikaans).

Initially he found it easier to write my first name in his journal than to speak it. Later in the same journal entry he wrote:

Students share their opinions and **Lesley** shows his enthusiasm for the implementation thereof (translated from Afrikaans, student journal entry, 02 March 1998).

During their own schooling students had addressed their teachers formally and at the University of Stellenbosch such formal modes of address are the norm for both lecturers and students. This may explain why my breaking with this convention seemed to have such a noticable impact.

Figure 9: Expected pedagogy and what actually happened



PHOTOGRAPH P



PHOTOGRAPH Q

Photographs P and Q shows the compelling contrast between the expected pedagogy as characterised by the architecture of the lecture venue (photo P) and the interactions between students and myself in the classroom (photo Q).

When the course commenced at the beginning of 1998 several policy documents on the NQF and the new curriculum (Curriculum 2005) had been produced by the Department of National Education. I thought that it would be important to distill

key concepts and principles from the policy documents and to share them with students. My first session with the students focused on an introduction to the NQF and Curriculum 2005. In the first part of the meeting I presented a lecture in which I introduced students to the key concepts and principles of the NQF and Curriculum 2005, as they are represented in the government's policy documents. I thought that this might be an appropriate approach given time constraints and the many policy documents that already existed at the time. I also introduced students to the specific outcomes and four organising themes (*planet earth and beyond, matter and materials, life and living, energy and change*) of the natural sciences learning area, as well as *environment* as a phase organiser (see chapter 3 for more detail). In the second part of the lecture I asked the students to work in three groups of three members each. In these groups they were required to develop concept maps to show relationships between some of the key concepts.

The OBE and NQF concepts were new to students, many of whom struggled to understand them. Students spoke and wrote of their difficulties with making sense of the concepts in informal class discussions, in their journals and in their first semester evaluation forms. For, example, one student wrote:

The whole Curriculum 2005 concept is confusing and complicated. Today the concept maps we made helped to make things clearer but I still do not have a clear picture in my mind (student journal entry, 9 March 1998, translated from Afrikaans)

Introducing many new concepts in a conventional lecture also seemed to be ineffective. As one student wrote:

When Lesley gave us the lecture I did not have clarity about the concepts because they were unfamiliar to me (Journal entry 9 March 1998, translated from Afrikaans)

Figure 10: Black and white students working together



PHOTOGRAPH R

Photograph R shows black and white students working together in group-work sessions. Such interactions are increasingly evident as student demographics change at historically white universities in a democratising South Africa.

I relate at this point the feelings of one of the black students in the class.

Story 1

Like all the other students, C enjoyed the informality of the classroom interactions. She says that in the general science method course there was greater participation and co-operative learning than in the other courses of her HDE year. She said that interactions were not only interesting but helped her to 'come out of her shell' a little.

Concerning the concept sustainability she says that she tries her best to conserve water, not to litter and so on but never thought about these things in terms of sustainability. In this sense the concept was new to her and made her aware of the extent of environmental problems – providing her with a more holistic perspective.

She raised an important issue when I interviewed her at the end of the course. She was one of two black students in the class and raises some of her feelings in this regard.

Where I grew up I only had contact with Coloured and Black people. I went to school in Mitchell's Plain ['coloured' township] and experienced political unrest and police shooting teargas at us. When I came to Stellenbosch it was different

and I became more aware of race. In the big lecture halls you sit with people of your colour. The general science method class was small and so I had more contact with students. They [white students] are actually just as I am. Although there are things that they take so for granted. It is just accepted that everyone is going overseas, everybody goes to university, everybody lives in a hostel – it is taken so for granted. It is as if it is just there. For me money is not always there. The [white] students in the class were very nice. I just sometimes wonder whether they are actually so nice or whether they are just trying to be nice.

However, the group activity of co-operative concept mapping enabled students to interact with me and with each other. This more collaborative approach resulted in more beneficial learning experiences which students reported in their journals and first semester evaluation forms. One student wrote:

In our previous session when we were introduced to the new outcomes-based education I was very confused. I did, however, understand that in outcomes-based education we start with the outcome and not the academic content. The exercise that we did to develop a concept plan helped all of us greatly. I now have clarity on what a learning programme, learning area, phase organiser and programme organiser is (student journal entry, 09 March 1998, translated from Afrikaans).

Although all students seemed to benefit from the group work their journal entries reflect subtle differences in their experience. One student describes how group work helped her to learn from others and to use the ideas of others to change and enhance her own.

When we started to work in groups we could jointly tackle the task and the related problems, attempt to solve and understand. Each group's inputs also helped me because I could use their understandings of the concepts to change and further develop my own ideas (Journal entry, 09 March 1998, translated from Afrikaans).

A student who normally preferred to work on her own wrote:

Another observation I made today is that I am beginning to enjoy working with other people. Usually I find it easier and more efficient to do things on my own, but group work definitely has an advantage because it makes one aware of others perspectives (Journal entry, 09 March 1998, translated from Afrikaans)

Another student described how her interactions with me prompted her to think differently about teaching:

The conversations with the lecturer are making me think more and more about new ways of teaching. We need to be less academic and educate learners as humans more holistically (student journal entry, 09 March 1998, translated from Afrikaans)

Yet another student reported his struggle with the group work exercise and its lack of structure as follows:

I found it very interesting how the 3 groups, given the same instructions, came up with 3 totally different ideas of what Lesley wanted from us. I found it a bit confusing though - a better explanation of the exact task might have lead to a better learning situation. I enjoyed making the charts, but was clueless, at times, as to what it was all for. Some groups were more systematic in their approach, whereas we were more random in our thoughts. I found the more systematic way of doing things easier to understand and a better way to learn (student journal entry, 09 March 1998)

Reflecting on the way I presented the key ideas and principles of the NQF and Curriculum 2005 to the students and in-service teachers I was working with in Grassy Park, as well as on conversations with others doing similar introductory workshops. I was reminded that new ideas are meaningless in learning processes unless they are related to what is familiar to learners. Time constraints allowed me to only attempt one different way of introducing an aspect of the new curriculum. I decided that rather than telling students what critical outcomes are (as stated in documents) I wanted to ask them individually or co-operatively to generate the attributes they believed that South African citizens should (ideally) have, and then to compare and relate their attributes to the critical outcomes stated in curriculum policy documents.

I then asked students to compare the views they had generated with the stated critical outcomes. We agreed that most of the desired attributes of a South African citizen they had produced closely related to most of the 7 critical outcomes of Curriculum 2005. The idea of relating the new curriculum terms to students' own views was useful. However, the many new terms generated by the Curriculum 2005 remained a concern for me. I wrote in my journal.

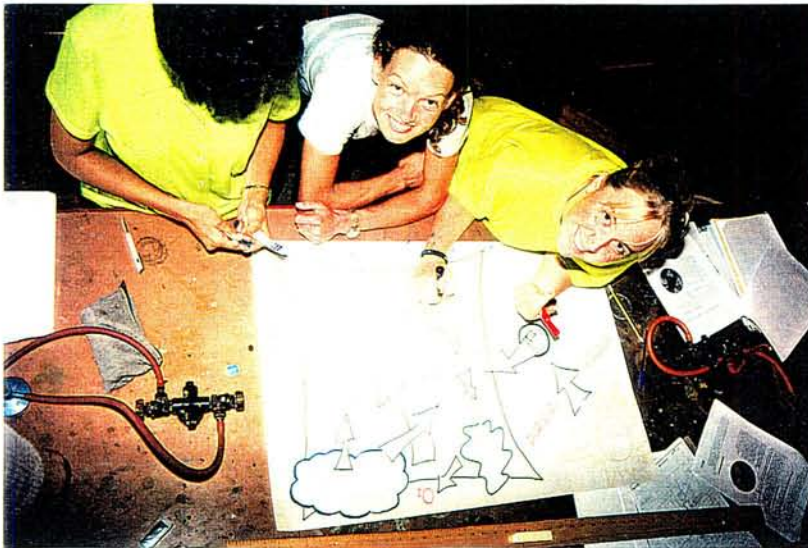
At this point in time I have conducted several workshops with in-service teachers in various settings. My work with teachers and the post-graduate students I teach at the university revealed that many teachers find making meaning of OBE terminology difficult. Using different approaches as I am doing (using co-operative meaning making and relating terms to familiar concepts) does help to some extent. However, what concerns me is why so many new terms have been introduced and why there is such a great emphasis being placed on the new terminology. For many teachers it is proving to be a disempowering rather than empowering experience (Journal entry, 10 March 1998).

Once we had worked through the key concepts and ideas around Curriculum 2005 I introduced the students to the *science and sustainability* activities. As a consequence of limited time (2 lectures per week) I decided to use our contact time to discuss and work through with students only a few of the key activities in the *science and sustainability* module. In their own time they would be expected to read the rest of the text, as well as additional journal articles I would provide. The first activity we discussed was called *how to make the earth a living planet*. The aim of the activity is to get learners to think about which factors seemingly enable planet earth to support life indefinitely (i.e. what makes the earth sustainable). The factors identified by learners would then be depicted on posters by each group and presented to the other groups (see appendix D for details of the activity).

Figure 11: Evidence of creative and co-operative work



PHOTOGRAPH S



PHOTOGRAPH T

In photographs S and T students demonstrate their understanding of concepts they encountered in the methods course. The photographs show evidence of creative and co-operative work on the part of students, which contrasts experiences they were used to in more traditional/conventional lectures.

I asked students to do the activity in three groups of three persons. All the students stated (in their journals and first semester evaluation forms) that they enjoyed the activity and thought that it would be useful for use with school learners. However, the exercise had a variety of disparate meanings to students. For one student the exercise brought to consciousness the uniqueness of the earth.

She wrote:

I never realised how unique the earth really is. Unconsciously I knew how life on earth was supported but never consciously thought about it (student journal entry, 16 March 1998, translated from Afrikaans)

Another student highlighted the significance of group interactions during the activity exercise.

The group work exercise was again a good learning opportunity because the gaps in my knowledge were filled by the work of the other groups (student journal entry, 16 March 1998, translated from Afrikaans)

A third student stated that the exercise helped her again to realise that different people have different views of things:

From this exercise I once again realise that every person has a different opinion and idea about something and that there are different ways of seeing things (student journal entry, 16 March 1998)

I share the story of one student who relates how a pedagogical climate of co-operative learning makes an indelible impression on her and her learning.

Story 2

N grew up in an urban area but enjoys outdoor life and in particular spending time in natural settings.

In the General science method class it is the group work that she initially enjoys most. For her it was a shift from traditional approaches and also provided opportunities for her to think about teaching and what it means to be a good teacher. During practice teaching, however, she discovers that group work sessions with 45 learners in the class can be quite chaotic. Yet she realises the importance of actively involving learners. She finds it difficult to put the theory that she learned at university into practice during her teaching practice session. Although this is so she does think about how she can bring new and creative ideas into the classroom. She wrote in her journal:

Sometimes I wonder how I can include new ideas in the class. How can I be more creative? The teachers are in a rut. Even the more enthusiastic teachers end up just transmitting content knowledge.

When I interviewed her at the end of the method course and asked her what stood out the most for her she said:

The group-work sessions. The way in which the classes were conducted. At the beginning it was difficult because I did not always know what was required of me. But I could contribute all of the time in the class and also in small groups. I did not just sit and listen to someone but could actively contribute to the class discussions. When I reflect on the general science classes I think about the way the classes were conducted more than on the content. More the way of presenting. When I think about the WOW [science and sustainability] activities I always link it to the group-work we did. I cannot separate the work we did in the class from our group-work interactions. I will always remember the WOW activities, but it is the interactions associated with them that made an indelible impression on me.

It was very different in the beginning. All of a sudden you are placed in a class where you must actively contribute to the class discussions for the first time. It was initially strange but nice and I enjoyed it. You must remember in my B.Sc. studies I was used to the lecturer standing in front of the classroom for 40 minutes and students just listen. In the beginning you are so scared to share because you don't know whether it is right or wrong. Nothing is right or wrong anyway. I first thought that I should say what you wanted me to say Lesley but after a while I was able to just say how I felt. I learned that others opinions also have value and that they should be respected. The most important thing I learned was that you should consider opinions of others. Others often look at things from an entirely different angle/point of view. Also, that one must accommodate and respect others opinions and that you can enhance and change your ideas and thoughts in the light of those of others (interview, November 1998).

Concerning what meaning the concept sustainability had for her, she writes:

I think that it is a very good unifying theme. It is the first theme that I have come across with which you can integrate everything. Every aspect of biology relates to the theme. Everything in the Grade 8 and 9 general science syllabus can be integrated into the theme. For me it is like an umbrella over all the loose concepts. It is good because all the different concepts in science can be linked to sustainability as an over-arching concept instead of dealing with many different concepts in isolation without knowing where they fit in.

Just learning the concept has been meaningful. When I walk outside, when I do things I link it to the concept. The concept has given me a broader outlook on life. When we did the WOW [science and sustainability] activities and the learning programmes I realised more and more that it is a concept that is part of our lives but we just don't see it. For me it is not just an idea but something that has become flesh. When I see living things I view them in terms of sustainability. It is not just an idea anymore but something that has become part of my life. It has made me understand the role of nature in sustaining life. Before I used to view things in compartments. To be part of nature meant visiting a nature reserve or going on a fieldtrip. I now realise that it does not matter what I do or where I

go, I am part of nature. For example, one day as I was walking I saw an earthworm and immediately started thinking about how it relates to sustainability. The concept has become something special for me and has in fact come to life. I did not think this in the middle of the year though, it was only when we did the learning programme that the whole thing came together. I know we moaned a lot about doing the learning programme. But in all my years of study at University nothing came together so wonderful as the learning programme we did. It tied together all the concepts we covered during the year.

The next activity that I introduced to the students was called, *biodiversity - the spice of life*. The aim of the activity is to explore reasons why biodiversity is important as well as personal values and beliefs individuals hold regarding biodiversity (for details of the activity see appendix D). Of the seven reasons given for importance of biodiversity students chose the following:

- It is important to conserve biodiversity for medical and economic reasons. Plants and animals provide us with additional foods, medicines and other products that can save lives and benefit society (one student).
- It is important to preserve biodiversity because no generation has the right to destroy the environment and resources on which future generations depend (two students).
- It is important to conserve biodiversity because it renders certain important ecological functions/services such as production of oxygen, recycling of nutrients and water (four students).
- It is important to protect biodiversity because all species have a right to exist. They are alive, they to have dignity, and like humans, have certain rights (one student).
- Our lives would not be as rich if we loose plants and animals around us, and the habitats in which they live. The rich diversity enriches recreational activities such as camping, hiking and fishing (one student).

Not only were different reasons chosen for why biodiversity is important, in cases where different individuals chose the same reason they were not necessarily motivated by the same values. Reasons for protecting biodiversity (as reported in students' journals) were informed by science, religion, human rights and needs, inter-species equity and a love of nature and outdoor life. In our discussion of the activity they agreed that all seven of the reasons provided for why we should protect biodiversity are important but that individuals choose specific reasons

based on the personal values they hold. The discussion provided an opportunity to learn what different people value, to respect what others value and further, as an opportunity to evaluate personal values in the light of those held by others. Also, importantly, students reported that they learned that learning science is not free from personal values and that people might be motivated to support a common cause for different reasons. In their feedback on the activity most students agreed that the seven reasons given for protecting biodiversity were 'too long' which 'made it difficult to remember all of them'. They suggested that key words be highlighted or that the reasons be stated more concisely. Their suggestion of shortening the wording was taken up and in future workshops with teachers and students shortened revised versions of the posters were used.

The third activity I introduced to students was the *HIPPO dilemma*. HIPPO is an acronym for the five threats to biodiversity: **h**abitat loss, **i**ntroduced species, **p**ollution, **p**opulation growth and **o**verconsumption. The activity is a co-operative learning exercise using the jigsaw method (see details of the activity see appendix D). The activity was done during the last session of the first quarter after we had discussed the activity, *biodiversity the spice of life*. Our time was limited and we therefore did not discuss the activity in any depth or detail. Students were, however, given the opportunity to work through the activity in two groups with myself joining one group. The activity seemed not to have much impact on the students. Only three of the students offered any reflections on the activity in their journals. One student enjoyed the activity:

The HIPPO activity was a wonderful and good activity

For another student the activity did not make much sense at the time. She wrote in her journal:

Personally I cannot see what the point of the activity was. It was time consuming and because it cannot be used as is with learners in school classrooms we should rather have discussed how the activity could be adapted for use with learners (student journal, 30 March 1998, translated from Afrikaans).

My aim was to get students to work through the activities as a way of introducing them to the concept of sustainability as well as to show how biodiversity relates to sustainability. I thought that the activities would serve as a focus for discussion about how the activities could be used in different school classrooms. I suspect that I might not have communicated effectively to students that I did not intend the activities from the core module to be prescriptive but rather to initiate debate around the module's uses in classrooms and for introducing new ideas to teachers.

As a co-operative learning exercise the HIPPO dilemma activity required each of us to read and share what we had read with other group members. One student said that the activity was useful in that she was learning to speak more in the class. Referring to the activity she writes:

The activity is effective. One is inclined to remember things when you listen rather than when you read. Time is saved because each person has only one threat to biodiversity to read up on. During the activity I drifted a little from what was required of us, something I tend to do. At least I am learning to speak more (student journal, 30 March 1998, translated from Afrikaans)

At this point I share a story of one individual in the class to provide greater insight into her experiences. She is white and Afrikaans speaking.

Story 3

The concept of sustainability had been familiar to M. She first heard the term during her undergraduate studies when visiting sites where sustainable farming was practiced. Encountering the concept from the perspective of a science teacher (EF) was, however, new to her. Although our interactions around science and sustainability contributed to her professional development her initial area of growth was personal. She relates her personal growth to her first encounter with 'black teachers' whom she learns to respect and view as role models. She writes in her journal:

I grew up in a rural area where non-whites were always protesting. The media often covered stories of how people were necklaced and murdered. Although a very dear black woman Thombi reared me, I saw her differently to others. When I think back I was scared, I was scared that black people (I dreamt it as well)

would attack our house at night and kill us. I must make it clear that I was not reared to be a conservative AWB¹¹ supporter. In contrast I never heard my parents say anything discriminatory of non-white people. Yet there was no black or coloured people with me at school, not on the school playground or park, not in the church and not even in shops or on beaches. From a child's point of view I will say it is indeed strange. To shorten a long story. It was at university that I first really made contact with coloured and black people. Although this was a positive experience, it was superficial because conversations were superficial. Students are often superficial - I think it is our escape because the university as institution is so SERIOUS, FORMAL and RIGID. However, what I want to come to is that you Lesley and Chris opened my eyes. I don't know how to say it better, but at this stage it has been of greater value than what I have been academically enriched. To have respect and admiration for your knowledge and skills. By the way, also the best human relation skills of any lecturer ever, are for me something great and wonderful. That's how I want to be - open-minded and critical (translated from Afrikaans).

Her critical thinking processes and reflections on our discussions and interactions enable her to engage with course literature and her own life with respect to sustainability critically. She concludes from an article on the Gaia hypothesis I gave to students:

In my opinion it is a nice story that can motivate one to care for the earth and its atmosphere, but provide no practical solutions or real examples that the ordinary person can identify with.

After reading the Eco-logic article she wrote:

This article in my opinion is outstanding. Besides the fact that its logic appealed to me, it had a personal impact. I looked at my own life and how I am living 'unsustainably'. The first aspect that had an impact on me was the efficiency part. I started switching off lights, kept dishwater for washing cups later and so on. However, I still need to consider recycling and renewable resource use, e.g., what do you buy, a plastic container or one made with recyclable paper? Concerning renewable resource use we probably would need to look at using solar energy

We did the HIPPO activity towards the end of the first university term. Following a short university vacation students visited schools for two weeks to undertake their first experience of practice teaching. Two key themes emerged from their reports of their teaching practice. First, they reported that they had struggled to relate the 'theory' (ideas about teaching) they learned in the HDE programme at

¹¹ AWB is the acronym for Afrikaner Weerstandsbeweging (Resistance Movement), which is a right-wing Afrikaner movement in South Africa.

university with the 'reality' of teaching in schools. The 'theory', in their view, seemed in many ways to be irrelevant to their experiences of schools and classrooms. Secondly - and in some ways contradictory - they also were critical of what they observed many teachers doing in classrooms. In their view, teachers were to a large extent still using textbook based, 'traditional' methods of teaching. Before they began their teaching practice session I had suggested to students that they might attempt to try out some of the science and sustainability activities with school learners. None of the students had done so for reasons including that the teaching practice period was 'too short' and that they 'had to teach lessons based on prescribed syllabi'.

The class discussion following their teaching practice provided me with many insights. For example, my journal notes include the following reflection:

Today was my first meeting with students after they returned from their teaching practice session. They had enjoyed the teaching practice so much that they were reluctant to return to university. Students shared that there was a huge gap between the theory they learned at university and the reality of teaching practice in schools. Some shared that teaching involved hard work and that it was tiring. I asked whether they tried any of the activities in the science and sustainability core booklet. They had not. I asked why they were unable to do? They said that there was no time and that they had been allocated work to do by teachers. I gathered from students that generally teachers were still following rigidly state syllabi despite the fact that these syllabi merely serve to guide teachers' work. Students said that it was difficult to do the science and sustainability activities because it was difficult to establish where they would fit into the existing interim syllabi for general science. I realised that formal school syllabi may make it difficult to implement new ideas in science classrooms. Moreover, that it would be particularly difficult if the perception of teachers and student teachers are that syllabi need to be followed rigidly and that they cannot implement their own designed programmes. It is understandable that it was difficult for students to trial *science and sustainability* activities when they were required to follow rigid programmes given to them by schools. Perhaps the teachers I am working with in Grassy Park may be able to do more in changing their classroom practices. I think it may be a better idea if I gave students a formal assignment to trial some of the activities during their second semester teaching practice session. I asked students what the general feeling of school teachers were regarding OBE.

They said negative. One student, who taught at a working class former model C school said that teacher-cut backs were impacting negatively on what the government hopes to achieve with OBE. It appears from our discussion today that the two weeks that students spent in schools influenced their thinking about teaching more profoundly than the interactions we had over a period of two months. Current practices in schools were more powerful in influencing students' views (journal entry on 28 April 1998).

In the last lecture period of the first semester I used some of the photographs I had taken of our classroom activities to stimulate reflection on what we had experienced and achieved up to that point. I audio taped this session, which initially seemed to make some students reticent but this soon passed and the classroom climate became warm, open and even jovial. The first photographs I showed were of students co-operatively constructing concept maps around key concepts related to Curriculum 2005. Their initial comments concerned how 'stunning' they all looked in the photographs.

More seriously, most students felt that the photographs helped them to remember what had occurred in our sessions, although one student felt that she had remembered things anyway. All students agreed that the concept maps had helped them to better understand the key concepts of Curriculum 2005 and that the group work activity was more meaningful than my lecture. Many of them emphasised that the group work had contributed significantly to their understanding of Curriculum 2005 because it required them to 'figure out things' for themselves and to remember what they had learned. Nevertheless, one student admitted that although the activity enhanced her understanding she remained confused. Reading through extracts of the curriculum documents on her own had helped her more.

Figure 12: Focus group discussion with students



PHOTOGRAPH U

Photograph U represents a reflexive moment in the course. Photographs are being used for reflecting on what transpired during the progress of the course.

Next we looked at the photos of students making posters on, *what makes the earth a living planet*. For some the idea of looking at the earth in terms of its ability to sustain life was new. They had never consciously thought about the earth in this way. Furthermore, although they had learned the concepts or ‘facts’ in their undergraduate studies they were not aware of the relationships between the concepts and how they related to sustainability. One student believed that she had learned about sustainability in her third year botany course and two others felt that it was ‘general knowledge’. However, one of the latter two students said that it was good to see how others viewed the same concepts and ideas differently. After further discussion students agreed that although the content knowledge was not entirely new to (all of) them they all had learned a new method of teaching this content that would be useful for school learners.

The next set of photos we looked at were those of the activity, *biodiversity the spice of life*. Student reflections included that it gave them an opportunity to see others’ views and to appreciate that nobody’s view was ‘wrong’, but rather that

people from different backgrounds, environments and prior knowledge's might not view things in the same way. Other reflections were that the exercise might make people aware that they do indeed care about the planet, that is, it served as a consciousness raising exercise. The photos of the HIPPO dilemma activity, enabled students to consolidate information to recall what they had learned.

After we had looked at all the photos I asked students about the two articles I had given them to read on sustainability, one on the *Gaia hypothesis* and the other entitled *Eco-logic*, dealing with how biological principles of sustainability may be used to inform the sustainability of human communities. They said that the Gaia article was 'very theoretical' and 'offered no practical solutions' whereas the *Eco-logic* article was 'more practical' and did 'suggest solutions'. I also asked students if they thought it was at all possible for humans to live sustainably. They agreed that it would be impossible to 'go back' into natural cycles and to 'live off the land' because 'people have become too dependent on technology'. One student said that we could do without many of the things we have and use but that we have become 'too comfortable' and that 'giving them up would be difficult'.

For their second semester teaching practice session I gave students an assignment that required them to trial at least two of the activities in the *science and sustainability* core module with school learners. Unlike the first teaching practice session, all the students were able to trial some of these activities. Giving the students some extrinsic motivation (that is, a formal assignment) to trial the activities appeared to be an effective strategy. The second teaching practice period also was longer than the first and gave students more opportunities to teach lessons other than those prescribed in syllabi. Most students reported that the activities worked well and could easily be adapted to different grade levels. I asked students to photograph what occurred in their classes whilst doing the *science and sustainability* activities. When they returned from their teaching practice students were encouraged to share what they had done during this period. Although their reflections were not particularly critical (either during this session or in their journal entries), they showed growth in confidence, increased understanding of the concept of sustainability and competence in learner-centred pedagogies. A

colleague who observed the students teaching during their practicum said that in all his years of observing student teachers he had never observed a group of students who were so confident and comfortable with doing group work in classrooms (Schreuder 1998, personal communication). One student did a science and sustainability activity for one of her formal evaluations. She received first class grade for the lesson and the supervising teacher complimented her for the innovative ideas she introduced in the lesson (see appendix G). The assignments submitted by students also provided evidence that school learners had enhanced their understandings of many of the concepts related to biodiversity and sustainability (see appendix H for examples).

Figure 13: School learners during a practice teaching session



PHOTOGRAPH V

Photographs V shows school learners doing some of the science and sustainability core module activities during a teaching practice session. It is noteworthy that black and white learners tend to group together in the group work sessions.

In the last part of the course students used what they had learned about Curriculum 2005 and science and sustainability to develop OBE learning programmes using *environment* as a phase organiser (see appendix I for an

example of a learning programme). I gave students the option of working on their learning programmes individually or in pairs. The class developed five different learning programmes that incorporated the following themes: *sustainability, adaptations of organisms for sustainable living, invader/alien species, fynbos and natural resources*. Students used their initiative and chose their own topics rather than following topics directly from the core manual. Students gave weekly progress reports to each other on the development of their learning programmes. This provided opportunities for students to give each other critical comments on the work in progress. As a teacher educator it seemed clear to me that all of the students had developed and demonstrated increasing competence in designing and delivering learning programmes that synthesised much of what we had done during the course of the year. As one student states:

When you said that we must design a learning programme using everything we did during the year, things started becoming clear. When we did the learning programme everything opened up for me. It was as if the heavens opened for me. It was amazing. I shared my experience with everyone at home. One just understands everything better. You have a better understanding of what you did during the year. You see how things fit together and how they complement each other. (Interview conducted in December 1998 - translated from Afrikaans)

I share another individual story within the larger case. It provides additional insights and highlights what an individual student experienced through interactions she had in the general science method course in 1998.

Story 4

The focus of the course on sustainability was initially a problem for D. Her experiences with the learning of ecology at school had been negative. In her undergraduate studies she majored in physiology to avoid ecology-related topics. In the general science method course environmental concerns was the key focus. This presented a challenge for her. She shared in the class on a few occasions that she does not have an interest in ecology and environmental concerns. My response to her was that we do not have to share the same interests and that she should share her views openly and that it was okay for us to hold different views. The freedom she had to share her views and opinions openly with us (even though they were different) had a significant impact on her and was for her what she benefited from most in the first term. She wrote in her quarterly evaluation form:

The classes gave me the opportunity and courage to share for the first time my opinions and feelings about certain concepts. I also had the freedom, or let me rather say, that the class situation gave me the freedom to say what I felt even if it differed from the rest

Her journal manifests some of the struggles she experienced as she reflected on three articles she read as part of her course notes, which focused on introducing environmental concerns to make biology curricula more relevant. She wrote:

I can't see how this ecological approach that concentrates on the natural environment has a bearing on all aspects of the biology curriculum, from grades 8 to 12. I know that it is important for us to be aware that people are responsible for the destruction of the environment and what we need to do to prevent such destruction. But, somebody who wants to learn to become a medical doctor will not be interested in how we destroy the environment but how the environment destroys people even if it may be a consequence of human action. But I also realise that people are biological beings that have integrated their health, culture and values with the relationship between people and their environment. I also realise that issues and problems arising from such a relationship can serve as key themes in Biology education (student journal entry, 16 March 1998, translated from Afrikaans).

Our class discussions around the central theme of sustainability increasingly make an impact on her. Towards the end of the second term she writes:

Concerning the theme sustainability that we continually discuss in the general science classes, it is now for the first time beginning to make an impact on my life. In the beginning I was very irritated with reading the articles dealing with this theme and could not understand how it was relevant to general science didactics. You would remember that I one day shared with you that I am not interested in ecology related topics and could not understand why we are dealing with them all the time. As you know my interest is in the physiology section of biology and while we were busy with the theme sustainability I was very frustrated. However, I am finally beginning to understand the purpose of this unifying theme in science and am beginning to realise that it is applicable to all aspects of science. In my opinion it gives a new dimension to the teaching of biology (student journal entry, 26 May 1998, translated from Afrikaans).

During her teaching practice the theme of sustainability really makes an impact. Teaching this theme made her think and reflect more deeply and read more widely around sustainability as a unifying theme in biology education. Teaching the lessons based on the theme also was an enjoyable experience. She reflects on the lessons she taught as part of the practice teaching assignment I gave the students:

It was really wonderful to teach the science and sustainability activities. For the first time in my life I see the relevance and importance of this topic (sustainability) in biology education. I now realise for the first time what it concerns and I do not have the same negative connotations I used to have with ecology and population dynamics that was a headache when I was at school. I

also now for the first realise how everything on our planet is related to each other and how important it is, at an early age, to teach learners around this theme.

5.7 CHAPTER SUMMARY

In this chapter I described two case studies related to my professional work with teachers. The first case study involved in-service work that I conducted with teachers in a local community, Grassy Park. In the chapter I described the context of the case and showed how historical and political factors were brought to bear on the case. I described how we negotiated access to the setting, and what transpired during the participatory workshops that a colleague and I conducted with teachers. The case reflects the struggles of historically disadvantaged teachers making meaning of, and implementing new curriculum policies in South Africa post 1994. Case study 2 represents work that I did with pre-service teachers at the University of Stellenbosch. The case study depicts the experiences of student teachers during the progress of a science method course and emphasises the importance of qualitative dimensions (relationships of trust, personal and social need, acceptance and so on) in pedagogical practices. It appears that these qualitative dimensions needed to be satisfied first before student teachers could focus their attention on the course content, or that it needed to be integrated with the course content. In chapter 6 I analyse, interpret and discuss the two case studies with evidence of changing pedagogical practices in mind.

Chapter 6

An interpretation

In this chapter I interpret the two case studies presented in Chapter 5. I use the conceptual tools that I developed in Chapter 3 to frame my analysis. I discuss some emerging themes from the case studies within Pendlebury's (1998) broad framework of '*who* may learn [or teach], *how* and *what* they learn [or teach], *when* and *for how long* and *where*'. I also use Turnbull's (1997) notion of performativity and comment on the social organisation of trust in a 'post-apartheid era'.

6.1 WHAT MAY BE LEARNED (TAUGHT)?

Pendlebury (1998:345) argues that Curriculum 2005 calls for shifts in the pedagogical space of teacher education because it changes what teachers need to know and be able to do. The changing education policy context made me revisit what should be the form and content of the pre-service programme with student teachers. It also influenced the content of the in-service programme I conducted with teachers in Grassy Park. I restructured the General Science method course with pre-service teachers in two ways. Firstly, instead of using the curriculum content prescribed by the interim syllabuses for Grades 8 and 9 General Science as a focus and starting point for our course, I introduced teachers to the principles and features of the NQF, Curriculum 2005 and OBE. In the in-service programme with teachers I focused on the same material. Secondly, I also introduced an alternative approach to Life Science teaching, using sustainability as a unifying theme with both the pre-service and in-service teachers. Using sustainability as a unifying theme was one way of introducing environmental concerns into Life Science curricula rather than more traditional approaches to Life Science teaching which focus on the use of unifying themes such as how the structure of organisms determines their function(s). Furthermore, during the course I created opportunities for critical discussion by teachers and students on some of the aforementioned aspects, as well as for students and teachers to reflect on what they had learned.

As we engaged with policy developments at the time it became clear that an important shift teachers were required to make within an OBE system was to design and deliver learning programmes. Previously teachers mainly played the role of curriculum implementers. Learning how to design and deliver learning programmes became central to the work I did with both pre-service and in-service teachers during 1998. Environment/sustainability was used as a phase organiser for the development of OBE learning programmes. The learning programmes served as concrete products of my work with both the in-service and pre-service teachers. Several themes emerged from the case studies with respect to what was taught (learned) in the programmes. I now discuss some of the themes that I constructed from the data.

6.1.1 The OBE language (terminology)

New school curriculum policy in South Africa (post-1994) made discussion on outcomes-based education in teacher education programmes necessary. I therefore incorporated aspects of OBE into the programmes that I facilitated with both pre-service and in-service teachers. I discuss what emerged from the case studies with respect to OBE.

Both the in-service and pre-service teachers experienced difficulty with making sense of terminology related to OBE. This finding supports criticisms that have been levelled against the complex, confusing and contradictory language of the OBE innovation in SA, by among others, Jansen (1998:147). It also corroborates the finding of the review committee on Curriculum 2005 and supports its recommendation that the terminology should be simplified (Chisholm, 2000). It was my work with the in-service teachers that made me reflect on why such complex terminology had been introduced by national education policy makers. My concern was especially with the demand placed on teachers who had been systematically deskilled and stripped of their professionalism by a past education system (Pillay & Naidoo cited in Reddy 1994:2) to make shifts required by a sophisticated OBE system.

In Chapter 3 I elaborated on the ‘poor quality’ of the initial teacher education received by historically disadvantaged teachers and the strong influence of Christian National Education and its delinquent cousin Fundamental Pedagogics on their initial teacher education. This was particularly the case for teachers who studied at colleges of education – most of the Grassy Park teachers had studied at colleges of education. Furthermore, in the South African system where the Research Development Dissemination Adoption (RDDA) model of curriculum development has been dominant, teachers functioned mainly as ‘technicians’, that is, as implementers of state-designed syllabi. This of course does not imply that teachers could (or did) not resist and challenge the dominant system. However, it appears that few teachers adopted alternative discourses during the apartheid era, or they found that it was difficult to do so given the tight controls placed on schools by apartheid education departments (see Chapter 1). What I wish to point out here is that the expectation placed on historically disadvantaged teachers, who perform their work in poorly resourced contexts, appeared to me to be not only unrealistic but grossly unfair. Rather than empowering the already ‘disempowered’, the complex terminology appears to be disempowering teachers further. Moreover, it appears that proposals on transformation and redress espoused in the plethora of education policy documents developed since 1994 remain at the level of rhetoric and that they might not be translated into processes that would bring about substantive change(s) in most school or teacher education classrooms.

I argue that the introduction of a sophisticated OBE system and its related complex terminology by the new South African government might be understood in terms of the symbolism of politics. Because apartheid education reproduced inequities in South Africa, it became necessary for education to be seen to be contributing to transformation and redress in post-apartheid South Africa. The new government therefore took steps to transform education in order to gain legitimacy both inside and outside of the country. However, bringing about immediate and substantive changes such as redressing inequalities in education would have been difficult given, among others things, the macro-economic

constraints and the politics of reconciliation in the 'Mandela era'. Because of public expectations that the education system would transform in order to gain legitimacy, we witnessed a plethora of policy proposals from the government. However, these policies appear to be about symbolic change rather than about 'real' change, since they focus on aspects such as changing curriculum terminology rather than the conditions inside the majority of South African classrooms (see Chisholm & Motala, 1995; Jansen, 1999).

Viewed in this context it is understandable that the education terminology which prevailed when the new government came into power, and which was perceived to be associated with apartheid education (and therefore illegitimate), would be changed in a new system to become an important symbolic and legitimising tool. The more elaborate the changes made to terminology/language, the more powerful and legitimate the change would appear. I contend that because the government policy proposals were chiefly concerned with symbolic change, little consideration was given to the needs of teachers generally and to historically disadvantaged teachers more particularly. The difficulties teachers in both the case studies have had with the meaning of OBE terminology should be understood in terms of the possible rationale for its introduction; OBE policy proposals might have been formulated in the way that they have been for reasons other than effective implementation in schools or for meaningful appropriation by teachers (both pre-service and in-service).

I do not elaborate on all the reasons why the OBE terminology has been made so complex. In summary, I briefly mention a few. Re-entering a global economy in 1994 meant that the new South African government had to gain legitimacy internationally and also had to show that it could be economically competitive. A more skills-based OBE system was therefore attractive (as the economy needed these skills), particularly since this system was being used in several first world countries (a sign of 'progress'). The belief of South African education policy makers that the education system needed to rid itself of terminology linked to apartheid education made OBE, with its cognate new and elaborate language, attractive. These reasons might provide some explanation as to why there have

been so many changes in curriculum terminology in recently developed educational policies. It is also important to note that the OBE policy-making process occurred within a technocratic discourse, a discourse which continues to dominate education policy processes and thought – what Giroux (1995:9) terms a ‘culture of positivism that is pervasive’. In short, it appears that one reason why teachers had difficulty with OBE terminology was essentially that it might not have been introduced to help them to make sense of the OBE language, nor to bring about changes in their classroom practices, but rather to confirm the implementation of symbolic change by the new government trying to legitimise itself both within and outside the country. As Jacklin and Kruss (1995:1-2) note, ‘current education policy is concerned with symbolic rather than substantive change, with changing [policy] rather than content, quality and contextual factors’.

6.1.2 Learning programme development

Curriculum 2005 calls for changes in what teachers need to be able to know and do and it therefore in a sense reconstitutes their professional identity (Pendlebury, 1998:345). One of the challenges currently faced by teachers is to shift from being curriculum implementers to developing competence in the design and delivery of learning programmes. In order to be responsive to national education policies, I incorporated into the programmes (for both the in-service and pre-service teachers) a focus on the delivery and design of learning programmes. I reflect on some aspects pertaining to learning programme design and development with both teacher groups.

A key feature that emerged from this research was the potential for developing locally relevant learning programmes through collaboration between university-based researchers and teachers from a local community. Also, the potential for developing learning programmes in a year-long teachers’ diploma course will also be reflected upon. In case study 1 the senior phase teachers developed learning programmes on biodiversity, focusing on threats to biodiversity such as *habitat loss, introduced species, population growth, pollution* and *over-consumption*. The activities developed in the learning programmes were mainly linked to the specific outcomes of the Natural Sciences. The learning programmes that were developed

integrated ideas from the capital materials with the local issues teachers identified in workshop three (see Chapter 5), enabling the learning programmes to be locally relevant.

The learning programmes that teachers designed were broad frameworks, which did not include technical aspects of Curriculum 2005 such as range statements, assessment criteria and performance indicators. Time constraints and the technical nature of these terms did not make meaningful exploration of them possible. Concerning content, the learning programmes to a large extent replicated the activities in the core module on science and sustainability as teachers hardly incorporated original ideas. Also, they followed strictly the pro forma for learning programme design that I had given to them. This occurred even though I told teachers that both the core module and pro forma were merely there to guide the design process. Most of the teachers claimed that they were not able to implement the learning programmes immediately, because they had already planned their programmes for the year and some of the topics had already been covered. One school did, however, implement some of the activities in the learning programme they had designed during the progress of the in-service education programme. This was possible because the school culture encouraged the introduction of innovative ideas, teaching methods and approaches. The principal of the school shared with me the information that teachers at his school regularly attended in-service courses and that as a school community (principal, teachers and parents) they were taking proactive steps to implement outcomes-based education approaches in all school grades (Vlotman, 1998, personal communication). However, because of the localised nature of the programmes, it might not be possible for the learning programmes to be used in other contexts.

In case study 2 the student teachers developed more detailed learning programmes than the in-service teachers. They decided on their own topics within the broad theme, *science and sustainability* and used the pro forma for the design of learning programmes (which I had given to them) flexibly by using it as a guide rather than as something prescriptive. The learning programme design process was also a learning experience for the students. Two students wrote in their journals

that the learning programmes they had designed tied together all the concepts and processes they encountered during the progress of the General Science method course. The student who had been negatively disposed to ecology and related topics said that it was the process involved in designing the learning programmes that had helped her to become more positively disposed to environmental education, ecology and related concerns (see case story 4 in Chapter 5). I now reflect on my work with both teacher groups with respect to the design and delivery of learning programmes.

Including the design of learning programmes in both the teacher in-service and pre-service education programmes was necessary for two reasons. Firstly, competence in design and delivery of learning programmes had been mandated by both curriculum and teacher education policies of the South African Department of National Education. Secondly, as university-based researchers we had to meet the objectives of the research project of the HSRC/EECI of which case 1 formed a part. It is my view that the possibilities and constraints for developing OBE science education (with a focus on environment) learning programmes need to be understood in terms of both historical factors and current realities. In their professional lives teachers in the Grassy Park area had become used to being – and it would be fair to say that some might have accepted their primary role as being – implementers of state-developed curriculum syllabi. The latter was evident in that there was an expectation from teachers that we, as university-based researchers, would demonstrate to them how to develop learning programmes so that they could use them as is, or develop their own in ‘copy style’ fashion. This state of affairs has become entrenched in many schools not only because of the strict controls enforced by education departments on schools, but also because of the legacies of apartheid education, underpinned by Christian National Education and Fundamental Pedagogics.

Moreover, the poor-quality science programmes (content not beyond Grade 12) presented in colleges of education meant that teachers did not have the background knowledge to grasp many of the science concepts they needed to understand so that they could include them in their science learning programmes.

Some of the teachers, for example, had no post-secondary qualifications in the sciences, but were teaching science in schools. This situation resulted in my having to spend a great deal of time teaching the concepts to them. Conditions in schools, such as having to teach over 50 learners in one classroom, sport coaching commitments and more importantly the teacher retrenchments, influenced the will and capacity of local teachers to develop learning programmes. The contextual and historical factors which had an impact on teacher capacity in this instance illuminate why 'one of the toughest nuts to crack in educational change is policy itself' (Darling-Hammond, 1998:642). As Fullan (1991:xiii) asserts, 'change does not always result from putting into practice the latest policy but involves the changing of the cultures of classrooms, schools, universities'.

Studies have shown that change ultimately is a problem of the smallest unit – that macro-level strategies are limited in changing micro-level realities (see Darling-Hammond, 1998; McLaughlin, 1998). There are several reasons why policies developed at a macro-level hold little promise for changing education practices 'on the ground' (a uniquely South African term). Two reasons are particularly instructive and relate to this study. McLaughlin (1998:72) asserts that change depends greatly on local capacity and will. She points out that local capacity and will are not only generally beyond the reach of policy, but that they also change over time. She writes:

(L)ocal events such as teachers' strikes, fiscal retrenchment, desegregation orders, or enrolment decline can negatively affect both capacity and will, engender competing pressures and define constraints upon local action.

My research with the in-service teachers corroborates what McLaughlin asserts. Teacher retrenchments in the Western Cape, South Africa resulted in the in-service teachers being negatively disposed to the Western Cape Education Department, which militated against attempts by my colleague and me as university-based researchers to introduce to teachers OBE and the design of learning programmes. Teachers' strike action in protest of imminent teacher cutbacks impacted negatively on attendance of the in-service workshops we were

conducting. McLaughlin (1998:72) also points out that even though teachers at a particular site may be eager to embrace change, they might opt not to do so, because their institutional setting is not supportive. The rigid curriculum programmes at many of the schools made it difficult for teachers to implement activities we designed, giving credence to McLaughlin's argument. The point here is that 'teachers' motivations and actions are embedded in a larger social and political context that mediates their responses to policy (McLaughlin, 1998:72). A second reason that McLaughlin (1998:72) identifies as to why policy cannot mandate what matters is that local variability is the rule; uniformity the exception. She points out that her research (conducted in the USA) showed that even though schools may have the same common features such as grade structures, syllabi and student placement policies, they also differed in fundamental and consequential ways. This is evident in case study 1 in that two teachers at one of the participating schools implemented some of the activities of the learning programme that they had designed because their school culture was conducive and supportive of innovations. Teachers from the other schools claimed that they could not implement any of the activities. The school (Sid G Rule Primary) that implemented some of the activities also provides evidence that schools and their agents (learners, parents and teachers) can transcend their histories as well as the constraints that present realities might place on them. Sid G Rule Primary made several newspaper headlines for their efforts to make the school a community school (open for all members of the community to use as a centre of learning) and to be proactive in implementing curriculum innovations.

Figure 14: Section of newspaper article on Sid G Rule Primary

Sid G Rule, hailed as a miracle school, has shown the way for other schools in the Western Cape, reports SERGIO BEN

HIS eyes dart to and fro, his hands are fidgety, and he is rather nervous during our interview. But Greg Vlotman, principal of Sid G Rule primary school in Grassy Park, is a modest man.

"I want to take myself out of the picture," he said. "This is not about me, the story is about the school's parents, teachers and pupils."

Nevertheless, in two years Vlotman has managed to inspire the community to take a collective approach to education in Grassy Park.

In November 1996 a fire destroyed most of the school's back wing. This was a turning point for Sid G Rule and a collective approach to education and community welfare has been taken ever since.

The school follows the concept of empowering and uplifting the community.

*We meet the
needs of
children
from diverse
backgrounds*

**Doors of
learning
will never
close**

In the case of the student teachers (case study 2), they were not affected by the contextual realities that the in-service teachers faced. Also because all of the students had degrees in science, they appeared to understand and grasp the concepts in the science and sustainability module more easily than the in-service teachers did. Students also had access to resources such as a well-equipped library and were perhaps also motivated to learn because my work with them formed part of their formal studies. However, as pointed out, students struggled initially to make sense of some of the OBE terminology required for learning programme development. Notwithstanding this, over the duration of the course students were able to make sense of many aspects of Curriculum 2005 and they demonstrated competence in developing learning programmes. However, it needs to be noted

that this was possible due to sustained interaction between the students themselves, between students and myself and through critical interaction with policy documents over a period of one year.

Another important point is that the principles of Curriculum 2005 were orchestrated in the classroom by me and that as teacher (lecturer) I played a significant role in bringing students into a working relationship with aspects of Curriculum 2005 and learning programme design and delivery. In Shalem's (1999:68) terms, I conducted 'epistemological labour'¹². Pertinent here is the pedagogical authority of the teacher, which I argue cannot be ignored in pedagogical processes. In this instance (case study 2), I decided when a pedagogical episode would begin and end, and it was epistemological labour on my part that enabled students to tie together important concepts in the latter part of the course (whilst they were engaged in designing learning programmes). In other words, educative means in the year-long General Science method course I had facilitated could not be accomplished without the pedagogical authority of the lecturer. It was epistemological labour on my part that enabled students to have an "ah-ha" experience when everything came together towards the end of the course (see 5.6).

6.1.3 Enabling environmental education through science education programmes

It would be reasonable to claim that since the 1970s it has been widely accepted that environmental education should be cross-curricular and interdisciplinary in its approach (see UNESCO-UNEP, 1978). As I pointed out in Chapter 2, traditionally approaches to environmental education had a narrow focus, partly because they were located within science disciplines such as ecology. In South Africa this narrow approach (ecology and environmental studies courses) continues to be dominant in public schools. This dominant approach to

¹² Shalem (1999:66-68) points out that 'the teacher's epistemological labour in constructing a pedagogical path for the learner can be seen as the condition of possibility for real learning to occur...if the authority of the teacher is presented as a mere form of paradoxical enactment then [pedagogy] is no more than an exercise in public relations, a false and misleading conception of pedagogy'.

environmental education could be understood as a legacy of apartheid education (with its ideology of Christian National Education and its 'science' of Fundamental Pedagogics) and a culture of positivism (see Chapter 3). Christian National Education and Fundamental Pedagogics provided no space for the development of a *language of critique*, nor for a *language of possibility* in environmental education. The Tbilisi principles of 1977 (UNESCO-UNEP, 1978), for example, were never adopted in South African public schools. At the level of policy selected Tbilisi principles were included in South Africa's first and only White Paper on Environmental Education that was produced in 1989. However, as I pointed out in Chapter 2 (see 2.7.2), the Tbilisi principles of a more critical nature were omitted from the 1989 White Paper. Also, the dominant positivist paradigm underpinning science education programmes militated against the inclusion of what Robottom (1983:27) refers to as the 'qualitative dimensions' of environmental education such as social need, emotions, beliefs, relations and political factors. Apartheid education and positivistic thinking produced a pedagogical space that was insulated, that is, hidden from public critique and influence. This impeded the enabling of transformative environmental education processes in educational institutions, particularly in schools.

Since the late 1980s and more particularly the 1990s we witnessed various critiques of narrow approaches to environmental education (see Clacherty, 1994; Janse van Renburg, 1995; Lotz, 1996). This included critiques of apartheid education (see Schreuder, 1995; Lotz, 1996) and the role that apartheid played in producing environmental problems and risks that are unique to South Africa (Ramphela, 1991; O'Donoghue, 1993). International developments in environmental education such as the emergence of socially critical discourses (see Fien, 1993; Gough, 1997), as well as broader critiques of apartheid education in South Africa (see for example, Kallaway, 1984; Unterhalter, 1991) provided space for a *language of critique* in environmental education to develop in South Africa. Articles published in the *Southern African Journal of Environmental Education* during the 1990s provide evidence that a *language of critique* has become firmly established in the environmental education community (particularly within academe). Also, since the establishment of the EEPI, various frameworks have

been developed for introducing environmental education into school programmes (see Janse van Rensburg and Taylor, 1994). Action research provided an alternative approach to curriculum development in environmental education as reflected in several research projects in environmental education by, among others, O'Donoghue (1990), Reddy (1994), Lotz (1996), Wagiet (1996) and Louw (1996). Action research framed within socially critical thinking provided a *language of possibility* for including environmental education in formal education. Despite these developments, and although a fair amount of research has been conducted on the possibilities for introducing environmental education into formal education (especially schools), this goal has not been achieved in South Africa. I argue that in addition to a *language of critique* and a *language of possibility*, a *language of probability* is needed if environmental education is to be effectively implemented in educational institutions. Deever (1996) states that appropriating a language of probability involves accepting that certain organisational patterns and practices are not likely to change soon and to work with/through/around these realities. With this in mind, I reflect on insights the case studies provide for a language of probability in enabling environmental education processes within science education programmes.

There has been much critique levelled at the new South African curriculum framework, Curriculum 2005, by among others Le Grange & Reddy (1997), Soudien and Baxen (1997, 1998) and Jansen (1998, 1999). However, the Curriculum 2005 framework may offer avenues for a tactical intervention of environmental education into science education programmes. In case study 1, for example, the learner-centred aspect as well as the phase organiser *environment* in the Curriculum 2005 framework provided space for the inclusion of local environmental concerns in the in-service education programme with science teachers in the Grassy Park community. Malcolm (1998:11) argues that learner-centred education 'calls for a curriculum that links to [learners] as individuals and members of their local community – to their interests, experiences, cultures, learning styles, abilities, dreams'. Curriculum 2005, through its learner-centred approach, could thus open up possibilities for including local environmental concerns into all school programmes. The phase organiser environment enabled us

to focus all the science learning programmes designed by both pre-service and in-service teachers on an environmental issue, in this instance sustainability. By doing so, science and environmental education processes became conflated, bridging the divide between science education and environmental education. Although phase organisers have since been removed from the Curriculum 2005 framework, the point here is that spaces or avenues for a tactical intervention of environmental concerns into education programmes within the new framework could and should be explored, whether it be through a phase organiser or something else.

Teachers from the majority of the schools did not implement the learning programmes they developed. However, in the case of Sid G Rule Primary School teachers, who implemented the activities of their learning programme, learners' horizons (concerning environment and cognate issues) were broadened and their critical thinking abilities enhanced. The process of engagement between the teachers themselves and between teachers and myself in the two programmes (pre-service and in-service) provided opportunities for the transformation of teachers' consciousness with respect to science and environmental education (as described in Chapter 5). The enabling possibilities for including environmental concerns in science programmes provided by post-apartheid education policies, and the instances of such inclusion represented in the case studies of micro-level pedagogical practices, provide some evidence of changes to the constitution of pedagogical space in South Africa.

In Chapter 2 I briefly discussed how a postmodern perspective on science could serve as a philosophical base for integrating concepts central to environmental education into science (education) programmes. Such a perspective provided a philosophical justification for the work I did with the pre-service and in-service teachers. However, this justification was important to me as an academic researcher rather than for the teachers I worked with. Understanding policies in terms of what they meant for changing the teachers' day-to-day activities seemed to be more important to them. Because of time constraints, the objectives of the programmes and the day-to-day challenges teachers face (such as large classes),

critical discussions with them on the relationship(s) between knowledge and values and other debates of a philosophical nature were not possible.

6.1.4 A gap between PRESET and INSET

Evidence from case study 2 points to the fact that there is a wide gap between what is done in pre-service courses and what actually happens inside schools. Students felt that what they had learned in the method course was not in synch with pedagogical practices inside schools. They reported that during their teaching practice sessions they had experienced tensions between what they learned in the method course and what they were required to teach in schools. They said that generally most in-service science teachers were rigidly following what state syllabi prescribed. This was so despite the fact that it has been pointed out by provincial education departments and stated in the syllabus documents that syllabi should serve only to guide teachers' work and that they should not be prescriptive. This situation made it very difficult for students to trial activities we produced in the method course in schools during their teaching practice sessions. The rigidity of school curriculum plans and the uncritical adoption of state-designed syllabi by teachers in case study 1 also prevented some of them from implementing activities of their learning programmes in their classrooms.

Both cases pointed to the fact that pedagogical practices in schools might not have changed significantly in post-apartheid South Africa, despite my belief that there is greater space for innovation and change within current curriculum policies. For example, departmental control of the end of the year examinations has slackened considerably and continuous assessment in school Grades 1 to 11 comprises up to 50% of the overall assessment of learners. Also, school-governing bodies can determine the curricula of schools with the proviso that they are developed within the broad national frameworks (see 5.2.1). What appears to be evident in schools is that the RDDA method of curriculum development and apartheid pedagogical practices remain entrenched in many of them due to a culture of positivism and the legacies of Christian National Education and Fundamental Pedagogics. Also, the way in which the pre-service students viewed the gap between what they were learning in their HDE programme and what they experienced in schools is

noteworthy. After their visits to schools students reported that they felt the work that they did in the method course, and the HDE programme as a whole, was not relevant to what they were expected to do in schools and what they were going to teach in the following year. What is interesting here is that they seemed to be critical of what was being taught/learned in the pre-service science method course and seemed to accept uncritically the status quo in schools. The critical debates raised in the method course and the alternative approaches to science teaching they encountered in the programme were almost rendered useless by students after spending three weeks in public schools. This finding is consistent with what Zeichner (1980) reported, after assessing several longitudinal and cross-sectional studies of education students at various points in their professional careers. In relation to this Zeichner and Tabachnick (1981:7) write:

It now has become commonly accepted within the teacher education community that students become increasingly more progressive or liberal in their attitudes towards education during their stay at the university and then shift to opposing and more traditional views as they move into student teaching and in-service experience.

It might be a truism that pre-service programmes hold little promise for effecting change in schools unless meaningful ways are explored in which PRESET and INSET can inform each other. It appeared easier for me to introduce changes into the pre-service course than for teachers to effect changed practices in schools. There are several reasons for this. As a university lecturer I have greater autonomy than the average schoolteacher and student teacher in deciding what is to be included in the programmes. In fact, case study 2 showed that student teachers have very little control over their teaching experience as they are compelled to conform to the teaching approaches and philosophies of the co-operating teachers at the schools where they are placed. Despite this, however, during their teaching practice sessions, they employed group work and co-operative learning strategies (see Chapter 5), indicating a shift from traditional transmission modes of teaching. In their criticisms of the pre-service HDE course they were perhaps not conscious of how the hidden curriculum of the programme had influenced their own teaching. In this regard I had employed group and co-operative strategies in the

method course and students tended to use these strategies in their own teaching. As Zeichner and Gore (quoted in Gore, 1991:253) assert, 'the impact of pre-service preparation lies in...images of teacher, learner, knowledge, and curriculum, which are subtly communicated to prospective teachers through the covert processes of the hidden curriculum of teacher education'. This might indicate that the 'effects of university teacher education' are not 'washed out by school experience' (Zeichner and Tabachnick, 1981:7) and that the debate around relations between PRESET and INSET is a great deal more complex than Zeichner & Tabachnick (1981) might have suggested.

What has been evident from the case studies is that there remains a wide gap between what is taught/learned in pre-service courses at universities and what happens inside schools. There appears to be a need for closer relationships between university faculties of education and schools so that what happens in these institutions can inform each other, and so that sustainable partnerships between schools and universities could be established in an attempt to transform school teaching and teacher education programmes at universities. This might be possible through strengthening the triad between university supervisor, student teacher and co-operating teacher and to reflect critically on their work together through collaborative action research. Since the schools (reported in case study 1) were not the same schools used by the University of Stellenbosch for teaching practice, the two processes could not meaningfully inform each other. Although I did indicate (see Chapter 5) that we could, for example, revise one of the activities for use with the in-service teachers in the light of what pre-service teachers reported.

6.2 HOW LEARNING (TEACHING) TOOK PLACE?

The emphasis placed on outcomes (as opposed to content) in Curriculum 2005 implies a shift from transmission modes of teaching to processes of facilitating and mediating learning. It often is said that teachers teach the way they have been taught. In other words, if teachers themselves were taught through transmission modes of teaching, they are likely to perpetuate such practices. If this is true it might be reasonable to argue that pre-service teachers who learn in environments

that encourage democratic pedagogical practices would in all likelihood be less authoritarian and more democratic in their approaches to teaching. With this view in mind, I organised my classroom sessions with pre-service students so that they were interactive - enabled through co-operative learning exercises. Among other approaches I used concept maps, the jigsaw method and focus group discussions. What I wish to explore here are two themes constructed from the data that might provide greater insight as to how learning took place in the two case studies.

6.2.1 Educator power

My aim in both the pre-service and in-service programmes was to remove hierarchical power relations from my interactions with teachers. I naively also thought at the time that it was possible to remove power from pedagogical interactions. I intended my interactions with teachers to be informal and open, and to engender critical thought and debate. My expectation was that teachers would participate actively in programme activities and that I would act as facilitator. Early on in my interactions with the in-service teachers I observed that they were reticent to communicate and that they did not participate in discussions as I had expected them to do. As my colleague and I reflected on what we observed, we decided that we should play a more dominant role (than we expected to) and at times transmit information in traditional lecture mode to teachers. We sensed that teachers expected us to do so as they perceived us (university-based researchers) to be the experts who should teach (lecture) to them. We combined the lecturer presentations with group activities so as to give teachers opportunities to participate in the discussions. Because I actively took up critical discourses, through my involvement in participatory action research processes, my reading of literature on critical theory and my involvement in the struggle against apartheid, I tended to perceive power¹³ as negative (or evil). I also viewed it as something that needed to be removed in social interactions such as pedagogical practices. My view at the time was consistent with 'some feminist, critical, and other radical pedagogues who have argued that their classrooms should or can do away with

¹³ Cranton (1994:129) defines power as 'a person's [institution's, ideology's] ability to influence another person's behavior and attitudes'. I argue that the word power is an ambiguous, polysemous term that cannot be reduced to a simple definition. My interest here is not primarily with what power is but rather with how it works and what it does.

power' (Gore, 1998:245). I remember feeling guilty every time I taught something to teachers because I felt that I knew more than they did. However, reading Foucault (1988) helped me to understand the productiveness of power, that power is not evil, and that it might not be possible to have human relations without the presence of power. As Foucault (1988:18) writes:

Power is not evil.... I don't see where evil is in the practice of someone who, in a given game of truth, knowing more than another, tells him [*sic*] what he [*sic*] must do, teaches him [*sic*], transmits knowledge to him [*sic*], communicates skills to him [*sic*]. The problem is rather to know how you are to avoid in these practices – where power cannot play and where it is not an evil in itself – the effects of domination which will make a child subject to the arbitrary and useless authority of a teacher, or put a student under the power of an abusively authoritarian professor, and so forth.

In the light of Foucault's arguments and after reflecting on the work reported in case study 2, I now understand that it was necessary for us as university-based teachers/researchers to take the initiative in the project at times, in Foucault's (1988:18) terms to 'teach, communicate skills and transmit knowledge'. In this instance teachers had voluntarily agreed to participate in the project. Given the time constraints, the objectives of the projects, teachers' lack of both content and pedagogical content knowledge¹⁴, and the fact that a great deal of information on new curriculum policies had not filtered down to teachers served as good reasons why it was necessary for us as university-based researchers to take initiatives and direct the process so as to enable productive pedagogical work. I argue that it is important, however, to note that, even though power might be inherent in pedagogical practices, it can be used in different ways and might be shared more equally among agents in a pedagogical setting. In the case of the in-service teachers, power relations changed with time as teachers participated more actively in small group discussions (see Chapter 5). Although they were initially reticent, teachers participated actively in small group discussions after they had learned to

¹⁴ By content knowledge I mean subject matter knowledge. Pedagogical content knowledge is defined as knowledge not simply of the subject area, but also of how to teach it and how to select, represent, and organise information, concepts and procedures for that subject [learning area] matter knowledge (McLaughlin & Talbert 1993:3).

know each other better. However, in larger group discussions facilitated by us as university-based researchers, teachers were reluctant to communicate their thoughts. Again the likely reason might be that teachers expected the pedagogical relations to be hierarchical. Even during the small group activities the pervasiveness of power was evident. The photograph in Figure 6 (page 113), for example, provides compelling evidence of the pervasiveness of power in pedagogical practices.

Following Foucault (1980), Gore (1998:234-245) elaborates on eight techniques of power to investigate pedagogical practices in four different sites. The techniques of power that Gore identifies are *surveillance*, *normalisation*, *exclusion*, *classification*, *distribution*, *individualisation*, *totalisation* and *regulation*. Surveillance is the technique of power evident in the photograph. According to Gore (1998:235), surveillance includes 'supervising, closely observing, watching, threatening to watch, or expecting to be watched'. At the time the incident was photographed I held the view that I could do away with power in my interactions with teachers, in line with the thinking of some radical pedagogues. However, the photograph provides compelling evidence of power at work in this pedagogical instance. Also, the power of the visual image in capturing the act of surveillance is illustrated here. The written word and my own reflections on my practice might not have resulted in my being as reflexive about my work. Next I explore some of the shifts in power in the pre-service education course I taught at the University of Stellenbosch. I commented on the aspect of surveillance because it was pertinent to my study.

You will remember from my discussion in Chapter 5 that I asked students to address me by my first name and wrote that it had a profound effect on their learning. Cranton (1994:148) refers to what I did as 'giving up *formal authority*'. She writes that giving up formal authority can involve fairly simple tactics that may have a strong impact:

(U)sing one's first name, sitting down rather than standing up,
sitting close to learners rather than at the front of the room or at

the head of the table, and dressing casually, or appropriately for the group. The educator who does not pretend to have all the right answers will encourage learners to break away from that perception of the teacher – perhaps leading to some initial frustration.

Cranton (1994:148) draws on Mezirow's (1991, 1993) works and argues that giving up educator position power is key to empowerment (giving power to) of learners and in promoting transformative learning¹⁵. In Chapter 5 I described how using my first name in the class had a profound effect on students. I gave a first draft of what I wrote concerning case study two to five students for member checking and used the process as a basis for interviewing them. The significance of the first name usage is reiterated by one of the students who responded when I asked her what she thought about the draft she had just read:

It's true. It is interesting. It is put together well. The first part of the story where you mentioned your name I found particularly interesting. I remember clearly the day you walked into the class and introduced yourself by your first name. I will always remember it. For me it was very striking. It was so different. I had become use to titles Dr, Prof, Mr which immediately creates a distance. When you walked into the lecture room and said your name was Lesley I thought, this is different! It was a lot more comfortable. It enabled me to say things that were both positive and negative. Usually one is scared to share all your opinions. It definitely reduced the distance between the lecturer and us as students. We still listened and had respect but we just had greater freedom to share anything we wanted to (positive and negative). I think that if we did not call you on your first name we would not have shared half of what we did. You don't just share everything with someone you address formally. It probably also depends on the number of people in the class. I don't know. I'm not sure you can do it with school children. We were adults (interview transcript, November 1998).

Formal authority as a source of position power has become entrenched in the South African education system. In traditionally white and Afrikaans institutions

¹⁵ Transformative learning theory is based on constructivist assumptions. Mezirow (1991:xiv) describes constructivist assumptions that underpin transformative learning as including "a conviction that meaning exists within ourselves rather than in external forms such as books and that personal meanings that we attribute to our experience are acquired and validated through human interaction and communication". Cranton (1994:4) argues that transformative learning occurs when, through critical reflection, an individual revises old or develops new assumptions, beliefs, or ways of seeing the world.

such as the University of Stellenbosch the pervasiveness of the exercise of formal authority should be understood as legacies of positivism, Christian National Education and Fundamental Pedagogics. My 'giving up formal authority' had a significant impact on student teachers (in this instance) because their experience in the General Science method classroom was anomalous compared to that of their own schooling, their university undergraduate studies and their experiences in other modules in the HDE programme. Importantly, however, the sharing of power in the General Science method class was received well by students and elicited critical responses in relation to the ways they had been socialised with respect to power (authority). There might be an indication here that as the staff and student demographics change at the University of Stellenbosch, in the light of a broader transforming socio-political environment, we might see formal authority becoming less dominant.

6.2.2 Pedagogy and agency

Lusted (cited in Lather, 1991b:85) describes pedagogy as addressing 'the transformation of consciousness that takes place in the intersection of three agencies – the teacher, the learner and the knowledge they together produce'. Such a view of pedagogy does not instrumentalise these relations, diminish the activity between them nor does it value the one over the other. Furthermore, Lather (1991b:85) points out that it denies the teacher as neutral agent, the learner as passive and the knowledge as immutable material to impart. In the two case studies that I reported as a university lecturer/researcher my role was that of teacher, and that of the pre-service and in-service teachers that of learners, and the curriculum resources that we used and produced (such as the science and sustainability core module) served as the material. However, I need to point out that the distinction between teacher and learner might be problematic because as teacher I also at times took on the role of learner, and the learners (pre-service and in-service teachers) also at times took on the role of teacher. Nevertheless, I see myself as the teacher in this instance, because I was the one who selected the materials we used and who decided what were the pedagogical entry and exit points (exercised epistemological labour) of our pedagogical interactions.

Lusted's (cited in Lather 1991b:85) description of pedagogy is useful for reflecting on the pre-service and in-service programmes I was involved with/in. His view of pedagogy provides space for (re)constructing concepts (in this case environmental concepts such as sustainability) as it brings to the fore interactive productivity as opposed to the merely transmissive nature of what happens in the pedagogical act. The transformation of teachers' consciousness was evident in that some of the in-service teachers indicated that they realised for the first time that the earth is a planet with finite resources. Through the programme they also became more aware of their local environment (and related issues) and how it might be used as a focal point for school learning programmes. As mentioned in Chapter 5 one teacher who had been teaching for twenty-five years attempted group work activities in her classes for the first time as a consequence of her growing awareness of the usefulness of more learner-centred pedagogies that were discussed and employed in facilitating the in-service programme. These changes in the consciousness of teachers are significant if one takes into consideration the broader historical context of the case. For example, a school principal noted that for some of the teachers, just attending the in-service programme was a major step in their professional development. In-service programmes were historically not provided for teachers (especially historically disadvantaged teachers) in South Africa and it was not expected of them (by former education departments) to develop professionally – it was the intention of the apartheid state to produce teachers who were inferior, docile and obedient to state policies. I argue that these new experiences and developments in consciousness were enabled by a pedagogical milieu that encouraged openness, critical thought and discussion (as described in Chapter 5).

Growth in student teacher consciousness is also evident in case study 2 that I reported in Chapter 5. The following anecdotes (extracted from Chapter 5) provide evidence of growth in student teachers' consciousness with respect to their encounters with the concept of sustainability:

For the first time in my life I see the relevance and importance of this topic (sustainability) in biology education. I now realise for the first time what it concerns and I do not have the same negative connotations I used to have with ecology and population dynamics that was a headache when I was at school. I also now for the first time realise how everything on our planet is related to each other and how important it is at an early age to teach learners around this theme.

It is not just an idea anymore but something that has become part of my life. It has made me understand the role of nature in sustaining life. Before I use to view things in compartments. To be part of nature meant visiting a nature reserve or going on a fieldtrip. I now realise that it does not matter what I do or where I go, I am part of nature.

I looked at my own life and how I am living 'unsustainably'. The first aspect that had an impact on me was the efficiency part. I started switching off lights, kept dishwater for washing cups later and so on. However, I still need to consider recycling and renewable resource use, e.g., what do you buy, a plastic container or one made with recyclable paper? Concerning renewable resource use we probably would need to look at using solar energy

Sustainability is a good unifying theme. But, one needs to explore other themes, which could be as useful if not more useful.

In the first anecdote the student came to view and understand sustainability as an important concept and useful for biology teaching. She describes that her interactions with fellow students and lecturer in the General Science method course, as well as her teaching practice sessions around the concept sustainability resulted in her being more positively disposed towards environmental concerns and the teaching of environmentally related topics (see 5.6). But what is significant here is that her professional growth was aided by the opportunities she had to express her initial discomfort with the subject matter of the General Science method course. It was a pedagogical milieu, which accommodated and respected differing points of view that contributed to the student altering her original views.

In the second anecdote the student describes how the concept of sustainability became part of her consciousness through thinking and relating her observations of environments to the concept. Also, since engaging with the concept, she now

views environment(s) holistically (as opposed to, 'I used to view things in compartments') and sees herself as part of the environment. This student wrote and said that she could not separate her growth in 'environmental consciousness' from the pedagogical milieu in the General Science method module. She said that she could not unlink her learning about sustainability from the group work activities and her freedom to express her views in the classroom. In fact, she said that it was the pedagogical atmosphere that stood out most for her in the General Science method module. Her experience supports Sauvè's (1999:12) argument that changes in pedagogical practices might be more important than focusing on particular discourses within environmental education such as Education for Sustainable Development (ESD), Education for a Sustainable Future (ESF) and Education for Sustainability (EFS).

The third anecdote represents a student's reflections on the concept of sustainability and the changes in her actions (saving energy, the re-use of resources and so on) after encountering the concept in the General Science method course, following her reading an article on the biological principles of sustainability. Her reflections noted above follow earlier reflections on her first encounter with black lecturers (see story 3 in Chapter 5). Changes in her consciousness with respect to sustainability occurred after she dealt with her initial perplexity with and later admiration for black lecturers she was working with. In her words:

I don't know how to say it better, but at this stage it [encounters with black lecturers] has been of greater value than the things that have been academically enriching [learning about science and sustainability and how to teach it]. To have respect and admiration for your knowledge and skills. By the way, your display of the best human relation skills of any lecturer ever is also for me something great and wonderful. That's how I want to be – open-minded and critical (translated from Afrikaans).

This instance highlights the importance of pedagogical relationships and I refer here to the relationship between teacher/lecturer and student/learner. In South Africa with its history of ethnic and racial divisions, face to face contact between teachers/lectures that are black and students (white) in classrooms of historically

white universities might play a role in positively enhancing race relations and/or in removing ignorance. By ignorance I refer here to whites stereotyping blacks as killers (engaged in necklacing and killing white farmers) and stupid. I note here that face-to-face contact between lecturers and students (across racial divides) might be important in pedagogical processes and express a concern that such experiences might become eroded as shifts towards alternative modes of learning, that is, open, distance and flexible learning, become more pervasive. Also, this instance enabled me to comment on changing perceptions of authority – here we see that authority of a teacher is recognised as one having knowledge (subject matter and pedagogical knowledge) and who is human (one who recognise his or her own potential and limitations and who has the interests of students at heart). This might be in contrast to formal authority with its focus on a lecturer's qualifications/titles/positions. There might be an indication here that as universities diversify one might see less emphasis being placed on formal authority/positional power to recognition of a lecturer's competence to perform their work. I refer to power vested in formal authority as positional power. The instance reported might suggest possibilities for research into constructivist learning, concerned with the role of ethnicity/race gender, personality and charisma in enabling learning.

The fourth anecdote provides evidence of a critical consciousness developed by the student. This student was the same student that wrote in his journal how he initially struggled to use my first name. At the end of the year, like most of the pre-service students, he recognised the usefulness of sustainability as a unifying theme but did not accept it uncritically and expressed a need on his part to explore alternative themes as well.

In this section I described how students' consciousness was transformed as lecturer, student and the knowledge related to sustainability intersected in a milieu characterised by openness, freedom and trust. What was illustrated here is in accordance with Robottom's (1983) view that environmental education is not just about learning content knowledge (in this case knowledge about sustainability), but about important qualitative dimensions such as social need, emotions and beliefs – enabling the transformation of consciousness.

6.3 WHO MAY LEARN (TEACH)?

South African educational institutions have been historically segregated on the basis of both race and ethnicity. In post-apartheid South Africa we are witnessing shifts in student and staff (to a much lesser degree) demographics at historically white universities. These changes have implications for what happens at all levels of social engagement at such institutions. My interactions (as a black South African) with students at a historically white Afrikaner institution gave rise to particular instances in my practice. For example, students shared that a striking feature of their classroom experiences (mentioned more times than anything else by students) was the informal classroom atmosphere, which encouraged debate, freedom of expression and opportunities for relationships to grow. Earlier on in the programme this seemed to have had a more profound effect on students than learning about the concept of sustainability. Students could not divorce the course content from a pedagogical milieu characterised by openness, freedom, sharing, acceptance and the close working relationships between lecturer and students. I am of course not suggesting that such classroom atmospheres only exist when black lecturers are present. But I wish to point out rather how in this particular case more democratic classroom practices were enabled when a black lecturer with a different biography and history interacted with white students who might have been socialised in classroom milieus characterised by undemocratic and authoritarian practices. In Chapter 3 I discussed the role that Christian National Education and Fundamental Pedagogics played in this regard.

Story 3 in Chapter 5 relates a compelling narrative of a white student who, like many white South Africans, had been isolated from black persons for most of her childhood and young adult life as a consequence of apartheid policies. As is the case for many white South Africans, her only close contact with a black person was the maid (for others it might have been a gardener, petrol attendant, and so on) in her home. Outside of her relationship with the maid, she constructed negative images of blacks through the South African mass media as barbaric, murderers and uneducated. Her first encounter with black lecturers whom she describes as knowledgeable, skilful and with excellent human relation skills (*the*

best human relation skills of any lecturer ever') comes to her as an obvious 'culture shock' – blacks are not supposed to be knowledgeable and have good human relation skills. Our (lecturers') critical, assertive but non-confrontational disposition enabled the student to work through her 'shock' experience and to express, in her own words, 'admiration for your knowledge and skills...that's how I want to be – open-minded and critical'. The pedagogical interaction between black lecturers and a white student in this case represents what might be opportunities for reconciliation, the development of relations of trust and removing ignorance about black persons (on the part of whites) brought about by indoctrination/socialisation and isolation (from black) during apartheid. Also, importantly here, might be evidence of changes in personal identity on the part of the white student from presumably being uncritical and narrow to being more critical and opened-minded. There could be an indication here that what might emerge (in relation to post-apartheid pedagogical practices) in historically white universities such as the University of Stellenbosch (should the university diversify further) is shifts on the part of traditionally docile/passive white students to ones who are more critical.

Two of the ten students in the General Science method module were black. It is only since 1986 that South African universities have been open to all 'races'. Prior to 1986 black students had to obtain a permit to gain access to what were then referred to as white universities. The permission was only granted to black students if the course they were going to study had modules that were not offered at black universities. In post-apartheid South Africa the number of black students at historically white universities are increasing as these universities are pressurised by the government to reflect the diversity and demographics of the South African population. This changing trend with respect to student demographics will likely influence pedagogical relationships in university classrooms/lecture halls. At present the number of full-time students at the University of Stellenbosch remains predominantly white and it appears that black students are assimilated into an existing culture. Against this background it might be fitting to reflect on what one black student shared in story 2 (see Chapter 5). In her narrative she describes her difficulty with 'fitting in' with other students at the University. She relates her

struggle to 'fit in' to the fact that she is black and that the majority of students at the university are white. She notes that in the large lecture halls white students sit together with other white students and black students sit together with blacks. Although everybody is free to sit wherever they wish, the tendency is for students to sit in segregated groupings based on 'race'. In the General Science method course she was challenged to work more closely with white students because the group was smaller and also because the contact sessions mainly involved co-operative group work activities. She experienced discomfort as she interacted with the white students and was not able to engage in their middle-class discourses about travelling overseas and so on. She is not only black, but also has a working class background with cognate discourses that would certainly not involve engaging in talks about travelling overseas, for example. Her story highlights the nexus between race and class that is also evident in the broader South African society. Similarly, photographic evidence showed (see Figure 13 on page 149) learners in a classroom of a former white school that has now become racially integrated, that learners in classrooms still groups themselves with others of 'their race'.

With respect to case study 1, as a black lecturer I was an agent in setting up the partnership between the University and a historically disadvantaged community. The fact that I had family and historical ties with Grassy Park influenced my decision to work with teachers from this area. My knowledge of historically disadvantaged communities such as Grassy Park facilitated, in this case, the partnership between the University of Stellenbosch and the Grassy Park schools. This illustrates how black lecturers/researchers in historically white universities can serve as key agents in the formation of strategic partnerships between the university and local communities in facilitating the university's mission of community service. The partnership enabled historically disadvantaged teachers to gain access to an in-service programme facilitated by university staff in the local community where they teach. This is an example of the extension of institutional space and a blurring of the boundaries between university and school. The extension of institutional space in this instance illustrates that new spaces are being

created for teaching/learning, thus providing evidence of a changing pedagogical space.

6.4 WHEN, FOR HOW LONG AND WHERE CAN LEARNING (TEACHING) OCCUR?

As described in Chapter 5 in-service workshops with teachers took place on school days. We (university-based researchers) collaboratively decided with school principals and teachers that the workshops would be held partially during school hours and partially after formal school hours. You will remember I reported that principals felt that teachers might be too tired to attend in-service workshops after full teaching days. This arrangement was negotiated between teachers and us since there were strong feelings on the part of teachers that consent should not be requested from the WCED. One teacher reported that her school had asked the WCED whether they could organise and conduct a one-day school-based in-service education programme at their school during school hours. She reported that the WCED did not grant permission to the school as schools are granted only 2 days leave from 'normal' school activities for in-service work, sport activities, etc. by the WCED. The majority of the teachers who participated in the in-service programme felt that we should proceed with the programme without the permission from the WCED. They justified their decision by claiming that the WCED was not providing them with much in-service support and was also working against the interests of teachers with their rationalisation policies involving, in the main, teacher cutbacks. Teachers felt that they would benefit from the programme and willingly defied departmental regulations so that they could participate in the programme.

The WCED regulation was introduced as part of an effort to restore the culture of teaching and learning which broke down in the interregnum between apartheid and democracy. Unfortunately, instead of treating each case on its merits, in traditional bureaucratic style the WCED just implements strict regulations militating against potentially useful school-based in-service programmes. This is so despite the fact that the Schools Act (1996), for example, makes allowances for schools to conduct such programmes through the governing bodies. The resistance of

teachers to these regulations of the WCED are perhaps positive signs of a growing democracy and the vital role that teacher unions could play in the voices of teachers being heard (see Chapter 5).

The in-service teacher education programme was held in Grassy Park, making it accessible for all interested teachers from the area. The partnership established between the University of Stellenbosch and the Grassy Park schools should be viewed in the light of greater emphasis placed on community service by the university and the need (or imperative) for the university to serve historically disadvantaged communities in particular. Establishing this partnership should be understood within the broader socio-political changes, which occurred at the time (or just prior to it) that, made the partnership probable. The proactive steps and choices made by my colleague and I to work with the teachers in Grassy Park and the teachers' choices to work with us was possible because a post-apartheid era provided space for such pedagogical engagement. I am not suggesting that new spaces for social interaction will necessarily bring about partnerships of this kind, but point out that human agency operative in such spaces can bring about productive partnerships, that is, partnerships giving rise to the production of practically useful knowledge.

Case study 2 provides evidence that learning (teaching) in university faculties of education and schools is still organised in traditional ways and along subject disciplines. Learning/teaching time in schools and in the Faculty of Education at the University of Stellenbosch continues, as has traditionally been the case, to be fragmented into 50 minute (more or less) teaching/learning periods. At the time the study was conducted each 50-minute period in the HDE programme was allocated to a different module such as Educational Psychology, Educational Management, Philosophy of Education, General Didactics, as well as to several subject didactics modules such as Biology Didactics, History Didactics and so on. I facilitated the Biology section of the General Science method module, which involved one contact period (per week) with students in the first semester and two contact periods (per week) in the second. The limited contact time and the disciplinary focus of the General Science module limited what could be achieved in

the programme. Additionally, the arrangement of the HDE programmes around fields of study/subject disciplines was also in tension with the focus of Curriculum 2005 on generic exit outcomes and more broadly defined learning areas as opposed to traditional school subjects. I therefore had to introduce aspects of Curriculum 2005 into the General Science method module, which was still framed within a traditionally arranged model. This limited what we could achieve. What might be indicated here is that, although new policies have been (and are being) formulated, institutional arrangements/traditions/cultures might not have changed significantly to support the new policies. I therefore had to explore possibilities for including environmental concerns in science teacher education programmes, and for developing learning programmes, within the time available to us.

Where students learn can provide enabling support for changing pedagogical practices, but can also counteract the transformation of pedagogical practices. The nature of the HDE programme (traditionally organised) limited most of my interactions with students to classrooms/lecture venues in the Faculty of Education building. The 50-minute lecture periods did not allow for exploring real-life issues in the immediate environment of the university. Also, the emphasis placed on traditional methods of assessment (formal tests and examinations) at the University of Stellenbosch meant that students devote a great deal of time and energy to examination-related activities. For example, the end of the year examinations in most of the modules (including the General Science method module) in the HDE programme make up 60% of the overall assessment mark. These institutional factors constrain efforts to transform pedagogical practices. Also, from reports of the pre-service teachers, it appears that even though policies have changed, school cultures have not changed to accommodate the policy changes. The student teachers reported (Chapter 5) that many schoolteachers still rigidly follow state-designed syllabi, which made it difficult for student teachers to introduce innovations.

6.5 THE SOCIAL ORGANISATION OF TRUST

In this section I use Turnbull's (1997) concepts of spatiality and performativity to explore the insights provided by the two case studies on the social organisation of

trust in post-apartheid South Africa. Case study 1 formed part of a broader national research project involving individual researchers from higher education institutions and provincial education departments. Case study 2 formed part of a larger research project involving Australian and South African higher education institutions. With this broader context in mind, I firstly explore how a changing socio-political climate created new spaces for social engagement and knowledge production in South Africa after apartheid. Secondly, I analyse micro-level pedagogical practices to investigate what insights could be gained on how trust is being arranged in post-apartheid South Africa.

Turnbull (1997) argues that all knowledge traditions are spatial in that they link people, sites and skills. Put another way, knowledge production occurs when people within a particular place use their collective skills to address a particular concern/problem. As I pointed out in Chapter 3, Turnbull (1997) argues further that the basis of knowledge is not empirical verification, as the orthodox view would have it, but trust. Rorty (1999:xxv) a neo-pragmatist makes a similar point when he argues that truth should not be regarded as a goal of inquiry. He notes:

The purpose of inquiry is to achieve agreement among human beings about what to do, to bring about consensus on the ends to be achieved and the means to be used to achieve those ends (Rorty, 1999:xxv).

Rorty (1999:xxv) thus emphasises the importance of social co-operation and trust in social inquiry. But, before discussing what insights the case studies provide as to how the social organisation of trust might be changing in post apartheid South Africa, I first discuss what is meant by trust. White (1999:66) notes, 'trust involves a belief that you can rely on someone (e.g. specifically, their beliefs, dispositions, motives, good will) or something (e.g. an institution or a piece of equipment) where there is a greater or lesser element of risk'. Trust is therefore both personal (trust in people) and social (trust in institutions). My analysis of the social organisation of trust in South Africa would incorporate both elements of trust that White (1999:66) identifies. White (1999:67), however, also points out that trust is actually reinforced by distrust. She refers here to a wary scepticism

provided in democratic systems by *inter alia*, a legal opposition, an independent judiciary, independent commissions of inquiry into matters of public concern, a free press, and so on. I argue that distrust might also play a pivotal role in reinforcing trust in knowledge production processes. Here I mean a scepticism that interrogates in whose interest knowledge is produced and disseminated. I refer to this form of scepticism (distrust) as epistemological scepticism (distrust).

The way that the organisation of trust might be changing in South Africa is linked to the way that institutional space is changing in the post-apartheid period. It is in relation to changing institutional space that I explore how trust works in new knowledge spaces created by socio-political change in South Africa and processes of globalisation and internationalisation currently prevalent. Globalisation is a complex, inexact term, which is difficult to define. Symes and Preston (1997:291), however, provide a useful start, describing globalisation as 'processes of cultural unification which are occurring across the planet at the moment, particularly in terms of culture and media'. They suggest further that it describes 'much of the political unification which is also occurring, leading to larger and larger political groupings, centred around economic activity'. Gough (2000b:335) notes that *internationalisation* involves the promotion of global peace, social justice and well-being through intergovernmental co-operation and transnational social movements, agencies, and communities.

I mentioned in Chapters 3 and 5 that case study 2 formed part of a broader South Africa/Australia institutional links programme. I think that providing some background and a brief history of the relationship between South Africa and Australia might be useful for exploring changing (dis)trust relations between the two countries. Shelton, Catley and Schmulow (1998:1) point out that South Africa and Australia have in common their shared heritage of British colonialism that left a similar legacy of English-speaking European communities in uneasy relationships with indigenous people. The two countries were tied closely to Britain by means of trade, strategy, head of state and institutional forms. Both South Africa and Australia fought on the side of the allies in the two world wars. However, after the Second World War the paths of the two countries began to

diverge with implementation of the apartheid policy by the Afrikaner-led National Party in South Africa after 1948. The apartheid policy resulted in South Africa being isolated from the international community. Shelton *et al.* (1998) argue that by the 1980s the bilateral relationship between the two states had diminished to almost nil. They point out that both the conservative and social democratic governments of Australia became vociferous advocates and implementers of a policy aimed at thwarting the race-based laws of the Afrikaner-nationalist government.

The relationship between the two countries during the apartheid era could be described in White's (1999:67) terms as fundamental distrust. I refer here to distrust on the part of Australia towards South Africa. I use White's (1999:67) distinction between fundamental and procedural distrust to support my claim. She argues that fundamental distrust is directed to the aims or ends of the system or institution, whereas procedural distrust refers to means and procedures. In South Africa apartheid policies did not serve the ends of democracy by providing all South African citizens with equal opportunities so that they could benefit from, and contribute to – in Gutman's (1998:28) terms – the “good life”, i.e. be able to participate actively in a democratic society. It was thus the Australian governments' distrust of the ends of the apartheid system (not democratic) that made them sever ties with South Africa in late apartheid years.

However, in the 1990s co-operation between South Africa and Australia was re-established. The release of Nelson Mandela from prison and the unbanning of the liberation movements in 1990, as well as South Africa's first democratic elections in 1994, enabled South Africa to re-enter the global community. This opened the way for South Africa to develop beneficial partnerships with other countries. As a consequence South Africa and Australia re-established bilateral relationships and since then we have witnessed a re-opening of trade, investment, migration, cultural and sporting ties. However, despite the common interests and a shared use of language, the socio-historical contexts and therefore experiences of their respective peoples have been different. Since 1994 South Africa's relations with Australia have increased significantly to the extent that bilateral trade in 1998

exceeded AUD\$1,5 billion, most of which was in Australia's favour (Shelton *et al.*, 1998). It is in this context of 'good relations' between the two countries that Australia Aid has been provided to assist with economic development and the development of democracy in South Africa.

I wrote in Chapter 3 that a recent programme funded by AusAid was established to enable higher education institutions in both countries to form links aimed at enhancing the capacity of staff at South African higher education institutions, particularly those who have been historically disadvantaged. This institutional links programme was comprised of more than 40 projects, funded over two rounds. Details of the particular project I was involved with/in, and represented in case study 2, is provided in Chapter 3 of this thesis. The project I was involved with/in was made possible by a changing socio-political milieu in South Africa that contributed to the re-establishment of relations of trust between the South African and Australian governments. Social trust between the two countries created new spaces for social engagement and for relationships of trust to be established at a micro-level between academics from South African and Australian higher education institutions. In other words, social trust was established between the institutions and personal trust between the individuals participating in the project.

On a macro-level trust between South Africa and Australia was established in the sense that co-operation occurred and agreements were reached between the two countries in the areas of trade, sport and so on in the period after apartheid. Co-operation between the two nations was enabled by political change in South Africa and forces of globalisation and internationalisation. The co-operation between the two countries extended to several spheres of social life, including higher education. The Australia/South Africa Institutional Links Project serves as one example of co-operation between higher education institutions of the two countries.

The co-operation that has been established between the two countries since 1990 represents a shift from a disengaged distrust which characterised their relationship during the apartheid era to greater trust and co-operation after 1990. But I argue

that there might be good reason for an engaged distrust, particularly on the part of South Africa concerning relations with Australia. I refer here to vigilance concerning neo-colonialist influences cognate to processes of globalisation and internationalisation. This concern might be warranted if one takes into consideration that trade between the two countries already favours Australia and that it was in this context that Australia donated funds to 'help' with the development of South Africa's democracy. In the context of the project *Educating for Socio-Ecological Change*, an Australian academic expressed his concern in this regard, and also his ambivalent feelings about participating in the project. He writes: 'Clearly, our [Australian] participation in the project is intended to be catalytic in some way – we are here to "help" – and I am very uncomfortable with being positioned as a "helper". I try to heed the advice of Lila Watson, an Australian Aboriginal educator and activist, who is reported as saying, 'If you've come to help me you're wasting your time. But if you've come because your liberation is bound up with mine, then let's work together' (Gough, 1998: 3). It is Lila Watson's idea of 'working together' that I explore further, focusing on how trust worked at the micro-level of social engagement between academics of both countries. I also explore how trust worked in case study 2, which formed part of the project *Educating for Socio-Ecological Change*, involving my work with the pre-service teachers, that I reported on in Chapter 5.

What could be inferred thus far is that in post-apartheid South Africa the re-establishment of relations of trust and co-operation between South Africa and other nations such as Australia (which were absent during apartheid) has occurred. This has brought about the extension of institutional space beyond national boundaries and created new transnational spaces for social engagement. Also, it has created new spaces for knowledge production, that is, new pedagogical spaces. In the context of higher education these new spaces have enabled academics from South Africa and institutions of other nations to collaborate in performing their work. For example, in the project *Educating for Socio-Ecological Change* academics from the two countries could engage with each other closely through electronic communication and face-to-face contact over a period of two years. Furthermore, collaboration and/or co-operation between the

academics has extended beyond the duration of the project and is currently still continuing in different ways. For example, Australian academics have been/are invited to present seminars and teach on programmes offered by the Faculties of Education at Rhodes University and at the University of Stellenbosch. South African academics have presented seminars at Australian institutions and have made inputs into an on-line Master's programme in professional development at Deakin University, Australia. I now will focus on trust within Activity 2 of the project, *Educating for Socio-Ecological Change* and my own case study research (case study 2 of this thesis) which formed part of Activity 2.

I have provided a brief description of Activity 2 in Chapters 3 and 5 of this thesis. However, I argue that it is necessary to emphasise again that the work that we did in Activity 2 was participatory/collaborative in nature, which meant that participants worked in close relationships with each other. Although this was so, it took some time for relationships of trust to develop to the extent that participants were open and honest with each other in providing critical feedback on each other's work. At the outset trust was evident in the sense that there was an accepted agreement that we would work together in the project, and in the initial stages of Activity 2 decisions were made through negotiations among participants. But, as the work in Activity 2 progressed, trust between the participants deepened and it enhanced the knowledge-production process. As some of the Activity 2 participants reflect:

It became clear during the professional development process that collaborative participatory work involves the forming of relationships and familiarity among participants. Participatory research needs to allow time for the building of professional relationships and trust. We found that informal social interaction 'after hours' was an important facet of enabling relationships of trust to develop. Although the process of field investigation during the participatory research is done individually and at different local contexts, collaborative writing, reflection and peer review offers positive critique of individual work. If relationships of trust are well established, critical review from peers is more open, honest and easily accepted. This, in turn, enhances professional relationships and confidence. Within this supportive environment of working with others, we have been able to improve our understanding of

participatory research, case study work and tertiary curriculum development (Le Grange, Lotz, Makou, Neluvhalani, Reddy & Robottom, 2000:7).

Relationships of trust between participants of Activity 2 enhanced (added quality to) the knowledge that was produced in the activity. The basis for knowledge production in this instance was professional and personal trust between participants of Activity 2. However, personal and professional trust was enabled by social trust between the two governments, which was in turn made possible by socio-political changes in South Africa after 1990. The funds provided by the Australian government did not only enable Australian and South African academics to collaborate, but also served as a catalyst that enabled South African educators/academics, who were isolated from each other (due to apartheid policies), to now work together. Social trust between the two governments therefore also made it possible (through funds provided by the Australian government) for South Africans to build relations of trust across race/ethnic boundaries. The South Africans who participated in Activity 2 included: two Venda-speaking blacks, one Shangaan-speaking black, one English/Afrikaans-speaking white and two English-speaking blacks ('coloureds'). I mention this because one of the apartheid government's strategies was a policy of 'divide (along lines of race/ethnicity) and rule', which meant that people of different 'ethnic origins' had to live isolated from others – in separate regions/areas. Within this context many South Africans took up discourses of separateness and difference (in a negative sense), not only white South Africans.

The project, *Educating for Socio-Ecological Change* served as a catalyst for the research work I did with the pre-service students (case study 2 of this thesis). I would have taught the General Science method module anyway, but the project provided me with an opportunity to research my interactions with students and between students. It is in the light of this that I explore the insights that case study 2 provides on how the social organisation of trust is changing in post-apartheid South Africa. Case study 2 highlights how trust worked at the micro-level of pedagogical practices. It appears from the case reported that trust relations are strengthened when pedagogical climates are characterised by openness, acceptance

of dissent and so on. The student in story 3 (see Chapter 5), for example, told me in an informal discussion that it was difficult for her to write in her journal about her racial feelings, but was able to do so because she trusted me. I assume that by this she meant that she was happy with me reading her journal entry and that she believed that I would use the information in my research prudently so as not to reveal her identity. She mentioned that she would not have written these thoughts in her journal had I been one of her other lecturers. Trust in this instance might be linked to the fact that I had given up formal authority as a lecturer. To support my contention, another student told me when I interviewed her that she believed as students they would not have shared half of what they did in the classroom if they had not addressed me by my first name. Evident here is the indication that the pedagogical climate influences relations of trust between lecturers and students and between students. Also, the level of trust in the classroom determines what and how much is shared in the classroom, which influences the knowledge produced in the classroom.

Formal authority still dominates pedagogical relations at the University of Stellenbosch and it might be fair to claim that this might be the case at other South African higher education institutions as well. As universities diversify and students and lecturers with different cultural/political histories interact with one another, we might witness formal authority increasingly being lifted with time. There might be an indication here that giving up formal authority is necessary for building trust in pedagogical relationships, which in turn could positively enhance race relations in instances where lecturers and students might have different racial backgrounds. Given South Africa's political history of racial and ethnic division, research on the nexus between pedagogy and race, particularly at the micro-level of pedagogical interactions, could provide insights into the way that pedagogical relations between lecturers and students with different racial histories impact on the production of knowledge at classroom level.

Notwithstanding what I said, however, I think it is also important to reflect on how the authority I had as lecturer influenced relationships in the classroom. As lecturer I to a large extent made the decisions as to what pedagogical climate

would prevail in the classroom. For example, I chose to give up formal authority in the classroom. Also, I had personally taken up a discourse of reconciliation, a dominant discourse in the first few years after South Africa's first democratic elections. This era is often referred to as the 'Mandela era' because, as South Africa's first democratically elected president, he (Mandela) was the embodiment of reconciliation. I know that my (dis)position was for students and me to work together in a spirit of openness and honesty and for us to attempt to transcend racial differences. My (dis)position was in synch with broader social processes occurring in South Africa at the time, such as the Truth and Reconciliation Commission, indicating that students and I had taken up dominant societal discourses in this early period after apartheid. What might be emerging within discourses of reconciliation in South Africa is a *pedagogy of reconciliation* – in this instance where micro-level relations between lecturers and students (with different racial backgrounds) reflect engagement, which transcends negative racial attitudes. However, it could be that white students found it easier to relate to me as a black lecturer than to fellow black students. I elaborate on this in the next paragraph.

As lecturer I am placed in a different position to that of a student. In a sense students were forced to interact with me because I was the lecturer. They had to listen to me at times, accept my guidance and so on. Students could not ignore me (or wish me away) which I argue compelled them (or at least one of them) to deal with who I was and with their own dispositions with respect to black people. It is in this context that the student (in Story 3) was able to observe my 'human relations skills' and was exposed to my 'knowledge and skills' that she writes about. Also, the respect shown for persons in authority by white, Afrikaans students especially comes into play here. Story 3 provides evidence that the narrator's (student's) exposure to and interactions with me contributed positively to her growth. She claimed that her perception of black people had changed (or that it did not fit the stereotypical perceptions she had constructed) as a consequence of her interactions with me. However, she still modelled me (as the adult lecturer in a position of authority), even though it might have been for more progressive reasons. In her words, as she reflected in her journal, 'that is how I

want to be – open-minded and critical’. This might be due to the influences brought to bear on her by among other things, Christian National Education (CNE) and Fundamental Pedagogics. White students might, however, be disposed differently to fellow black students (not in positions of authority).

One of the black student’s stories is noteworthy. She wrote (see Story 2) that in the larger lecturer halls white students sit grouped with each other and blacks students sit together. She acknowledges that in the General Science method course this was not the case because the class was small and students did a great deal of co-operative work. This situation meant that students worked closely with each other in randomly constituted groups. The black student writes that the white students appeared to be ‘nice’ but that she was not sure whether they were actually ‘nice’ – indicating the black student’s scepticism (distrust) about the actions of white students. The distrust evident here should be understood in the sense that many blacks have historically distrusted many white South Africans for having supported the former (apartheid) government’s policies. The distrust is often generalised by black South Africans to all interactions with white people. There are a few points I wish to raise here. Firstly, there might be an indication that co-operative learning strategies in classrooms that are ‘racially mixed’ might compel students from different racial backgrounds to work closely together, which could serve as a catalyst for them to confront, or to reflect on, their own racial feelings/concerns. Secondly, students with different racial backgrounds might trust each other to work together professionally if so required, but at a personal level may distrust each other – one could therefore distinguish between professional trust and personal trust in such instances. I now turn to a discussion of how trust worked in the in-service programme I facilitated.

In Chapter 3 I indicated that the in-service work that I did with teachers formed part of a broader HSRC/EECI project. The project was participatory in the sense that it involved several researchers who either worked in smaller teams or on their own in smaller projects which formed part of the larger research project. At national colloquia held during the progress of the project researchers in the smaller projects reported their work in progress. At these colloquia researchers from

different higher education institutions and from national and provincial education departments reported on their work. The first level of trust evident here was in the partnership between the HSRC and the EECI. The HSRC is a parastatal responsible for commissioning research projects in the human sciences. The EECI is a state/civil society partnership, between the National Department of Environmental Affairs and Tourism and the Environmental Education Association of Southern Africa - the latter representing civil society. The EECI was established in 1996 because of greater social trust between civil society and South Africa's first democratically elected government. Because the project has a research focus, the partnership with the HSRC was strategic. However, such partnerships (between government departments and civil society organisations) with respect to environmental education were not present during apartheid rule. The emergence of such partnerships should be understood in the context of the greater social trust that now exists between institutions/organisations in post-apartheid South Africa. The HSRC/EECI partnership made it possible for environmental education researchers from different universities, technikons and state departments to work together and share each other's research work for critical scrutiny. The partnership brought together researchers from historically advantaged and disadvantaged institutions. The project enabled the development of professional trust to be developed between these individuals which had not existed previously. I now explore how trust worked in the project I was involved with/in that formed part of the larger HSRC/EECI project.

My work with the teachers in Grassy Park started with visits made to schools by my colleague and me (see chapter 5). Our negotiations with the school principals and teachers at a first meeting was a first step in developing trust between the teachers and us – trust in the sense that the teachers agreed to work with us in the project. It became clear to us after meeting with principals and teachers that they were resentful of the WCED because of teacher cutbacks. They were also disappointed with officials of the WCED for not offering them any support with the implementation of the new curriculum. Their distrust of the WCED was evident at the first meeting (attended by 43 teachers) when they (with the exception of one principal) decided that we should not seek permission from the

WCED to conduct parts of the workshops during formal school time. The willingness of the Grassy Park teachers to do work with University of Stellenbosch represents a shift from what occurred in the past. It would be fair to claim that prior to 1990 the University of Stellenbosch mainly offered in-service support to historically white schools. Also, the tight controls exercised by apartheid education departments meant that it was difficult for schools to establish partnerships with universities and non-governmental organisations (NGOs). In addition to the University of Stellenbosch there were non-governmental organisations doing in-service work with some of the Grassy Park schools. This might indicate that, in their own interests and for the sake of development, schools are entering into mutually beneficial partnerships with universities and NGOs, possibly indicating new trust relationships and also that trust (in educational knowledge production processes) is becoming more socially distributed.

In the programme we facilitated with the Grassy Park teachers the building up of relations of trust between the teachers and us and between the teachers themselves took some time to develop. This is understandable, since some of the teachers had not participated in this kind of programme before. Also, teachers participating in the programme were from different schools, which meant that many of them did not know each other prior to the commencement of the programme. We found that trust relations were enhanced when teachers worked in smaller groups and during informal discussions when refreshments were provided a few minutes before each workshop started. I recall that it was when I started working closely with the senior phase group and we sat around a table every time we met that teachers started sharing information about their teaching experiences freely, what they were learning from the programme and how they were changing their practices. Earlier on in the programme, when we interacted with the larger group, teachers were reticent about sharing their thoughts. The trust relations established between the University of Stellenbosch and the schools (or the human agents working in these institutions) have made it possible for further in-service work to be done with these schools, indicating that a sustainable partnership that may have been established. In-service programmes offered by the University of Stellenbosch have continued with these schools and are likely to continue in the future.

The discussion on trust and the way its organisation is changing in post-apartheid generated a number of insights. Before mentioning them, I must point out that in addition to the insights White (1999) provides on trust, Hargreaves (1994:252-253) distinguishes between trust invested in persons and trust invested in processes and abstract systems. It appears that the new knowledge production spaces created as a consequence of socio-political change in South Africa have strengthened personal and professional trust among South Africans of different racial/cultural backgrounds. This study suggests that trust relations were enhanced between South African academics and Australian academics, between South African researchers (of disparate backgrounds), between university researchers and teachers in a local community, between the local teachers themselves, between the students teachers (in case study 2) and between myself and the student teachers. My research provides evidence that trust between individuals from different racial background has also been enhanced through interactions between them in the new knowledge spaces emerging in post-apartheid South Africa. It also appears that South Africans are developing greater trust in collaborative, participatory processes of engagement and in partnerships and simultaneously distrust in bureaucratic systems, which seem not to have changed in post-apartheid South Africa. I refer here to policy processes and systems restructuring that have taken place in both the Department of National Education and provincial education departments, for example. Policy restructuring processes remain top-down and centrally controlled, fostering distrust rather than trust.

6.6 CHAPTER SUMMARY

In this chapter I gave my interpretation of the case studies reported in Chapter 5. I used the works of Pendlebury (1998) and Turnbull (1997) to frame my analysis. Within Pendlebury's (1998) broad framework of '*who* may learn [or teach], *how* and *what* they learn [or teach], *when* and *for how long* and *where*' I constructed themes from the case study data for investigating changes in pedagogical space. The themes constructed for exploring changes in higher education pedagogical space/practices are: *OBE language, learning programme development, science education and environmental education, the gap between PRESET and INSET,*

educator power and *pedagogy and agency*. Furthermore I used Turnbull's (1997) conceptual tools to comment on the insights the case studies provide on the way that the social organisation of trust might be changing in post-apartheid South Africa.

From the data it is evident that pedagogical space in post-apartheid South Africa is changing and that there are signs of changes occurring in higher education pedagogical practices. New policy frameworks have provided greater space for introducing transformative work in higher education classrooms. The introduction of a new school curriculum framework, Curriculum 2005, has made it imperative for university faculties of education to reorientate their programmes so that student teachers can develop competence in the design and delivery of outcomes-based programmes. There is an indication that involving teachers in the design and delivery of learning programmes might bring about a change in teachers' professional identity from teachers functioning as technicians (mere implementers of state-designed syllabi) to taking on the role of curriculum developers. The case studies provide evidence of the potential for teachers to take on this more transformative role. However, I pointed out that school and university cultures, legacies of Christian National Education and Fundamental Pedagogies and current policy motives (with their emphasis on symbolic change) might militate against efforts to transform classroom pedagogical practices.

Concerning what might be taught and learned in schools and university pre-service and in-service programmes, I have pointed out and illustrated that it was possible to introduce, in this instance, environmental education into such programmes. Both case studies illuminate such possibilities. My research has shown that new education policies provide more space (than during apartheid) for including environmental concerns into science programmes because state-designed syllabi embedded traditional approaches to science (education). The tight controls exercised by local educational departments on schools during apartheid worked against the efforts of teachers attempting to introduce alternatives to what the syllabi prescribed. The possibilities highlighted in this study for including environmental education into formal curricula is evidence of a more porous

pedagogical space. However, a greater challenge might lie in the way that a more porous space can lead to transformed pedagogical practices. In this regard the case studies highlight what was possible and also what the constraints were in attempting to enable transformed pedagogical practices.

Case study 2 more specifically, provided insights concerning changes in pedagogical relationships. The case study showed how changes in staff demographics at the University of Stellenbosch served as a catalyst for enhancing race relations. In the light of this positive observation, I express a concern that we might witness qualitative dimensions of pedagogy such as social need (for instance, better race relations) being eroded as the constitution of pedagogical spaces change in view of the processes of globalisation and internationalisation currently prevalent. I refer here to emerging virtual pedagogies as knowledge is increasingly produced and transmitted in cyberspace, and in more open and flexible ways (such as distance education), which removes face-to-face contact.

From the cases, it appears that the area where change in pedagogical space is less evident relates to pedagogy, time and place. Both inside schools and the Faculty of Education at the University of Stellenbosch teaching/learning mainly occurs in traditional classrooms/lecture halls and is fragmented into teaching/learning periods of approximately 50 minutes. The learning/teaching periods on a given day are usually allocated to different subject disciplines, giving learners the impression that what is learned in one classroom does not relate to what is learned in another classroom. This situation at the University of Stellenbosch placed constraints on what I was able to do in the General Science method course, because I had only one lecture period allocated to me in the first semester and two in the second semester. In case study 1, however, there might be an indication of changes to pedagogical space since we performed our work, as university lecturers, in a local community, thus shifting place from the University buildings at Stellenbosch to Grassy Park, where the teachers worked.

In the last part of this chapter I discussed the insights that the cases may provide into the way that the social organisation of trust may be changing in post-apartheid

South Africa. Socio-political change in South Africa created new spaces for social engagement and knowledge production. Social trust between South Africa and Australia after the dismantling of apartheid enabled academics from the two countries to work together on the project, *Educating for Socio-Ecological Change*. The collaborative work done by the academics enabled the development of both professional trust and personal trust between them. I mentioned that distrust might be necessary for building trust in projects of this kind, as there might be a danger of neo-colonialist influences in transnational spaces brought about by processes of globalisation and internationalisation. An awareness of this danger enabled us to decide from the outset of the programme that our work should be mutually beneficial (to Australian and South African academics).

The project served as a catalyst for investigating my interactions with student teachers in a pre-service programme at the University of Stellenbosch and for illuminating how trust worked at the micro-level of pedagogical practices. Giving up formal authority in the classroom contributed to the building of trust between the lecturer and students that in turn enhanced race relations in the classroom. In case study 1 trust relationships were established between a historically white university and teachers from schools in a historically disadvantaged community, Grassy Park. Trust in this instance brought about a sustainable partnership between schools in this area and the University. It appears that teachers from some of the schools were willing to establish mutually beneficial relationships with universities and NGOs, but were sceptical about the WCED's capacity to offer them any substantive support, perhaps indicating a shift in (dis)trust of bureaucratic and centrally controlled systems to trust in locally established partnerships.

The case studies have brought to our attention the centrality of trust in knowledge-production processes within the new knowledge spaces created by the social and political transformation in South Africa after 1990. They also highlighted shifts occurring from trust in centrally controlled/bureaucratic systems to trust that is socially distributed and evident in mutually beneficial partnerships

Chapter 7

A reflexive summary

7.1 INTRODUCTION

In Chapter 1 of my thesis I distinguished between two forms of reflexivity, *personal reflexivity* and *epistemic or disciplinary reflexivity*. *Personal reflexivity* draws attention to the view that the self that researches has an autobiography marked by the significations of gender, sexuality, ethnicity and class (Usher 1996:38). *Epistemic or disciplinary reflexivity* concerns moving away from the researcher to the research act so that the focus switches to the communities within which the research as a practice is located (Usher 1996:37). In this chapter I use these two forms of reflexivity to reflect on aspects of my research and to open up possibilities for further research in the light of the case studies (re)presented.

7.2 ON PERSONAL REFLEXIVITY

I began this dissertation by reflecting on how my years prior to entering professional life, my professional experiences, and earlier theoretical influences informed my interest in science education, environmental education, teacher education and educational research. I showed how my biography has been shaped by broader socio-historical factors prevalent during the apartheid era. I made the point though, that my biography was not merely shaped through socialisation, but that I actively adopted certain discourses rather than others.

My thesis reflects a journey of learning to do research on professional practices I was involved with/in at a time of transformation in South Africa. The thesis reflects my own struggle and growth in doing research in education at a time of great ferment over what is seen as legitimate within the boundaries of the human and social sciences. My analysis of pedagogical practices in terms of variables such as power and the way it works at the micro-level of classroom practices does not imply that I am able to situate myself outside of the realm of such forces. As Culler (1990:4) writes:

(A)ny analysis of, say, the political forces in a society cannot situate itself outside of the realm of political forces; it is necessarily caught up in the processes, affected by the forces it is describing, and itself involves a political move or stance. So that one way to study the political forces at work would be to analyse the analyst's own stance and investigate how his or her analytical discourse is worked by the forces it is analysing.

With this in mind, I briefly focus on a theme that I give attention to in my study – a theme that also pervades South African history. I refer here to the theme of *race*. Race-based apartheid policies have had real consequences for all South Africans. Many black South Africans in particular have suffered humiliation, were denied opportunities to participate in many aspects of South African social and political life, lived (and still do) in abject poverty, and so on. On the other hand, many white South Africans have developed false consciousness – believing that they are superior to blacks and stereotype blacks as stupid, lazy, inferior, murderers and so on. The student's perception of blacks in Story 3 (see Chapter 5) would very likely ring true for many white South Africans.

Given the pervasiveness of racial issues in various sites and discourses of social and political life in South Africa, it might be expected that any study on pedagogical practices in higher education, in the years immediately after institutionalised apartheid, would give some attention to issues on race. Having lived in South Africa as a black person during apartheid rule makes it difficult or even impossible for me to situate myself outside the influence of discourses on race. The attention I give to issues of race in my study is therefore understandable. In the first chapter I discussed how my growing consciousness of racial discrimination in South Africa, and my growing understanding of the impact that race-based policies had on education, influenced my decision to pursue a career in education. I also noted in the same chapter how I adopted critical (reconstructionist) discourses in my early student life and how with other black teachers I later became involved in participatory action research processes aimed at emancipating us in some way from an oppressive education system. My work with the pre-service students at the University of Stellenbosch, and the way I

constructed Case study 2, provide evidence that I personally adopted a discourse of reconciliation (a dominant discourse in South Africa in the years immediately following the abolition of legal apartheid). My study shows that I have not been able to situate myself outside the realm of racial discourses/influences and, importantly, that I adopted particular discourses at certain times, indicating that my subjectivity was not unitary or fixed, but multiple and constantly in process.

However, although I gave some attention to the racial issues in my thesis, I do not give sufficient attention to significations of class and gender, and perhaps have not sufficiently explored the nexus between race, gender and class. I find Wagner's (1993) ideas of *blank spots* and *blind spots* useful for reflecting on the point I have just made. Wagner (1993) argues that it is useful to assess educational research in terms of how educational researchers respond to two kinds of ignorance, which he refers to as *blank spots* and *blind spots*. For him *blank spots* are what scientists know enough about to question but do not answer, and *blind spots* are what they don't know enough about or care about. My relative silence on issues of class and gender may be because of my own class position and the fact that I am a male. Even though I was denied many opportunities as a black South African, I did have greater access to material resources and educational opportunities that were denied to the majority of black South Africans. This enabled me to enjoy some benefits available to middle-class white South Africans. My class position and gender (male) might have produced *blind spots* with respect to significations of class and gender in my work. However, my attempts at self-critique might be limited as I acknowledge that there are 'serious limits to our abilities to self-critique' (Lenzo, 1995:18). As Alcoff (1991:22) cogently puts it:

The desire to find an absolute means to avoid making errors comes perhaps not from a desire to advance collective goals but a desire for personal mastery, to establish a privileged discursive position wherein one cannot be undermined or challenged and thus is master of the situation. From such a position one's own location and positionality would not require constant interrogation and critical reflection; one would not have to constantly engage in this emotionally troublesome endeavour and would be immune from the interrogation of others. Such a desire for mastery and immunity must be resisted.

I trust that my attempts at being reflexive in this study might have opened spaces for new research opportunities and practices. With this in mind I turn to a brief discussion on disciplinary reflexivity.

7.3 ON DISCIPLINARY/EPISTEMIC REFLEXIVITY

Research is a social practice. By this I mean that research activity is influenced by, and contributes to, a body of knowledge constructed by a community of researchers/academics. In my study I drew on and benefited from theoretical and empirical insights produced by several scholars in the fields of (science) education, environmental education, (classroom) pedagogy, teacher education, educational research, and so on. Both case studies were also located within particular communities, with histories that account for idiosyncrasies produced in the two cases. What I specifically focus on are insights this study might provide on (higher) pedagogy in South Africa, on the use of photographs in case study research, and on interpretative research after poststructuralism.

7.3.1 Some thoughts on pedagogy

Although this study does not focus primarily of how power works in pedagogical settings, it does open up possibilities for further research concerning how power works at the micro-level of pedagogical practices. The focus of many of the critiques on South African pedagogical practices have been on the effects that state power and pedagogy (underpinned by Christian National Education principles and Fundamental Pedagogics) has had on such practices (see Kallaway, 1984; Nkomo, 1990; Unterhalter, 1991; Kallaway *et al.*, 1997). The case studies I report reflect the beginnings of probing/investigating how power works at the micro-level of pedagogy rather than only focusing on the macro-realm of structures and ideologies.

As Foucault (1980:39) writes:

In thinking of the mechanisms of power, I am thinking rather of its capillary form of existence, the point where power reaches into the very grain of individuals, touches their bodies and inserts itself into

their action and attitudes, their discourses, learning processes and everyday lives.

My study opens up possibilities for further research on the way that power works at the micro-level of pedagogical practices.

The case studies provide evidence that different pedagogies (dominant/traditional pedagogies, critical pedagogies¹⁶ and pedagogies of reconciliation) co-exist in post-apartheid school and university classrooms. Reports from both in-service and pre-service teachers indicate that traditional approaches to teaching remain dominant in many public schools. The pre-service teachers' 'shock' reaction to my giving up formal authority in our contact sessions might indicate that at the University of Stellenbosch authoritarian pedagogical practices remain dominant. The case studies also provide evidence that teachers and students at times expect such authoritarian pedagogical practices to continue. My work with the pre-service teachers and the classroom experiences of the two Sid G Rule teachers are instances of more critical pedagogies reported in my thesis. My efforts to share power with the in-service teachers also represent an element of critical pedagogy. My work (as a black lecturer) with the pre-service teachers (the majority of whom are white) at the University of Stellenbosch and our efforts to build relations of trust through open and honest dialogue might provide evidence of an emerging pedagogy of reconciliation (see Chapter 6). I contend that a key to transforming pedagogical practices in South Africa might be in understanding that these disparate pedagogies should co-exist and intersect, and also that there might be a need to work with elements from different pedagogies to enable transformed practices. I borrow Hildebrand's (1998:335) term and refer to an 'enabling pedagogy'¹⁷ which might represent the intersection of dominant pedagogies,

¹⁶ Critical pedagogy is a term that incorporates an array of perspectives. For the purpose of my research critical pedagogies would subsume the following elements. That knowledge learned is not fragmented, and is relevant to the social lives of learners. That teachers/learners are empowered to actively participate in decisions that affect their personal/professional lives. That dominant power relations in classrooms/society should be questioned and changed. Also, critical pedagogy is a process that examines the complex ways in which race, class and gender identities of teachers/learners are constructed.

¹⁷ Hildebrand (1998:355) writes, 'Enabling pedagogy both pragmatically accepts that the authority of a teacher in a regular school [university] classroom cannot be given over entirely to the students and yet expansively seeks to shift the power balance within the classroom.... An

critical pedagogies, and pedagogies of reconciliation in post-apartheid South Africa.

7.3.2 Use of photographs in case study research

In this section I briefly reflect on the use of photographs in interpretative case study research. Since reality is not knowable outside of our constructions of it, the tools/images we use to represent social reality is manipulated in various ways by us. This is so irrespective of whether we use visual images, the written word or quantitative indices (numerals) to represent particular instances/events. In interpretative research generally qualitative descriptions have dominated the way in which events/human actions have been represented. In this study I used visual images to represent instances of my professional work to provide an alternative narrative to my written descriptions. Additionally, I have used photographs in focus group discussions with the pre-service education students for the purpose of joint reflection and collective meaning making on what transpired during the programme. The different ways in which I used photographs show how we can use 'photographs as keys to memory, rather than illustrative social facts' (Walker 1993:83). As Walker (1993:84) writes:

We can use the photograph in the context of memory-work, as an instrument for the recovery of meaning, in a way that we all recognise when we think of how we view collections of photographs in the drawer at home. What is important is not the image in itself so much as the relationship between the image and the ways we make sense of it and the ways in which we value it.

However, photographs have the same potential to manipulate, distort and exercise authority (Walker 1993:84). When photographs are taken, certain events, people or instances are selected which inevitably lead to some form of distortion. As Duff (1981:76) asserts:

enabling pedagogy would recognize the systemic constraints that operate on teachers' daily work, such as an intended curriculum content and structure that is prescriptive.... An enabling pedagogy accepts that there are no universals that apply to all teaching contexts, all students, and all teachers, nor does it presume deficits in *otherized* students'.

Photography, then, is a mechanical process crucially dependent on a single human decision. The process produces single images which are again, crucially dependent, on the context, in which it is seen. Photographs might appear to be self-evident but they are more often open, incomplete and ambiguous, and to make sense of them they need to be seen with words or with other images.

But Walker (1993:87) points out that:

The power of the photograph lies to some extent in its exactness and precision, which lends it undeniability, despite its acknowledged capacity to select and distort. The ways in which the camera 'sees' are very different from the ways in which we see things, but in that difference lie important keys to understanding the intersection of what is personal and what is social.

The debate on the use of visual images in interpretative studies will continue. It is an important debate that might contribute to greater reflexivity on the part of researchers when representing their work. Further research on the use of visual images in interpretative case study research could contribute to knowledge in this regard.

My study provides an example of how photographs can be used in combination with the written word to produce case study research in environmental/science education pedagogy in a higher education context. The photographs in my study did not attempt to mirror reality, but I used them to provide meaning to a bigger whole. As Welpott, in Carothers and Roberts, (1989:34) writes:

Photography has the potential to mirror reality. That's what they thought it was originally. But it's a very inexact mirror, and we've begun to realise that the photographer's psychology, feelings, attitudes and so many things get into it. It's highly editorialised. I don't believe the idea that the picture is truth. It is a truth generated by the feelings of the photographer. But also, it can be a total metaphor and operate like poetry. The object shown, the thing depicted, can only be a vehicle to some larger meaning. A little bit like the way a good poet can take the most common words, just little one syllable words, and put them together so they add up into something much beyond what those simple words mean. I feel that way about photographs. The photographer can walk in and

photograph common objects and transcend them, take them right beyond their literal meaning into some kind of poetic realm.

I trust that in my study the photographs are not just a collection of individual pictures but that, with the written words, they provide a narrative that is more than the sum of the individual photographs or words. In constructing photographic narratives for case study research, the following guidelines might help the beginning researchers, who may find case study (using photographs) as a research approach attractive. The consecutive steps are:

- Take photographs of the setting in which the research is to take place.
- Take photographs highlighting the education problem(s) that the researcher intends to investigate.
- Take photographs of events related to the programme (intervention), during its implementation.
- Give the photographs to research 'subjects' for their critical comments
- Select key photographs for the development of a photographic case record. Additional photographs may need to be taken to fill 'gaps' in the pictorial record.
- Add captions to each of the photographs.
- Write a commentary/narrative of the case.

Although case study research holds great promise, it remains a neglected area of research in South Africa. In an audit conducted on all research done in environmental education up to 1998, Irwin (1998) points out that in the main research done has been empirical analytical, using survey research methods. It would be reasonable to generalise this to other fields of education as well. Recent education policy changes and government initiatives in South Africa such as new school governance structures, rightsizing of schools as well as a new curriculum provide great challenges to schools. We have witnessed many debates on these issues in the media, at academic conferences and in published books and articles. Much of this debate, however, remains at the level of rhetoric and very little research has been done that provides praxiological comments on these policies and

initiatives – by this I mean research that mediates the relationship between policies, on the one hand, and the realities of educational practice in widely disparate school/university contexts in South Africa, on the other. It is here that case study research has a notable promise with its portrayal of the particular and the idiosyncratic as legitimate in themselves.

For example, the use of photographs in case study research on the impact of outcomes-based education on classroom practice, in widely differing South African school contexts, may be particularly illuminating. Reading about the fact that there are some teachers who still teach learners under trees whereas other teachers work in schools that have the luxury items such as underfloor heating is just not as compelling as seeing it visually. Photographs can provide meaningful insights into how Curriculum 2005 is being practised in these strikingly disparate contexts.

Walker (1993:80) argues that, ‘unlike the written word, photographs carry little with them in the form of high cultural baggage, social class connotations or other pretensions’. Sontag (cited in Walker 1993:81) sums this up by noting that “photographs are part of the vernacular culture”. This point may be significant in South Africa where 11 official languages as well as many others are spoken. The language used by researchers often alienates certain members of society and serves as barriers to participation in research processes.

Photographs hold the promise of engaging those who may be less educated or who do not speak the language of researchers. Photographs can also be used as a research technique for member checking with all members of society, young and old, parents and learners, literate and less literate, numerate and less numerate. Walker (1993:84) points out that, in contrast to photographs,

...numbers and words trigger responses of deference and demeanour effectively discriminating against the less well educated, the less articulate and the less numerate, especially when the context is public.

In South Africa with its fledgling democracy photographic case studies may hold the promise of contributing to the democratisation of social processes such as teaching and educational research.

7.3.3 Interpretive case study research after poststructuralism

My study was chiefly framed within an interpretivist paradigm. As a neophyte in conducting postpositivist research I found navigating the uncharted waters (of postpositivist research) difficult. My previous research work (in Master's studies) was done within a positivist/empiricist paradigm. Although this study represented a shift from positivist research, I still found it useful to work within a particular framework as it helped me to focus my work and to complete the academic exercise of doing a PhD as a right of passage into the academy. However, my recent reading of poststructuralist research enables me to provide a brief reflexive focus on how I constructed what I investigated in my study. You will remember that the central aim of my study was to investigate changing pedagogical practices in higher education teacher in-service and pre-service programmes, with a particular focus on science education and environmental education. Working within an interpretative tradition meant that the focus of the study was to describe and interpret the experiences of participants in the in-service and pre-service programmes.

The first concern that I wish to raise has to do with the use of paradigms in the human and social sciences as well as the role that language, visual images and so on play in constructing our own stories. In the social sciences we have perhaps incorrectly borrowed Kuhn's (1970) idea of paradigm. In fact, Kuhn (1970:160) himself argued that the social sciences are a pre-paradigmatic conglomeration of techniques largely borrowed from the natural sciences; the social sciences are too young to support his notion of normal sciences. Lather (1991b:10) argues that this aspect of Kuhn's thought has rarely been noted by those in the human sciences, who have adopted his language of successive paradigms, anomalies and revolutions. The complexity and changing nature of social forces makes it very difficult to frame research neatly into what might be considered to be paradigms in the natural sciences. Lather (1991b:11) importantly asserts that 'Kuhnian

frameworks deny both the political content of theories and methodologies and the way that language constructs rather than reflects the objects of investigation'. It might therefore be important for us to move beyond Kuhnian structures to frame our work differently and accept a 'hybridity' of techniques and genres to represent our work.

My own study, although loosely framed within an interpretative tradition, reflects elements of what have been termed positivist and critical traditions. I agree with Atkinson, Delamont & Hammersley (1988:243) that, 'while we need conceptual frames for purposes of understanding, classifying research and researchers into neatly segregated "paradigms" or "traditions" does not reflect the untidy realities of real scholars...and may become an end in itself... Traditions must be treated not as clearly defined, real entities but only as loose frameworks for dividing research'. In my own research I drew on insights from narrative inquiry, critical inquiry and poststructuralist thought and regarded these insights as not being embedded in oppositional 'paradigms', but rather as ways of augmenting or enriching my interpretative work. For example, in constructing case study 1 I mainly represented the Grassy Park teachers as a unified entity – all black, struggling to cope with new curriculum innovations and in a sense victims of apartheid education policies. Reflecting on how I constructed case study 1, in case study 2 I integrated individual narratives within the larger narrative of the student teacher group. This highlighted the fact that not all individuals experience phenomena in the same way and that they make choices about what they adopt from the discourses they encounter – that is, they are not simply subjects of history or socialisation but are subjects with agency. My decision to integrate the photographs into the text also provided an alternative narrative(s) to those constructed through the written word, which served as one way of being reflexive about my use of language. Conversely, the written word also enabled me to be reflexive about what was represented by the visual image.

The way in which we order our words, the visual images we select and where we place them in the text all shape and give meaning to the text. Poststructuralist theory helps us to recognise that meaning is embedded in language, whether those

language images are words, visuals or quantitative indices. In this study I ordered the written words, I selected the visual images and placed them in the text, which gave particular meaning to the text. I therefore cannot claim that I am able to distance myself from what has been constructed, but trust that the reader might find my narrative(s) persuasive and defensible given the resources available to me when I conducted my research. I accept the poststructuralist perspective that 'the analytic posture...is not one of scientific detachment but of intractable involvement' (Culler 1990:4).

In South Africa insights from poststructuralist theory are neglected in research work reported in local journals, but this is an area of research that can provide greater insight to and enrich the interpretative and other approaches to research that is conducted in this country.

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1. Schreuder DR, Le Grange, LLL & Reddy. 1998. Environmental Education as processes of change and reconstruction: The science and sustainability project.

Paper presented at the annual conference of the Environmental Education Association of Southern Africa. Gaborone: University of Botswana.

2. Le Grange, Lesley. 1999. Ecological Sustainability: A metaphor for curriculum and research in the new millennium. Paper presented at the annual conference of the Education Association of South Africa. Wellington: Boland College of Education, January.

3. Le Grange, Lesley. 1999. Is qualitative research a useful term for describing the cross-fertilisation of ideas, which characterises contemporary educational research? Paper presented at the Qualitative Research Conference. Johannesburg: Rand Afrikaans University, 6-8 July.

4. Le Grange, Lesley. 1999. Does Curriculum 2005 provide space for addressing environmental concerns through science teaching. Paper presented at the National Didactics/Learning Area Symposium. Stellenbosch: University of Stellenbosch, 14-17 September.

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HSRC/EECI PROJECT - PROPOSED PROGRAMME

Part 1: National Qualifications Framework (NQF) and Curriculum 2005 <ul style="list-style-type: none"> • Why a new curriculum? • How does Curriculum 2005 fit into the NQF? • Key aspects of Curriculum 2005 • From content-based to outcomes-based education • What are outcomes? • From teacher-centred to learner-centred education • Why the need for outcomes-based education? 	Proposed dates and times Workshop 1 3 December 1997 (12h00 to 14h30)
<ul style="list-style-type: none"> • The changing role of the teacher- teacher as curriculum designer • How to develop learning programmes • Changing Assessment practices • Unpacking OBE jargon 	Workshop 2 28 January 1998 (13h00 to 15h30)
Part 2: Environmental Education and Curriculum 2005 <ul style="list-style-type: none"> • What is Environmental Education(EE) ? • An overview of the international development of EE • The development of EE in South Africa • Environmental Education in Curriculum 2005 	Workshop 3 11 February 1998 (13h00 to 15h30)

Part 3: Development of learning programmes for Intermediate and Senior phases <ul style="list-style-type: none"> ● Using environment as a cross-curricular theme (phase organiser) ● Using locally relevant topics (programme organisers) ● Choosing appropriate specific outcomes ● Developing activities ● Ways of assessing 	Workshop 4 25 February 1997 (13h00 to 15h30)
<ul style="list-style-type: none"> ● Feedback on trialing of activities ● Improving activities 	Workshop 5 4 March 1998 (13h00 to 15h30)
Part 4: Introducing resource materials <ul style="list-style-type: none"> ● We Care - Intermediate phase (IP) ● Windows on the Wild (WOW) - Senior phase (SP) ● Workshopping activities and ideas from materials 	Workshop 6 10(IP) and 11(SP) March 1998 (13h00 to 15h30) Workshop 7 17(IP) and 18(SP) March 1998 (13h00 to 15h30)
Part 5: Using activities from support materials to develop learning programmes <ul style="list-style-type: none"> ● 4 workshops with trialing of activities in between 	Workshops 8 to 11 22(IP) and 23(SP) April 1998 6 (IP) and 7(SP) May 1998 20(IP) and 21(SP) May 1998 3(IP) and 4(SP) June 1998 (13h00 to 15h30)
Part 6: Summative evaluation of the project <ul style="list-style-type: none"> ● Possibilities for an ongoing partnership between teachers and university 	Workshop 12 22 July 1998 (13h00 to 15h30)

Questionnaire

1 Biographical details

Name: _____

School name: _____

Teaching experience (in years): _____

Subjects taught / Std or Grade: 1) _____

2) _____

3) _____

Institution where qualifications were obtained: _____

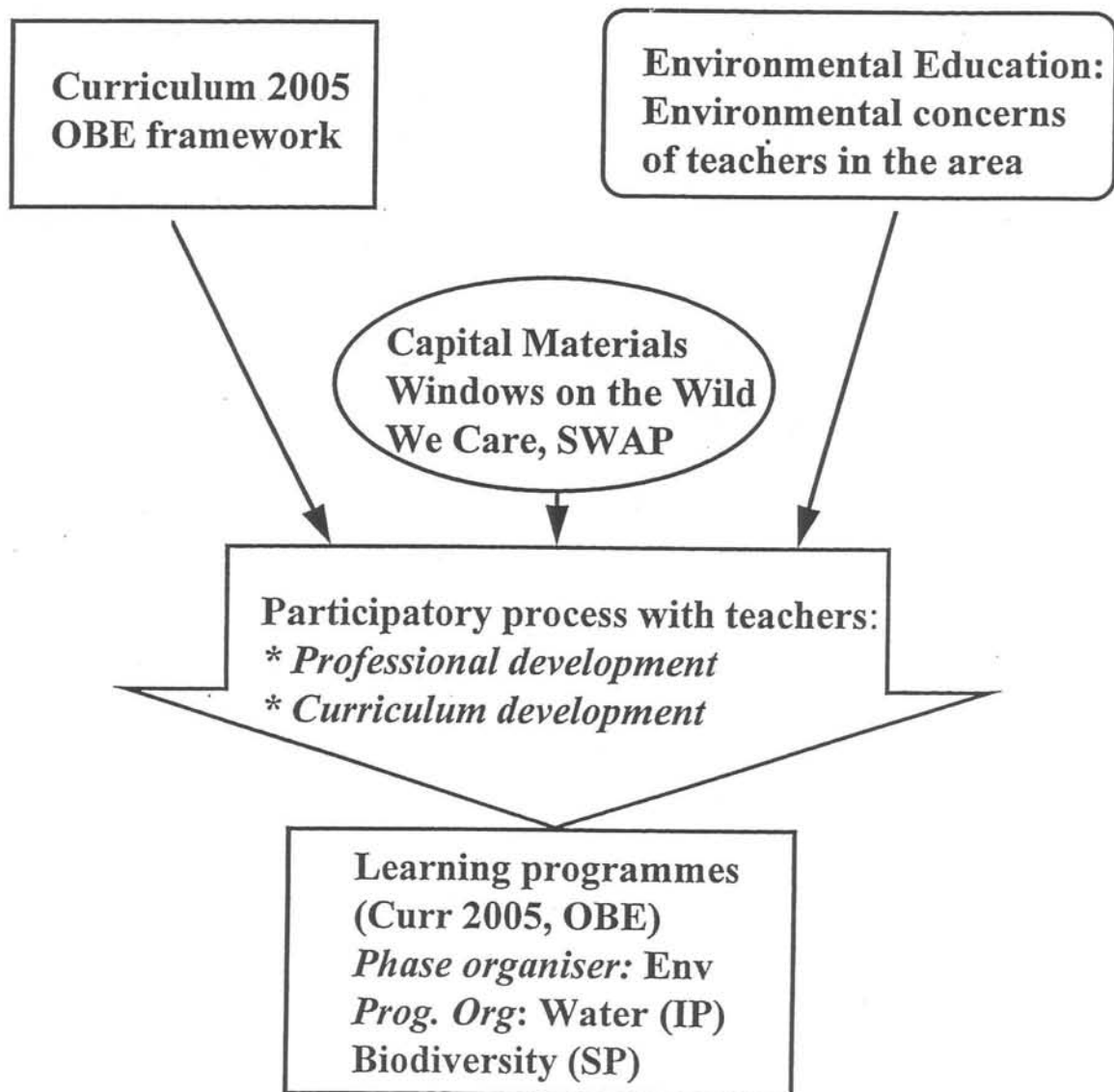
2 Outcomes-based education (OBE)

Have you attended any inservice programmes on OBE? _____

What was the duration of the inservice programme? _____

Who presented the inservice programme (s) you attended? _____

What are your views on OBE and the new curriculum? _____





Focus:

Sustainability on planet earth

Grading: T

Time: 88

Place: Inside

Group size: Groups of four

Activity Outcomes:

- To develop awareness of life-sustaining processes and the availability of natural resources
- To apply knowledge in the design and drawing of a poster
- To create appreciation and respect for the life-sustaining processes on earth
- To foster a caring attitude for planet earth

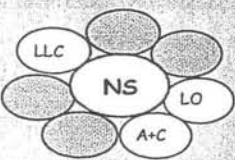
Assessment:

- Evaluate group discussions
- Assess group presentation (include peer assessment)
- Evaluate posters and adjustments

Process Skills:

- Recording
- Communication

Cross-curricular links



What Makes the Earth a Living Planet?

Background

Learners are given a short introduction to the main theme of "Windows on the Wild" namely, to study the earth and its capacity to sustain life and, to find meaning for the concept of sustainability by investigating how certain conditions on the planet make it possible for life to exist and evolve indefinitely.



Read Teacher's Guide: "The earth is a living planet.", pg. 4-6

Activity Guidelines:

Needed: Poster paper; colour markers

- ✎ Learners are divided into groups of no more than 5 per group. They are encouraged to discuss possible ways to illustrate the concept of sustainability, to reach consensus and work together in creating a poster which portrays those features that make life possible. [No more than 10 - 15 minutes should be spent on this phase of the activity.] It may be necessary to help learners with hints such as:
 - Position in space; sun; movement
 - Energy and nutrient flow
 - Bio-geochemical cycles
 - Biodiversity
 - Water
- ✎ Afterwards ask one of each group to come forward and explain the group's effort to the rest of the class.
- ✎ Keep all the posters stuck to the walls and, as the session progresses, let learners revisit their presentations and make adjustments if necessary.



Part Two

Focus:

Maintaining Biodiversity

Grading: T T T

Time: 8

Place: Inside

Group size: Groups of 4-6

Activity Outcomes:

- To foster an appreciation of biodiversity
- To develop an understanding of the different reasons for biodiversity
- To present a point of view regarding the importance of biodiversity

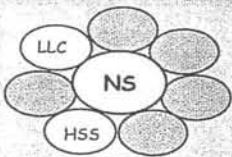
Assessment:

- Evaluate group presentations
- Assess individual contributions to group presentations

Process Skills:

- Interpretation
- Communication

Cross-curricular links



The Spice of Life

Background

With so much habitat destruction, development, pollution, and species extinction going on these days, everyone needs to think about the importance of biodiversity. Having learned about biodiversity, learners decide for themselves what efforts should be made to maintain biodiversity, considering factors such as economics, personal responsibility, and the future of the planet Earth.

Activity Guidelines

Needed: *The six signs which state the reasons for caring about biodiversity (pages B-15 through B-17).*

- Present to the whole class the following questions, either on paper or written on a chalkboard. Let the learners read them and think silently for a few minutes.
 - Do people actually need wild plants and animals for either economic or medical reasons?
 - Can't scientists synthesise medicines in the laboratory or freeze genetic material for later use, therefore making the original plants and animals unnecessary?
 - Is it acceptable to let a species die out if it has no apparent medical or economic purpose?
 - What sorts of ecological processes does biodiversity help maintain?
 - Are there some species that are more important to protect than others?
 - Is it acceptable to let venomous snakes, biting insects and other unpleasant species go extinct?
 - Do people have the right to use the world's resources in any way they see fit?
 - Do people have responsibilities to other living things?
 - Why should people today do without things they want when we don't even know what future generations will need or want?
 - Will future generations really care about species that disappeared before they were born?

- What inventions, stories, or works of art can you think of that were inspired by living things?
 - What kind of recreational activities rely on wild spaces and species?
- As the learners are thinking, tape signs around the room with the 6 possible reasons why we should care about biodiversity. Also, put up a sign labelled Other. Have the learners group themselves according to which reason they feel is most important. Give the groups a few minutes to put together their points of view then each group present their reasons. At the end, ask if the presentations have changed anyone's opinion. Also ask if there really is a most important reason or if they are all important.

Variations

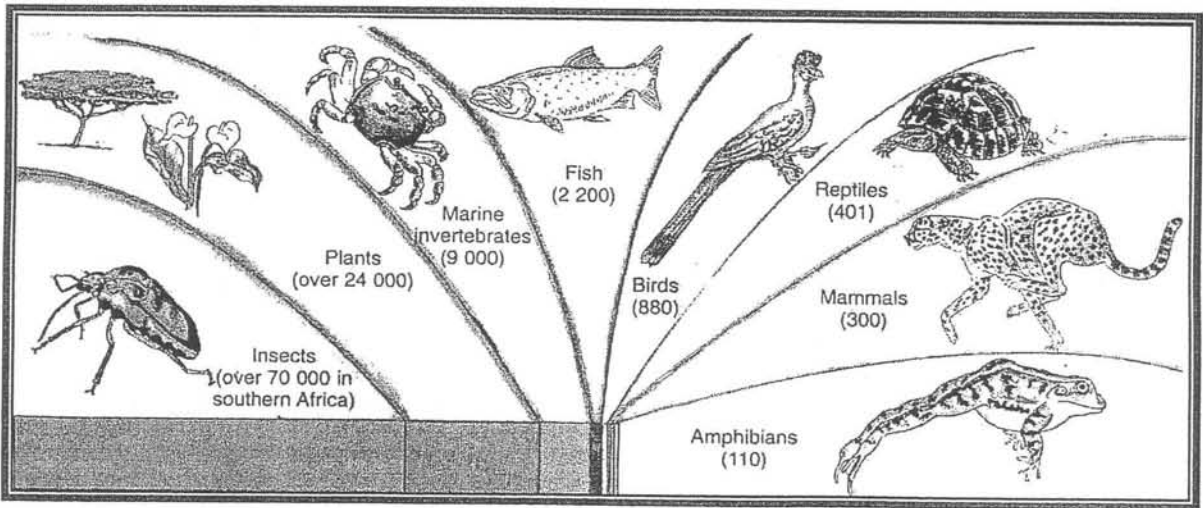
Create a Collage

Have each group create a collage that supports their reason for the importance of biodiversity.

Make a Plan

Discuss the biodiversity of South Africa and what's being done to save it. What can learners do to help? Come up with a plan of action and organise how to implement it.

HOW MANY SPECIES IN SOUTH AFRICA?



MEDICAL AND ECONOMIC REASONS

It is important to conserve the diversity of life for medical and economic reasons. Plants and animals could provide us with additional foods, medicines, and other products in the future that will save lives and benefit society.

MAINTENANCE OF ECOLOGICAL PROCESSES

It is important to protect the diversity of life because biodiversity helps maintain important ecological processes such as oxygen production, pollination, and flood control that, in turn, help support all life on Earth.



RECREATION AND LIFE ENRICHMENT

Our lives would not be as rich if we lost species such as bears, beetles, frogs, lizards, and shrews, and the habitats where they live. The rich diversity of life also allows for important recreational activities such as hiking, fishing, camping, and birding.

FUTURE GENERATIONS

It is important to conserve the diversity of life because no generation has the right to destroy the environment and resources on which future generations depend. It is our responsibility to take care of the diversity of life.



INSPIRATION FROM NATURE

It is important to conserve the diversity of life because biodiversity provides inspiration and provokes curiosity and imagination. Art, music, and poetry are often inspired by the diversity of life. And many of our technological advances, such as flight and Velcro™, have been inspired by examples found in nature.

RIGHT TO EXIST

It is important to conserve the diversity of life because all species have a right to exist.





Part Three

Focus:

Biodiversity Loss

Grading: Y

Time: 2222

Place: Inside/Outside

Group size: Five groups

Activity Outcomes:

- Learners are made aware of five threats that face biodiversity and sustainability around the world.
- Learners will be introduced to ways of protecting our natural heritage and how to slow down biodiversity loss.

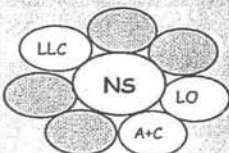
Assessment:

- Evaluate group discussions
- Assess group presentations
- Evaluate posters

Process Skills:

- Observation
- Forming hypotheses
- Recording
- Evaluation

Cross-curricular links



Background:

Biodiversity is reduced when changes in the environment exceed the ability of populations of plants, animals and other living things to adapt. This leads to the extinction of species - either locally or globally. To understand the role people are playing in biodiversity loss, it helps to think of something called the **HIPPO dilemma**. This term does not refer to the endangered hippopotamus but rather to the threats to biodiversity:

- **H**abitat loss
- **I**ntroduced species
- **P**opulation growth
- **P**ollution and
- **O**ver-consumption

These problems have one thing in common - they are all caused by people.

Activity Guidelines:

Needed: WOW poster, paper, camera, film, colour markers, glue, contact paper.

- ✎ Learners are given a short explanation of the WOW poster and then are divided into 5 groups. Each group is named after one letter of the HIPPO dilemma. The groups are then assigned to take photographs of their specific research topic. For instance, the "H-group" will take photographs of the influence of humans on habitat change, the "I-group" will research the most common alien plants and/or animals in their biome.
- ✎ These photographs can then be displayed on posters created by the learners themselves or they can make use of the WOW poster. Link the 5 posters created by the learners to the specific area on the WOW poster (use arrows or coloured ribbons). The posters could be displayed in the school library or lobby.



See Teacher Guide pg 9-11

QUESTIONNAIRE - GRASSY PARK TEACHERS

1. What are your impressions of outcomes-based education?
It seems to be a much more specific kind of method. By stating outcomes, before actually teaching the lesson, or facilitating it, one is (more) guided more towards your perceived aims.
It allows for more structure to your lessons.
Also, by its nature, it contributes enormously towards self-evaluation.
2. Do you see your role as a teacher changing within an outcomes-based education system?
Can you say how?
Yes, my role will change, but perhaps not overly so. As a teacher, my role was always to achieve certain things at the end of a subject or a lesson taught. However, it might have been done in a hit-and-miss manner. Now, I will need to be totally focused on what I am ^{hoping} ~~about~~ to achieve from the outset.
This might be a bit strange at first, but it would soon become second nature.
3. What is Environmental Education and what does it mean to you?
E. Education encompasses all subjects to me. It is a thread which can connect all things taught, owing to its linking up with different aspects of a child's living world, be it physical, social or moral.
I find it an integral part of my role as a ~~the~~ person who is trying to give something back to impressionable young minds.
4. Do you see any links/similarities between Outcomes-Based Education and Environmental Education?
Yes there are links in that by its nature, E.E. contributes to whatever we're hoping to achieve.
Our aims in E.E. will be engineered by what we will be teaching.
(outcomes)

5. Have the workshops helped you to better understand outcomes-based education and environmental education? Explain

Yes it has.

I was impressed with the way the "new" concepts were explained, showing the links between Learning Areas, Range statements, specific outcomes etc. Planning by facilitators were exemplary in this regard.

6. What role do you foresee teacher inservice programmes playing in supporting the implementation of Curriculum 2005? How do you see this happening?

I feel that it is going to be essential for T.I.P. The whole Curriculum 2005 debate is growing more and more negative, but the bottom line is that it must & will be implemented.

The support from our Education Department has always been mediocre and teachers are constantly looking for outside support.

This inservice programmes would need to establish and maintain strong supporting links with the schools. They serve. It could be achieved by constant monitoring, guidance, facilitation and evaluation.

7. Do you see a role for curriculum materials to support the new curriculum? If so, how do you see these being developed?

Curriculum materials need to be developed from grass roots level. The people who are going to use it, should develop it.

Teachers are always wary of the 'top-down' approach as they always resent non-consultation.

These materials could be in the form of workbooks, journals, recordings, etc.

There would, however, need to be a support service for printing, collating & distribution, etc.

8. Why have you chosen to participate in this project?

Its strong point initially, was that I was being afforded the opportunity to work with Senior Secondary teachers, within the same field.

Also, I needed a better² understanding of all the buzz-words going around, like 'L.A.C's', Specific outcomes, Range statements, etc.

9. What did you learn - what benefits did you gain - from participating in the workshops thus far? Have they stimulated any changes to your classroom practice?

The benefits were personal.

As mentioned before, I needed a better understanding of this new concept :- G.B.E.

I have not really changed classroom practice as yet, but I'm slowly getting there.

My interest is high - but classroom factors do play a major role in what can be achieved.

This is not a cop-out, it's just reality.

But, I'm a little bit more fired up. Hopefully, I'll start ringing in the changes in the new term.

10. Did you experience any difficulties, obstacles or barriers as a participant/or in the workshops?

No, not really. The number of teachers attending the ~~Inter~~ fee Junior Secondary phase workshops, were however disappointing.

11. Can you recommend any improvements or changes to any aspects of the workshops?

Perhaps teachers could participate more. Sometimes the talking and explaining ~~and~~ could get tiresome. After all, we had spent the better part of the day in class, teaching.

12. In your opinion what are the priority areas for change and development in science for the senior phase? (1) Human Development

(2) Humans Response to our Living World.

RESOURCES:

CONTACTS:

COMMENTS:

SUPPORTING OUTCOMES BASED EDUCATION

LEARNING PROGRAMME IDEAS

PHASE:

Senior Primary

LEARNING PROGRAMME:

Natural Sciences

PHASE ORGANISER:

Environment

PROGRAMME ORGANISER:
(topic)

*What can we do to protect
Biodiversity? (in the Gromy Park/Lotus
River Area)*

SPECIFIC OUTCOMES:

(selected for the programme organiser, phase organiser and learning programme)

Natural Sciences S.O's 3, 4, 5, 6, 9
Lang, Lit & Comm. S.O's 1, 2, 3, 4, 6, 7
Arts & Culture S.O's 5, 6
Human & Soc. Sciences S.O's 1, 2, 4, 5, 6, 7, 8
Life Orientation S.O's 5, 6, 7
Economic & Mar. Sciences S.O's 1, 2, 8

IDEAS FOR ACTIVITIES	ACTIVITY OUTCOMES
<p>The pupils are divided into groups of 5 or 6 members. They discuss (in their groups) what the possible solutions are for the 5 threats.</p> <p>The teacher puts sheets of newsprint on the board and every group gives their ideas/solutions.</p>	<p>→ Cooperative learning</p> <p>→ Listening skills</p> <p>→ Information sharing skills</p> <p>→ Skills that will promote their creativity.</p>
<p>The different groups are also asked to draw a picture of what the area would look like if there are no threats.</p>	<p>→ The pupils demonstrate a personal role in increasing their own awareness of the environment.</p>
<p>The learners can invite a speaker from environmental organisations in the area to share their views on possible solutions and to ask answer questions the pupils may have.</p> <p>They can also ask groups (environmental) if they can have a clean-up campaign one week-end by cleaning up rivers, etc.</p>	<p>→ The pupils demonstrate an understanding of the interaction between man and nature.</p>

ly cleaning up rivers, etc.

Photo's can be taken and distributed to neighbouring schools and organisation

ASSESSMENT STRATEGY (how you will assess the activity)	PERFORMANCE INDICATORS (what will indicate whether the learner is showing evidence of competence)
<p>The pupils must also say why they chose certain solutions.</p>	<p>The learners can write letters to the editor of news-papers and magazines on possible solutions to the threats.</p>
<p>The pupils can then be asked to put their posters up at school to increase the level of awareness among the other students.</p>	<p>→ A puzzle can be given to the pupils and can be marked by the teacher.</p>
<p>The active participation of the learners through questioning will be an indication of the successfulness of the activity.</p>	<p>→ The pupils are asked to write an article for the school magazine or an essay.</p>

RESOURCES:

Lions Quest Lifeskills : Energizers

CONTACTS:

COMMENTS:

SUPPORTING OUTCOMES BASED EDUCATION

LEARNING PROGRAMME IDEAS

PHASE:

Senior Primary

LEARNING PROGRAMME:

Natural Sciences

PHASE ORGANISER:

Environment

PROGRAMME ORGANISER:
(topic)

Biodiversity: What is Biodiversity?

SPECIFIC OUTCOMES:

(selected for the programme organiser, phase organiser and learning programme)

Natural Sciences: SO's 1, 2, 3, 5, 9

Life Orientation: SO's 5

Lang. Lit & Comm.: SO's 2, 4, 5, 6

Economic & Man. Sciences: SO's 4

IDEAS FOR ACTIVITIES	ACTIVITY OUTCOMES
<p>pupils are divided into groups of 6, consisting of a: right hand, left hand, head, torso, left leg, right leg.</p> <p><u>Aim of each group:</u> to blow up a balloon and pop it.</p>	<p>→ To emphasise uniqueness and differences</p> <p>→ To demonstrate diversity</p>
<p>pupils go outside (school grounds) and list 10 different, living things. (with clear instructions)</p> <p>pupils report back in groups.</p>	<p>→ To identify different, living organisms.</p> <p>→ To observe the differences in organisms</p>
<p>Teacher puts sheets of newsprint on the board and ask pupils to classify their living things under the headings (i.e. mammals, insects, fungi etc.)</p>	<p>→ Correct classification</p>

ASSESSMENT STRATEGY (how you will assess the activity)	PERFORMANCE INDICATORS (what will indicate whether the learner is showing evidence of competence)
<p>Teacher rates pupils' execution of instructions (i.e. to blow up and pop a balloon)</p> <p>eg. 1; 2; 3</p>	<p>The success of the task will be an indication of whether the pupils could follow the instructions given.</p>
<p>Each group is given a column-sheet to record their findings. (i.e. to list their findings)</p>	<p>The teacher takes this sheet in to be marked.</p>
<p>groups must report back why they classified a certain plant/animal under a certain heading</p>	<p>The reasons given to the teacher must be based on scientific evidence</p>

RESOURCES:

CONTACTS:

COMMENTS:

SUPPORTING OUTCOMES BASED EDUCATION

LEARNING PROGRAMME IDEAS

PHASE:

SENIOR PRIMARY

LEARNING PROGRAMME:

NATURAL SCIENCES

PHASE ORGANISER:

Environment

PROGRAMME ORGANISER:
(topic)

Why is Biodiversity important?

SPECIFIC OUTCOMES:

(selected for the programme organiser, phase organiser and learning programme)

Natural Sciences S.O's 1, 2, 3, 4, 5, 6, 9
Lang. Lit & Comm. S.O's 1, 2, 4, 7
Math. & Literacy S.O's 3, 6
Human & Soc. Sciences S.O's 4, 5, 6
Economic & Man. Sciences S.O's 1, 4

IDEAS FOR ACTIVITIES	ACTIVITY OUTCOMES
<p>Give each child a sheet with the reasons for the importance of Biodiversity. They then choose their most important number and form groups with other pupils with the same number (all who chose no. 1 together etc.).</p> <p>The groups report back by giving their reasons why they chose a specific reason. Teacher writes it on small sheets of newsprint 4 all 2 c.</p>	<p>→ Decision-making based on facts!</p> <p>→ Groupwork toward uniformity.</p> <p>→ Reasons why Biodiversity is important.</p>
<p>The pupils are asked to build a pyramid which will represent the food-chain. Each level must be a different colour. The teacher removes 1 level from each group's pyramid. They must then report back via discussions as to what will happen to the food-chain. The teacher writes these down on big newsprint-sheets.</p>	<p>→ To emphasise the important role each organism plays then no matter how insignificant it may seem.</p>
<p>The pupils (in their groups) are asked to draw up a shopping list for the month. (Budget 10000) Big sheets of newsprint are stuck on the board and the pupils must list where the products on the shopping list come from. Teacher writes it on the sheets under plant or animal etc.</p>	<p>→ To be able to make good decisions and not to "over-consume" for the month.</p>

ASSESSMENT STRATEGY (how you will assess the activity)	PERFORMANCE INDICATORS (what will indicate whether the learner is showing evidence of competence)
<p>The teacher observes and listens to the discussion of the pupils. Buggy = positive participation</p>	<p>The reasons on the newsprint should be based on scientific evidence and this will be an indicator to the teacher of the pupils' competence.</p>
<p>The final product (pyramid) can be circulated among all the groups to see if it is correct.</p>	<p>The pyramids can be collected and marked by the teacher to see if the pupils know what a food-chain is.</p>
<p>The shopping lists can then be passed around to different groups to see if the other groups "wasted".</p>	<p>The newsprint with the sources of the products on, will indicate whether the pupils knew where the different products come from and how important each and every source is (i.e. plant or animal).</p>

Windows on the Wild: Science and Sustainability
(University of Stellenbosch) Pg. 15

SUPPORTING OUTCOMES BASED EDUCATION

LEARNING PROGRAMME IDEAS

PHASE:

Senior Primary

LEARNING PROGRAMME:

Natural Sciences

PHASE ORGANISER:

Environment

PROGRAMME ORGANISER:

(topic)

The threats to Biodiversity

SPECIFIC OUTCOMES:

(selected for the programme organiser, phase organiser and learning programme)

Natural Sciences S.O's 1, 2, 3, 4, 5, 6, 9
Lang., Lit. & Comm. S.O's 1, 3, 4, 6, 7
Technology S.O's 1, 2, 5
Life Orientation S.O's 5, 8

CONTACTS:

COMMENTS:

<p>The class is divided into 5 groups. Each group is assigned a letter of the acronym. Each group gets a copy of "Why are we losing Biodiversity" to read. Afterward, each member forms another group of 5 with 1 member coming from each group to form the word HIPPO. Each member must ensure that</p>	<p>Cooperative learning skills</p> <p>→ Information sharing skills</p> <p>→ Reading with insight skills are developed</p>
<p>the rest of the members of the new group understands the information that person's letter represents.</p> <p>The teacher then put sheets of newspaper on the board and everybody discusses it corporately.</p>	<p>→ Skills that display positive attitudes and values that will benefit the environment and improve inter-personal relationships.</p>
<p>Three by sheets of newspaper can be used for: 1) problem 2) causes and 3) solutions to each letter.</p> <p>The groups give their insights on this. The teacher writes them down</p>	

The groups can do research on the various topics: (i.e. Habitat loss
Introduced species
Pollution
Population growth and overconsumption)

	INDICATORS (what will indicate whether the learner is showing evidence of competence)
<p>The pupils can write a small paragraph on their letter and this can be passed on to other member of the groups.</p> <p>The other member/s evaluate whether the pupil know what he or she is writing about.</p>	<p>The teacher can mark these paragraphs to see if the pupils show any sign of competence.</p>
<p>The activity can be assessed by the pupils's input on the sheets (1-3)</p>	<p>The pupils can imagine that they are one of the animals or plants that are being negatively affected by the HIPPO-dilemma, and they then write an essay.</p> <p>The teacher can mark this.</p>

They can report back after a few days with a summary. The teacher can mark the summary.

OPMERKINGS

- 1. Die inhoud moet hoofpuntgewys en bondig gestel word.
- 2. Metodes en tegnieke moet volledig en in besonderhede uitgestip word. Dit geld vir onderwyser- sowel as leerlingaktiwiteite.
- 3. In die mediakolom moet die apparatuur sowel as die programmatuur gespesifiseer word.
- 4. Lesse moet u eie kreatiwiteit en dinkwerk reflekteer. Lesse wat reeds aangebied en bepunt is, mag nie herhaal word nie. Modellesse wat uit handboeke oorgeneem en aangebied word, is ontoelaatbaar.

EVALUERING: Dui u punt m.b.v. 'n kruisie op die onderstaande skaal aan

10	20	30	40	50	60	70	80	90	100
*	*	*	*	*	*	*	*	*	*
MOET LES HERHAAL									

STUDENT: Annemie Hugo
KURSUS: HOD

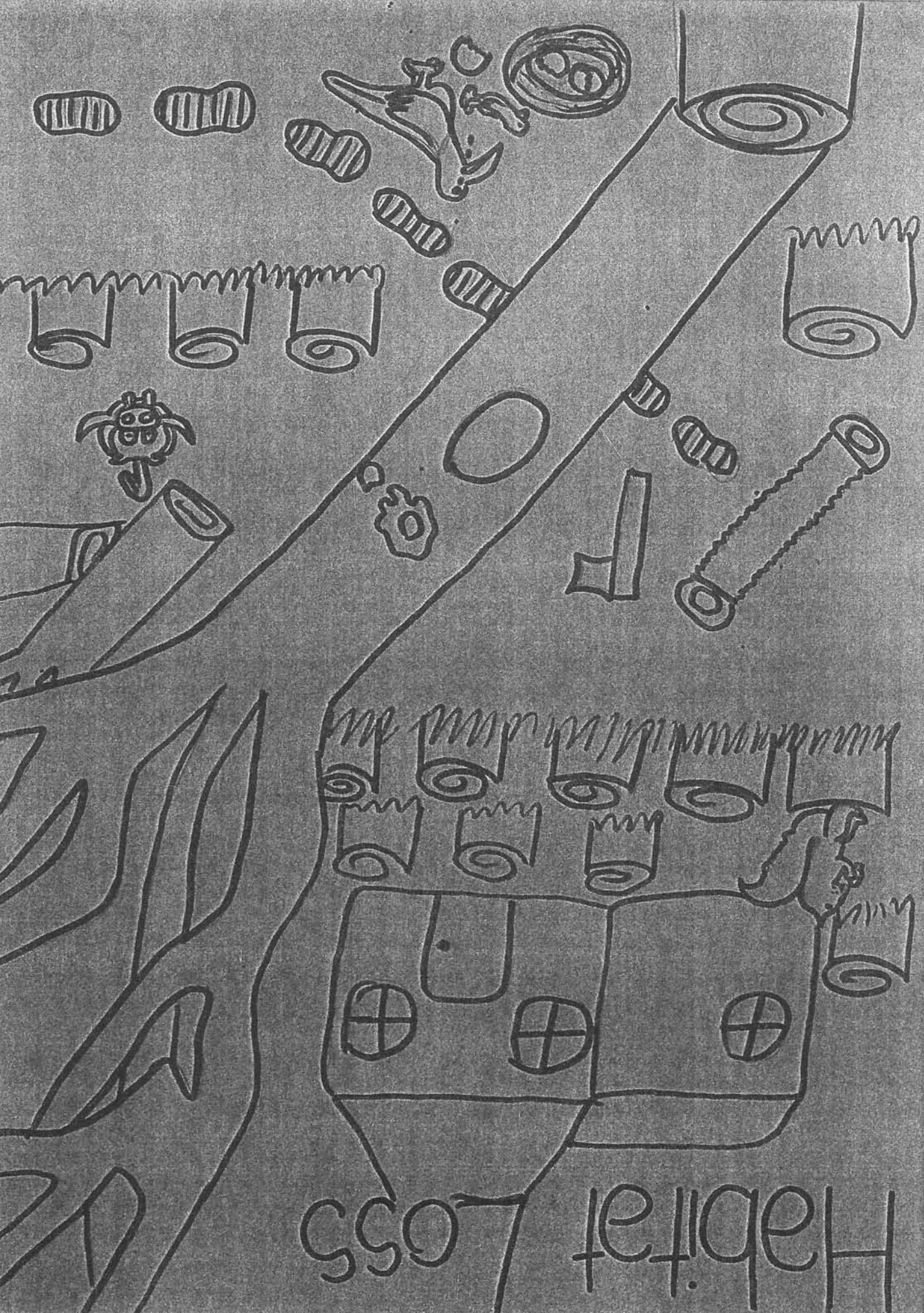
LESSKEMA

DATUM: 3 Augustus
SKOOL: Hoërskool Stellenbosch
STANDERD: 6
VAK: Biologie
ONDERWERP: Ons aarde in lewendende planeet.

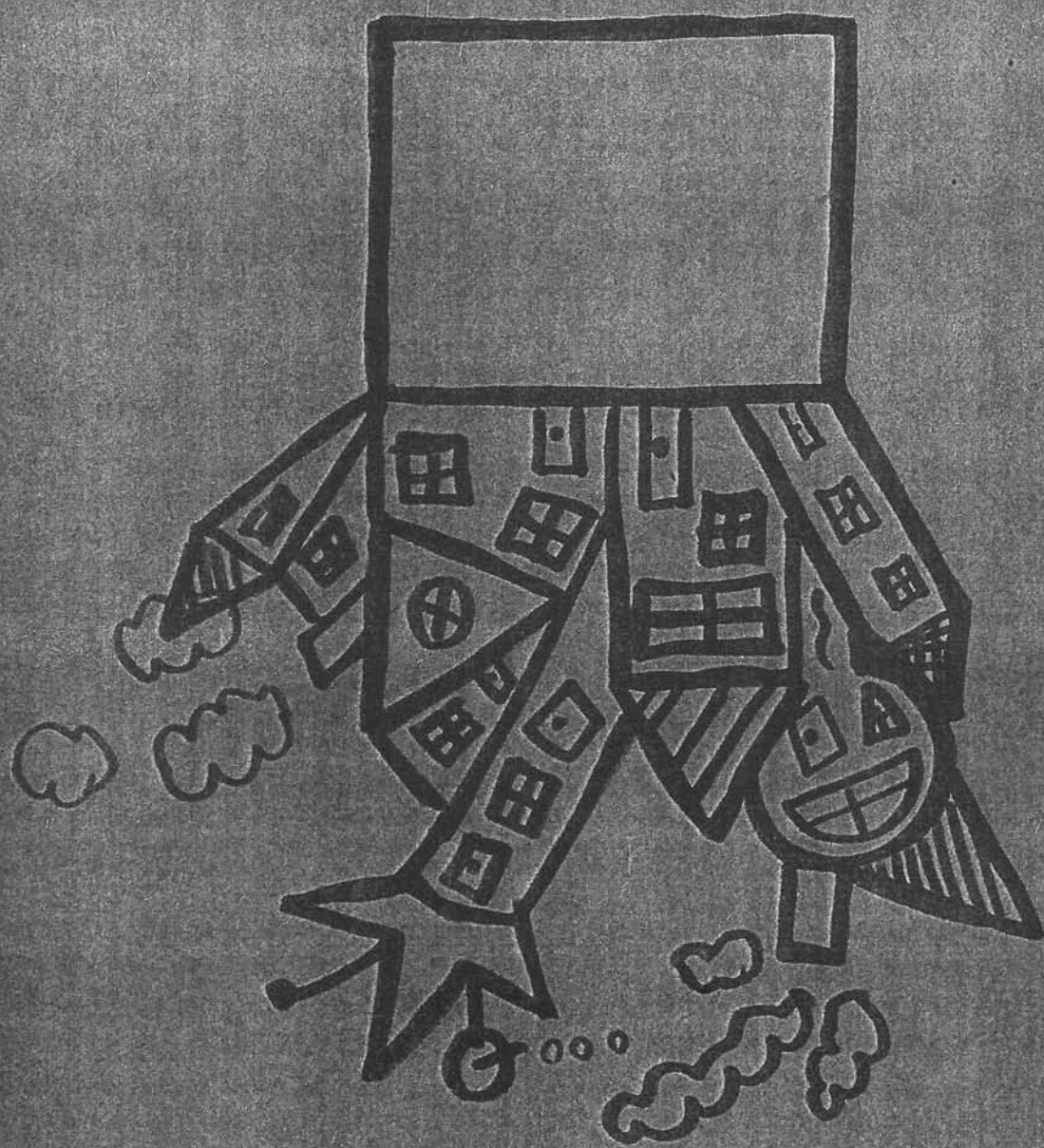
ALGEMENE LESDOELSTELLING EN FOKUS VAN DIE LES:

Die leerders moet aan die einde van die les instaat wees om faktore te noem wat die aarde lewend maak. Leerders moet besef dat elkeen van dié faktore bewaar moet word.

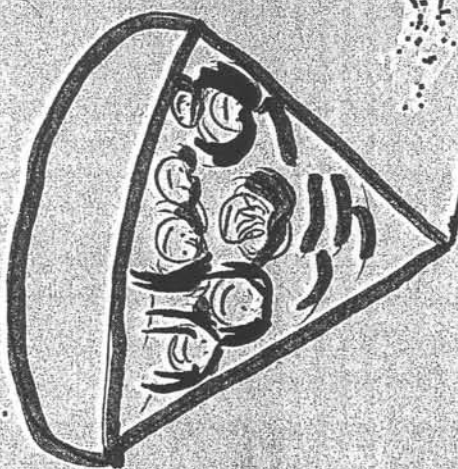
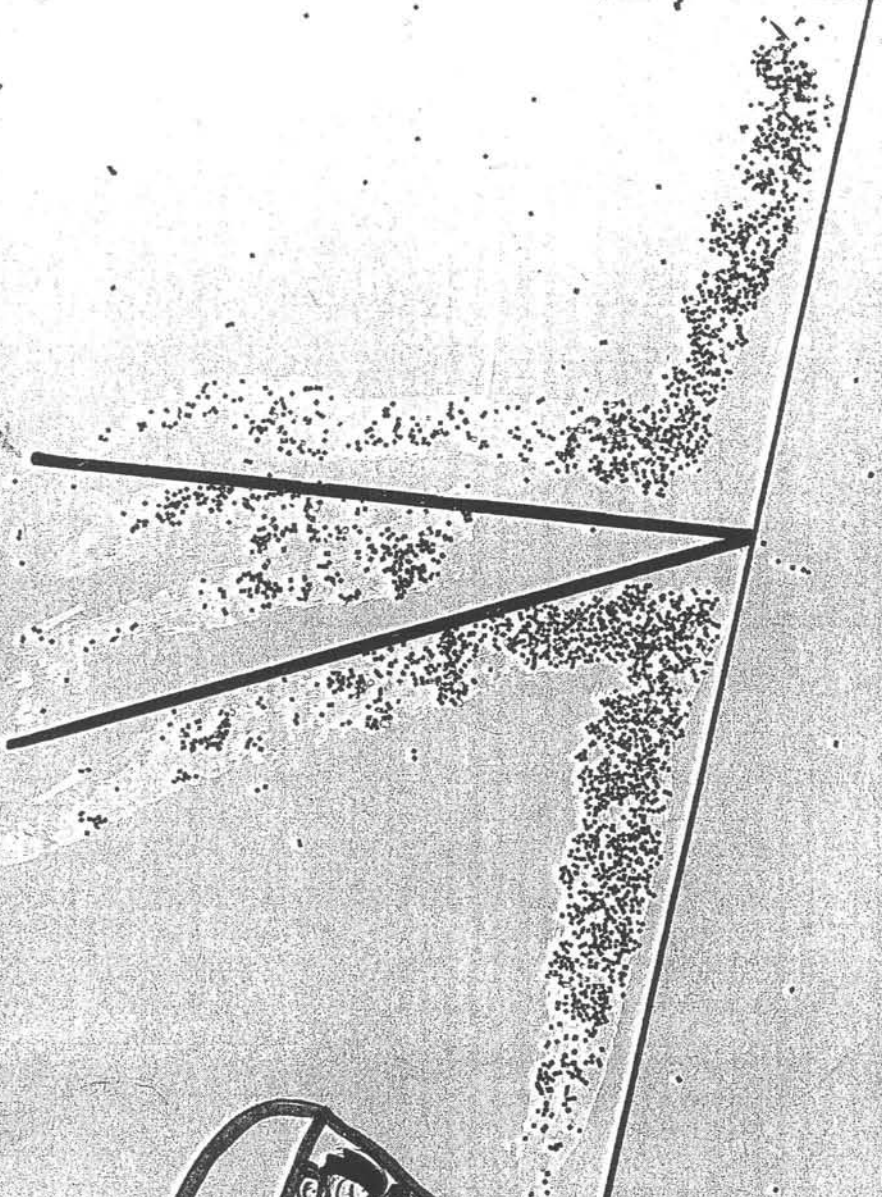
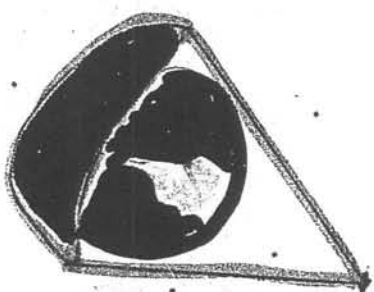
LEERDOELWITTE	INHOUD	METHODEN EN TECHNIEKEN (ONDERWYSER- EN LEERDERAKTIVITEITEN)	ONDERWYS- MEDIA	EVALUERING	DOSENT/ONDERWYSER SE KOMMENTAAR
Leerlinge behoort in staat te wees om:					
Die aarde as 'n geheel te sien en dat ons deel vorm en afhanklik is van die aarde	Die aarde is 'n sisteem waar alles naamwerk. lewe al vir miljoene jare op die aarde.	Ek wys transparant van aarde en vertel van bio- diversiteit.	Wys transparant		Handig het jy die term "geheel" meer in funksie met die leerling & swaai gefin. Jou atypiese manier van klugte is van groot waarde. Dit is as "new" manier van aanpak se. Jy pikket die leerling swaai Jy is verrewer te goet plus met die onderwyser van leerling Jou so veel
In groepe die faktore wat die aarde lewend maak kan identifi- seer.	Posisie van die son Beweging v aarde Water, CO ₂ , O ₂ Biodiversiteit Energie vlei en leuens siklusse.	Leerders ontvul papier & kryte en maak in groep saamwerk.	Papier en kryte	Die suksesvolle saamwerking in groepe.	
		Leerders kan in groepe na vore en verduidelik diens	Plakkaat vir swaai card	Die leerders kan na vore en het meeste van die groepe.	
Nadat al die groepe n beurt geky het dit te kan opsoek.		Verduidelik en help leerders met transparant van lewe	Transparant		



Over-Consumption



OVER POPULATION



LEARNING PROGRAMME - BIOLOGY

by Lucian Herbst & John Herman

PHASE: Senior Phase

LEARNING PROGRAMME: Natural Science

PHASE ORGANISER: Environment

PROGRAMME ORGANISER:

**Threats to biodiversity: Introduced and alien species
Biological & chemical control**

CRITICAL OUTCOMES

1. Communicate effectively using visual, mathematical and/or language skills in the modes of oral, written, and/or presentation work;
2. Identify and solve problems by using creative and critical thinking;
4. Work effectively with others in a team, group, organisation and community;
6. Use science and technology effectively and critically, showing responsibility towards the environment and the health of others.

LESSON 1 - INTO LESSON

Activities: The "HIPPO DILEMMA" (see attachment) is done on the general threats to biodiversity.

- habitat loss
- introduced species**
- population
- pollution
- over-consumption

Activity Outcomes: The learner will be able to explain the general threats to biodiversity and understand the implications of these threats to biodiversity and the environment.

LESSON 2 - INTRODUCED SPECIES

Specific Outcomes:

2. Demonstrate an understanding of concepts and principles, and acquired knowledge in the Natural Sciences.
4. Demonstrate an understanding of how scientific knowledge and skills contribute to the management, development and utilisation of natural and other resources.
9. Demonstrate an understanding if the interaction between the Natural Sciences and socio-economic development.

Activities:

- The learners brainstorm, individually, the different introduced species in their environment.
- Learners form groups and discuss their examples, perceptions and information of introduced species with the rest of the group.
- Make a poster (A1 newsprint). Learners encouraged to be creative.
- Report back from groups and a class discussion takes place.

Activity Outcomes: Learners must be able to identify as least four introduced species and their general threats to the environment.

Performance Indicators: Poster should include:

- names of introduced species
- their threat to the environment, eg. faster reproductive rate, require more water and nutrients, kill indigenous plants, disturbing the balance of the indemimic environment.
endemic ?

Research project: Assign groups (3) one of the introduced species

- Water catchment
- Water hyacinth
- Port Jackson

Groups have to give a 5 minute introduction to each lesson. Must try to be creative and use different media. Mention how the species was introduced or brought into the country (the history), it's distribution, and what threat it is to indigenous species.

LESSON 3 & 4 - PROCESS SKILLS

Topic: Water catchment

Specific Outcomes:

1. Use process skills to investigate phenomena related to the Natural Sciences.
4. Demonstrate an understanding of how scientific knowledge and skills contribute to the management, development and utilisation of natural and other resources.
7. Demonstrate an understanding in the changing and contested nature of knowledge in the Natural Sciences.

Activities:

- Teacher conveys information to class on the catchment mechanism.
- Divide class into pairs.
- Distribute alien vegetation task sheet (see attachment) to learners.
- Teacher explains how to plot a graph.
- The learners must plot the graph in axis provided and draw conclusions from their findings.
- Task cards to be handed in (ensure learners write their names on the cards).

Activity Outcomes: The learners should be able to draw straight-line graphs and draw conclusions from those graphs.

Assessment Strategy: Marks allocated for task card.

Performance Indicators: The graph should be a straight line graph.

Graph 1: positive gradient

Graph 2: negative gradient

Relationship between the 2 graphs: As the area introduced species increase, so the flow rate of the water released from the catchment area decreases.

LESSON 5 - PROBLEMSOLVING

Topic: Water hyacinth

Specific Outcomes:

1. Use process skills to investigate phenomena related to the Natural Sciences.
3. Apply scientific knowledge and skills to problems in innovative ways.
7. Demonstrate an understanding in the changing and contested nature of knowledge in the Natural Sciences.

Activities:

- The group gives a report back to the class as an introduction to the lesson.
- The teacher hands out information sheets on the water hyacinth. These sheets should contain 1) how water hyacinth reproduce, 2) water hyacinth characteristics.
- Divide class in groups (5\6 per group).
- The group must come up with a hypothesis for control, possible positive and negative effects that control and its effectiveness. The control could be chemical or biological in nature.
- The group reports back to class and a class discussion follows.

Activity Outcomes: The learners must develop a viable hypothesis for the control of introduced species.

Assessment Strategy: Peer assessment: a mark is given to the group at the end of each presentation. Encourage learners to be as objective as possible.

Assessment Criteria: Marks should be allocated for:

- viability
- cost effectiveness
- reasons for the method used.

Performance Indicators: The hypothesis should contain:

- Pro's and con's of their proposed method
- reasons for their choice
- the mechanism of the control strategy.

LESSON 6 - PRACTICAL WORK

Topic: Port Jackson

Specific Outcomes:

1. Use process skills to investigate phenomena related to the Natural Sciences.
2. Demonstrate an understanding of concepts and principles, and acquired knowledge in the Natural Sciences.
4. Demonstrate an understanding of how scientific knowledge and skills contribute to the management, development and utilisation of natural and other resources.

Activities:

- The group gives a introduction to the lesson.
- Divide class into groups.
- Teacher gives a demonstration on how to dissect a Port Jackson gall in such a manner as not to damage its contents.
- Task cards are provided that shows the exact procedure for the dissection.
- After gall is opened, the wasp or larva is placed on a viewing slide and it is studied under a microscope.
- Learners make a drawing and short description of what they see. This must be handed in.
- The teacher must act as a facilitator during the practical work and help the groups where needed.

Activity Outcomes: To use process skills and apply it to practical work. To provide an opportunity to develop fine motor control by doing a practical dissection. To study the wasp and larva under a microscope - this implies that the learners are able to use the microscope correctly.

Assessment Strategy: The drawings and description of the observations are used as assessment.

Assessment Criteria: The drawings must contain:

- the correct scientific form of labelling
- neatness of drawing is assessed.

The description is assessed according to the following criteria:

- accuracy and detail

Research Project: For the next lesson the class divides into two groups. The one group has to find information on the pro's and con's of biological control of introduced species and the other group on the chemical control.

LESSON 7 - COMMUNICATION

Topic: Pro's and con's of biological and chemical control

Specific Outcomes:

1. Use process skills to investigate phenomena related to the Natural Sciences.
5. Use scientific knowledge and skills to support responsible decision-making.
7. Demonstrate an understanding of the changing and contested nature of knowledge in the Natural Sciences.
9. Demonstrate an understanding of the interaction between the Natural Sciences and socio-economic development.

Activities:

- The two different groups, biological and chemical control, get 5-10 minutes to discuss their different information and organise their argument.
- The teacher acts as the judge.
- Jury (4 learners): they must take notes of the court proceedings and give reasons for their judgement at the end.
- Council to support Biological control of introduced species
- Council to support Chemical control of introduced species
- Each council is given an opportunity to state their case and convince the judges and jury of the merit of their method.
- The councils then have an opportunity to cross examine the opposing council. In doing so the negative aspects of the different control methods are explored.
- The judge and the jury are also given the opportunity to question the two councils.
- Encourage different people to answer/make statements each.
- At the end of the court case the jury make it's ruling as to which method is the most beneficial and effective.

Homework: The learners must write a critical review on the proceedings of the court case. The review should include their own opinions on which method of control is the most effective and beneficial to the environment, giving full reasons for their opinions.

Activity Outcomes: The learners must be able to give their own opinion on which method of control is the most effective and beneficial to the environment and give reasons for their opinion.

Assessment Strategy: The teacher allocates marks for the reviews by the learners.

Assessment Criteria: Validity, for the reasons, of the learners choice of control method. Marks to be allocated for a general overview on the court case.

ACTIVITY: THE HIPPO DILEMMA

Overview: Take part in a group reading activity to find out why biodiversity is threatened.

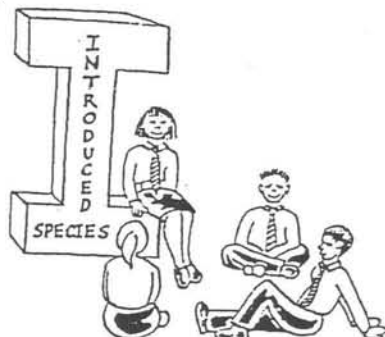
What you need: The section: "Why are we losing Biodiversity?" (p.15).

Objective: Read and discuss an article focusing on the major threats to Biodiversity.

The HIPPO dilemma provides an acronym for the five major problems which characterises modern human lifestyles, and which threaten the earth's biodiversity: **H**abitat loss, **I**ntroduced species, **P**ollution, **P**opulation and **O**ver-consumption. By turning the HIPPO dilemma into a "jigsaw" reading session, participants can get acquainted with the features of unsustainable living, while working on cooperative learning and language skills.

First divide the group into five groups and assign each group a letter: H, I, P, P, or O. Explain to the participants that they should read and discuss the report section from "Why are we losing biodiversity?" that begins with their group's letter. It may be necessary to give the groups some guidelines for their discussions. For example, they could describe the problem, explain what is causing it, and list some of the possible solutions to it. Explain that each group member should understand the problem his or her group is investigating.

Afterward, have the participants form new groups with one member coming from each of the previous groups. Have participants teach each other about the aspect of the HIPPO dilemma they discussed during the first part of the activity. Explain that each person is responsible for making sure everyone else in the group understands the information that person's letter stands for. When participants have finished, discuss the HIPPO dilemma as a group, assessing participants' understanding about concepts that they did not actually find themselves in the first part of the activity.



SOME OTHER IDEAS:

- Discuss with participants what aspects of the HIPPO dilemma have impacts on their communities;
- Discuss possibilities of effective strategies for curriculum development ideas.

ALIEN VEGETATION **TASK CARD**

RAW DATA:

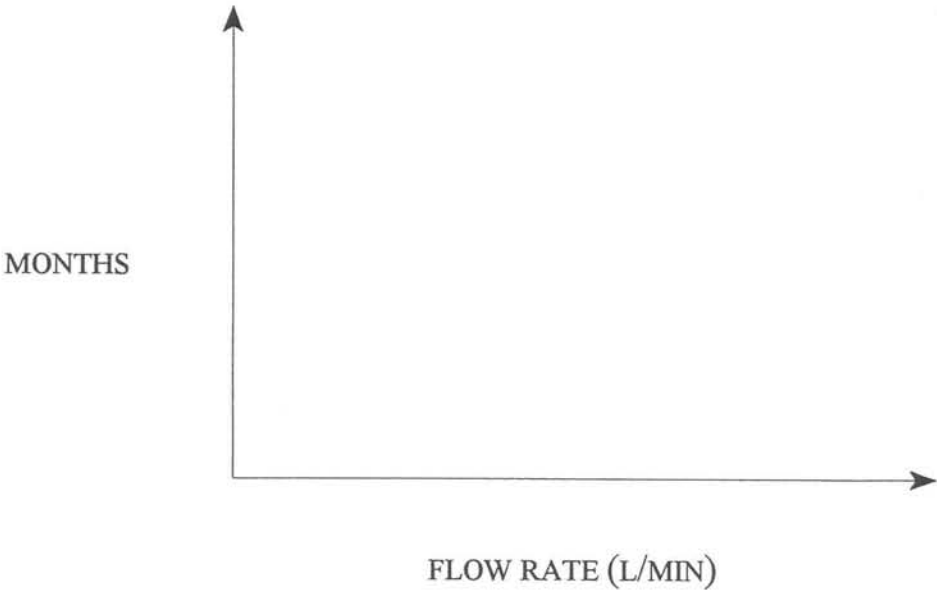
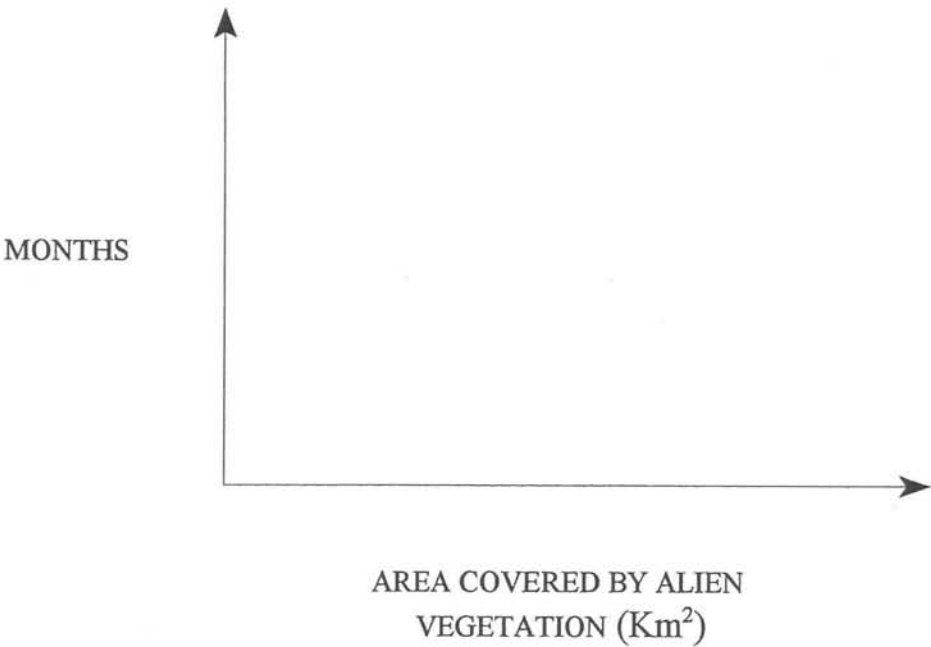
		AREA COVERED BY ALIEN VEGETATION (IN Km ²)	WATER RELEASE FROM CATCHMENT: FLOW RATE (IN l/min)
Months	16	1	2860
	12	2	1900
	8	4	1270
	4	8	850
	1	12	560

ALIEN VEGETATION **TASK CARD**

RAW DATA:

		AREA COVERED BY ALIEN VEGETATION (IN Km ²)	WATER RELEASE FROM CATCHMENT: FLOW RATE (IN l/min)
Months	16	1	2860
	12	2	1900
	8	4	1270
	4	8	850
	1	12	560

GRAPHS



What can be said about the relationship between the two graphs?
